OPERATION CROSSROADS
1946

United States Atmospheric Nuclear Weapons Tests
Nuclear Test Personnel Review

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BAKER Emerges From Bikini Lagoon Amid Target Fleet
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<tr>
<td><strong>GOVT ACCESSION NO.</strong></td>
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<tr>
<td><strong>RECIPIENT'S CATALOG NUMBER</strong></td>
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<tr>
<td><strong>TITLE</strong></td>
<td>OPERATION CROSSROADS—1946</td>
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<td><strong>PERFORMING ORGANIZATION NAME AND ADDRESS</strong></td>
<td>Kaman Tempo, 816 State Street (P.O. Drawer QQ), Santa Barbara, California 93102</td>
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<tr>
<td><strong>CONTROLLING OFFICE NAME AND ADDRESS</strong></td>
<td>Defense Nuclear Agency, Washington, DC 20305</td>
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<tr>
<td><strong>REPORT DATE</strong></td>
<td>1 May 1984</td>
</tr>
<tr>
<td><strong>NUMBER OF PAGES</strong></td>
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</tr>
<tr>
<td><strong>DISTRIBUTION STATEMENT (of this report)</strong></td>
<td>Approved for public release; distribution unlimited.</td>
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<td><strong>ABSTRACT</strong></td>
<td>Crossroads was the first peacetime nuclear weapons test series. It was conducted at Bikini Atoll in 1946. Report emphasis is on the radiological safety of the personnel. Available records on personnel exposure are summarized.</td>
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**SUBMISSION OF THE ABSTRACT**

This work was sponsored by the Defense Nuclear Agency under RDT&E RMSS Code B350079464 U99QAXMK50609 H2590D. For sale by the National Technical Information Service, Springfield, Virginia 22161.
FACT SHEET

Operation CROSSROADS was an atmospheric nuclear weapon test series conducted in the summer of 1946. The series consisted of two detonations, each with a yield of 23 KT:

- **ABLE** -- detonated at an altitude of 520 feet (158 meters) on 1 July
- **BAKER** -- detonated 90 feet (27 meters) underwater on 25 July.

It was the first nuclear test held in the Marshall Islands.

The series was to study the effects of nuclear weapons on ships, equipment, and material. A fleet of more than 90 vessels was assembled in Bikini Lagoon as a target. This target fleet consisted of older U.S. capital ships, three captured German and Japanese ships, surplus U.S. cruisers, destroyers and submarines, and a large number of auxiliary and amphibious vessels. Military equipment was arrayed on some of the ships as well as amphibious craft that were beached on Bikini Island. Technical experiments were also conducted to study nuclear weapon explosion phenomena. Some experiments included the use of live animals.

The support fleet of more than 150 ships provided quarters, experimental stations, and workshops for most of the 42,000 men (more than 37,000 of whom were Navy personnel) of Joint Task Force I (JTF I), the organization that conducted the tests. Additional personnel were located on nearby atolls such as Enewetak and Kwajalein. The islands of the Bikini Atoll were used primarily as recreation and instrumentation sites.

Before the first test, all personnel were evacuated from the target fleet and Bikini Atoll. These men were placed on units of the support fleet, which sorted from Bikini Lagoon and took safe positions at least 10 nmi (18.5 km) east of the atoll.

In the ABLE test, the weapon was dropped from a B-29 and burst over the target fleet. In BAKER, the weapon was suspended beneath an auxiliary craft anchored in the midst of the target fleet.

ABLE operations went smoothly except that the test weapon was dropped between 1,500 and 2,000 feet (457 and 610 meters) off target. The radioactivity created by the burst had only a transient effect, and within a day nearly all the surviving target ships had been safely reboarded. The ship inspections, instrument recoveries, and remooring necessary for the BAKER test proceeded on schedule. Five ships were sunk as a result of the test.

The crews of the target ships that had been remanned following ABLE were evacuated before BAKER to the support fleet east of the atoll. BAKER sank
eight ships and damaged more ships than ABLE. The detonation caused most of the target fleet to be bathed in radioactive water spray and radioactive debris from the lagoon bottom. With the exception of 12 target vessels anchored in the array and the landing craft beached on Bikini Island, the target fleet remained too radiologically contaminated for several weeks for more than brief on-board activities.

The inability to complete inspections on much of the target fleet threatened the success of the operation after BAKER. A program of target vessel decontamination was begun in earnest about 1 August. This involved washing the ships' exteriors using work crews drawn from the target ships' companies under radiological supervision of monitors equipped with radiation detection and measurement devices. Initially, decontamination was slow as the safe time aboard some of the target ships was measured only in minutes. As time progressed, the support fleet itself had become contaminated by low-level radioactivity in marine growth on the ships' hulls and seawater piping systems.

By 10 August, a decision was made to stop work in Bikini and tow the surviving target fleet to Kwajalein Atoll where the work could be done in uncontaminated water. The move was accomplished during the remainder of August and September. A major task at Kwajalein was to offload ammunition stored aboard the target ships. This work continued into the fall of 1946. Personnel continued to work on target ships at Kwajalein into 1947.

Eight of the major ships and two submarines were towed back to the United States and Hawaii for radiological inspection. Twelve target ships were so lightly contaminated that they were remanned and sailed back to the United States by their crews. The remaining target ships were destroyed by sinking off Bikini Atoll, off Kwajalein Atoll, or near the Hawaiian Islands during 1946-1948.

The support ships were decontaminated as necessary and received a radiological clearance before they could return to the fleet. This decontamination and clearance process required a great deal of experimentation and learning at Navy shipyards in the United States, primarily at San Francisco.

Finally, a formal resurvey of Bikini Atoll was conducted in the summer of 1947 to study long-term effects of the CROSSROADS tests.

All CROSSROADS operations were undertaken under radiological supervision intended to keep personnel from being exposed to more than 0.1 roentgen (R) per day. At the time, this was considered to be an amount of radiation that could be tolerated for long periods without any harmful effects on health.

Radiological supervision included predicting areas of possible danger, providing trained personnel equipped with radiation survey instruments to act as guides during operations involving potential exposure, and elaboration of rules and regulations governing conduct in these operations. Personnel were removed for one or more days from areas and activities of possible exposure if their badges showed more than 0.1 R/day exposure.
About 15 percent of the JTF 1 personnel was issued at least one of the 18,875 film-badge dosimeters during CROSSROADS. Approximately 6,596 personnel were on islands or ships that had no potential for radiation exposure. Personnel anticipated to be at greatest radiological risk were badged, and a percentage of each group working in less contaminated areas was badged. The maximum accumulated exposure recorded was 3.72 R, received by a radiation safety monitor.

Lacking complete radiation exposure data, reconstructions have been made of personnel exposures for unbadged crewmembers of the ships involved. These calculations have considered the several sources of radiation at work in Bikini, such as the low-level contamination in the lagoon water, living aboard support ships, and boarding the contaminated target ships. The calculations relied upon radiation measurements recorded by radiation safety personnel in 1946. This data was used in a computer model that includes such factors as the radiation-shielding properties of ships' hulls and realistic patterns of daily personnel activity on weather decks and below. The actual movements of each ship were then used to reconstruct a dose for the crew. Calculated exposures range from 0 to 2.5 rem (gamma) for support ships. Exposures for target ship crews that reboarded their ships after BAKER were higher than those for support ship crews. A summary of film badge readings (in roentgens) for July and August, when the largest number of personnel was involved, is listed below:

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<th>Actual Film Badge Readings:</th>
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<tr>
<td>Total</td>
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<td>July</td>
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<td>August</td>
<td>6,664</td>
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Between 1945 and 1962, the U.S. Atomic Energy Commission (AEC) conducted 235 atmospheric nuclear weapon tests at sites in the United States and in the Pacific and Atlantic oceans. In all, about 205,000 Department of Defense (DOD) participants, both military and civilian, were present at the tests. Of these, approximately 142,000 participated in the Pacific test series and approximately another 4,000 in the single Atlantic test series.

In 1977, 15 years after the last aboveground nuclear weapon test, the Centers for Disease Control (CDC) of the U.S. Department of Health and Human Services noted more leukemia cases than would normally be expected among about 3,200 soldiers who had been present at shot SMOKY, a test of the 1957 PLUMBBOB series. Since that initial report by the CDC, the Veterans Administration (VA) has received a number of claims for medical benefits from former military personnel who believe their health may have been affected by their participation in the weapon testing program.

In late 1977, the DOD began a study that provided data to both the CDC and the VA on potential exposures to ionizing radiation among the military and civilian personnel who participated in the atmospheric testing 15 to 32 years earlier. In early 1978, the DOD also organized a Nuclear Test Personnel Review (NTPR) to:

- Identify DOD personnel who had taken part in the atmospheric nuclear weapon tests
- Determine the extent of the participants' exposure to ionizing radiation
- Provide public disclosure of information concerning participation by DOD personnel in the atmospheric nuclear weapon tests.

This report on Operation CROSSROADS is one of a series of volumes that are the product of the NTPR. The DOD Defense Nuclear Agency (DNA), whose Director is the executive agent of the NTPR program, prepared the reports, which are based on military and technical documents reporting various aspects of each of the tests. Reports of the NTPR provide a public record of the activities and associated radiation exposures of DOD personnel for interested former participants and for use in public health research and Federal policy studies.

Information from which this report was compiled was primarily extracted from planning and after-action reports of Joint Task Force 1 (JTF 1) and its subordinate organizations. Documents that accurately placed personnel at the test sites were desired so that their degree of exposure to the ionizing radiation resulting from the tests could be assessed. The search for this information was undertaken in archives and libraries of the Federal Government, in special collections supported by the Federal Government, and, where reasonable, by discussion or review with participants.
For CROSSROADS, the most important archival source is the National Archive and Record Center, Modern Military Branch, Washington, D.C. The Naval Archives at the Washington Navy Yard also were helpful, as was the collection of documents in the AFRL Technical Library at Kirtland Air Force Base, Albuquerque, New Mexico, and the Stafford L. Warren Papers at the University of California, Los Angeles. Other archives searched were the Department of Energy (DOE) archives at Germantown, Maryland, its Nevada Operations Office (DOE/NV) archives at Las Vegas, and archives of the Test Division of the Los Alamos National Laboratory.

JTF 1 exposure records and an additional file of exposure-related documents that had been microfilmed by the Reynolds Electrical and Engineering Company, Inc., support contractor for DOE/NV, were also useful.

Primary documentation of personnel movement in areas of potential radiation exposure is limited. This has been compensated for, where possible, with inferences drawn from secondary sources and the exposure records themselves.

The work was performed under RDT&E RMSS B350079464 U99 QMXMK 506-09 H2590D for the Defense Nuclear Agency by personnel from Kaman Tempo. Guidance was provided by Mr. Paul W. Boren of the Defense Nuclear Agency Biomedical Effects Directorate.
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CHAPTER 1
OVERVIEW

INTRODUCTION

After the atomic bomb attacks on Japan had abruptly ended World War II, many military leaders felt that military science was at a crossroads. The officer who commanded the first postwar nuclear test series commented that "warfare, perhaps civilization itself, had been brought to a turning point by this revolutionary weapon" (Reference C.12.1, Cap. Plate XI). With this in mind, he therefore had the nuclear test operation designated CROSSROADS. Operation CROSSROADS was at that time the largest U.S. peacetime military operation ever conducted. It involved 42,000 personnel, 251 ships, and 156 aircraft.

This series consisted of two detonations at Bikini Atoll in the Marshall Islands during the summer of 1946. These were:

- ABLE (1 July 1946, 0900) -- an airdrop detonated at an altitude of 520 feet (158 meters)
- BAKER (25 July 1946, 0835) -- an underwater shot 90 feet (27 meters) below the surface

An additional deep underwater detonation, Test CHARLIE, was planned but was not conducted.

This report documents the participation of War and Navy Department* personnel who were active in the test series. Its purpose is to bring together available information about the atmospheric nuclear tests series pertinent to the exposure of both uniformed and civilian personnel to radiation. The report lists the organizations represented and describes their activities. It discusses the potential radiation exposure of personnel. Finally, it presents the exposures of participating personnel recorded by film badges and scientifically based estimates of radiation doses for participating units.

The weapons used in the CROSSROADS tests were of the same design as the one that had been dropped on Nagasaki, Japan. Each had a yield of 23 KT (the equivalent of 23,000 tons of TNT). This weapon type had been developed by the U.S. Army's Manhattan Engineer District during the war, primarily at the District's laboratory at Los Alamos, New Mexico, with research support from laboratories at the University of Chicago and Oak Ridge, Tennessee, and material production from Hanford, Washington. Under the terms of the Atomic Energy Act of 1946, the Manhattan Engineer District was dissolved at the end

* In 1947 the War Department was dissolved. Jurisdiction over the ground components of the Army became the function of the newly created Department of the Army, and the new Department of the Air Force was established to direct the former Army Air Forces. These two new departments and the Department of the Navy formed the new Department of Defense.
of 1946, and its contracts, facilities, and management responsibilities were transferred to the newly established Atomic Energy Commission (AEC).

The primary purpose of CROSSROADS was to determine the effects of atomic bombs upon naval vessels. The effects of nuclear weapons on ships was of considerable interest to the U.S. defense establishment. As early as August 1945, the Chairman of the Senate's Special Committee on Atomic Energy proposed that the effectiveness of atomic bombs be demonstrated on captured Japanese ships. In September, the Army Air Forces commanding general put the question of such a test before the Joint Chiefs of Staff (JCS) (Reference A.1, p. 10).

The Navy's response to this proposal was that such a test also should include a few modern U.S. naval units in the target array (Reference A.1, p. 10). In effect, this broadened the test from a mere demonstration of the power of nuclear detonations to a scientific test whose results could be used in designs of naval vessels and naval tactics. In November the JCS established a subcommittee to prepare a detailed proposal. The subcommittee completed its work in 6 weeks.

Secondary purposes of CROSSROADS were to afford training for Army Air Forces personnel in attack techniques using atomic bombs against ships, and to determine atomic bomb effects upon military equipment and installations. Such information was not available from the Trinity test or the Hiroshima and Nagasaki bombings (Reference C.9.189, p. XIII).

On 10 December 1945, the President announced that the United States would further explore the capabilities of atomic energy in the form of scientific atomic bomb tests under JCS jurisdiction. The JCS proposed a joint task force to be composed of Army and Navy personnel and civilian scientists, and on 10 January 1946 the President approved the formation of this task force. On 11 January the JCS created Joint Task Force One (JTF 1) and approved a naval officer who had commanded large Army-Navy operations in the Pacific during the war and who also had been Chief of the Navy's Bureau of Ordnance to serve as Commander JTF 1 (CJTF 1).

CROSSROADS, as proposed, was to have consisted of three nuclear events. In approving the plans, the President approved the detonation of three nuclear weapons, one-third of the U.S. stockpile at the time -- surely a measure of the importance given the operation (Reference A.7).

Among the major problems confronting CJTF 1 after his appointment was the selection of a test site. Several locations were considered in the Atlantic and Pacific oceans and in the Caribbean Sea. The requirements were:

- A protected anchorage (at least 6 nmi [11 km] wide) to hold the target and support fleet
- A site that was nearly uninhabited
- A location at least 300 statute miles (about 483 km) from a city
- Freedom from severe cold and violent storms
Predictable winds directionally uniform at all altitudes from sea level to 60,000 feet (18 km)

Predictable water currents of great lateral and vertical dispersion; fast currents avoiding important fishing areas, ocean shipping lanes, and inhabited shores

Control by the United States.

The location that best satisfied these requirements was Bikini Atoll. Bikini's location in the Central Pacific is shown in Figure 1 and a map of the atoll itself in Figure 2. The final choice of Bikini was announced on 24 January 1946 by the JCS after a slight delay because the fishing industry feared the tests might kill millions of fish, especially tuna and whales. To evaluate any dangers, the Department of Interior's Fish and Wildlife Service conducted surveys. Those surveys concluded that Bikini was not a critical area for tuna fish or other fish of commercial importance and was far from migratory whale routes (Reference A.1, pp. 19 and 20).

CJTF 1 requested that the Bikini native population be evacuated from the atoll by 15 March 1946. Rongerik Atoll was selected as the future home for the Bikinians and on 26 February a group of Navy Construction Battalion personnel (Seabees) began construction of cisterns, water catchments, and 26 house frames there. These frames (Figure 3) were temporarily covered with canvas, but this was replaced by thatch from the pandanus, or screw pine, tree. The thatch was brought to Rongerik by the Bikinians. The cisterns were initially filled with 25,000 gallons (94,785 liters) of water brought from Kwajalein.

Bikini was evacuated on 7 March. Figure 4 shows the Bikinians collecting their belongings, and Figure 5 shows the loading of the LST that transported them. The 167 Bikinians arrived at Rongerik the next day (Figure 6). In an effort to improve the lives of the Bikinians who were unhappy with Rongerik, meetings were held in 1946 and 1947 between the Chief and members of his council and military authorities to find a more suitable island. On 3 November 1948, the Bikinians and their possessions were resettled on the island of Kili, in the southern Marshall Islands, 400 nmi (741 km) southeast of Bikini and 27 nmi (50 km) southeast of Jaluit Atoll (Reference A.8, pp. 507-551).

On 23 March, after preparations for the operation were well underway, the President changed the date of the first test from 15 May to 1 July; the second test was scheduled for 25 July. This allowed certain members of Congress to observe Operation CROSSROADS. On 7 September 1946, the President announced that Test CHARLIE, the third scheduled and a deep underwater test, was indefinitely postponed (Reference C.9.206, p. V-(D)-5). Engineering problems in constructing a bathysphere capable of withstanding the tremendous pressures involved precluded the scheduling of Test CHARLIE before Spring of 1947 (Reference C.9.206, p. V-(A)-5).

REPORT ORGANIZATION

Subsequent sections of this overview chapter discuss the form of weapon effects test programs, with emphasis on potential radiation exposure of participating Navy and War Department personnel. The chapter concludes with a description of JTF 1 and indicates how elements within JTF 1 functioned.
Figure 2. Bikini Atoll, 1946, showing ABLE and BAKER test sites.
Figure 3. Navy Construction Battalion personnel, assisted by Marshallese, construct wooden house frames on Rongerik for Bikinians.

Figure 4. Bikinians collecting their belongings for move to Rongerik.
Figure 5. Bikini outrigger swung aboard LST for transport to Rongerik.

Figure 6. USS LST-1108 arrives at Rongerik, 8 March 1946.
Chapter 2 is concerned with radiological safety (radsafe) aspects of the tests. This chapter documents procedures, training, and equipment used to protect participants from potential radiation exposure.

Chapter 3 discusses the general role of personnel in the weapon effects program in CROSSROADS, leading to a discussion of operations for test events in Chapter 4, and in the post-test operations discussed in Chapters 5 and 6.

Chapters 7 through 10 report participation by the Army Ground Forces, Army Air Forces, Navy, and Marine Corps, respectively. Chapter 11 summarizes participation of other government agencies, contractors, and universities. Personnel exposures are discussed in Chapter 12.

NUCLEAR TESTS AND RADIATION EXPOSURES

In general, nuclear testing before 1961 consisted of the unconfined detonation of nuclear devices (usually not weapons) in the atmosphere. The devices might be placed on a platform or a barge on the ocean’s surface; emplaced on or slightly beneath the Earth’s surface; atop a tower; or supported by a balloon, dropped from an airplane, suspended underwater, or fired from cannon or rocket launchers. CROSSROADS employed two operational weapons: one was dropped from an aircraft and detonated in the air; the other was suspended from a ship and detonated underwater.

In theory, personnel can be exposed either to the radiation emitted at the time of explosion and for about 1 minute thereafter -- usually referred to as initial radiation -- or the radiation emitted later (residual radiation). Initial radiation is part of the violent nuclear explosion process itself.

The neutron component of initial radiation indirectly contributes to the later exposure of personnel. Neutrons are emitted in large numbers by nuclear weapon detonations. They have the property of altering certain nonradioactive materials so that they become radioactive. This process, called activation, works on sodium, silicon, calcium, manganese, and iron, as well as other common materials. Activation products thus formed are added to the inventory of the radioactive products produced in the explosion process. The radiation emitted by this inventory more than 1 minute after detonation is referred to as residual radiation.

The potential for personnel exposure to residual radiation was much greater than the potential for exposure to initial radiation. In the nuclear explosion process, fissioning atoms of the heavy elements, uranium and plutonium, split into lighter elements, called fission products, releasing energy. When the uranium and plutonium fission, they produce a variety of fission products. Different fission products have different half-lives. In general, the lighter fission products have half-lives that are shorter than the mother elements. The residual radiation produced by these products, given their shorter half-lives, is initially quite high. However, over a period of time, the radioactivity diminishes. The decay of the original fission products produces other, lighter fission products that may (or may not) be radioactive themselves. The net result is that initial decay of fission products produces fairly high levels of radioactivity that dissipate over time. While a radioactive fission product
theoretically continues to exist forever (albeit in diminishing amounts), a point is reached where it is practically undetectable.

Overall radioactivity of all the fission products formed decays at a rate that is closely approximated by a rule that states that for each sevenfold increase in time the intensity of the radiation will decrease by a factor of ten. Thus, a radiation rate of 1 roentgen per hour (R/hr) at 1 hour after the detonation would be expected to be 0.1 R/hr after 7 hours and 0.01 R/hr after 49 hours. This rule seems to be valid for about 6 months following a nuclear detonation, after which the observed decay rate is somewhat faster than that predicted by this relationship. Activation products, in general, decay at a faster rate than the fission products.

Fission products and the activation products, along with unfissioned uranium or plutonium from the device, are radioactive components of the material in the debris cloud. This cloud and its fallout are the primary sources of potential exposure to residual radiation.

In a nuclear airburst, the central core of intensely hot material, or fireball, does not touch the surface. The bomb residues (including the fission products, the activation products resulting from neutron interaction with device materials, and unfissioned uranium and/or plutonium) are vaporized. These vapors condense as the fireball rises and cools, and the particles formed by the condensation are small and smoke-like. They are carried up with the cloud to the altitude at which its rise stops, usually called the cloud stabilization altitude. Spread of this material then depends on the winds and weather. If the detonation is of relatively low yield, the cloud stabilization altitude will be in the lower atmosphere and the material will act like dust and return to the Earth's surface in a matter of weeks. Essentially all debris from detonations with yields equivalent to kilotons of TNT will be down within 2 months (Reference A.9). Areas in which this fallout material will be deposited will appear on maps as bands following the wind's direction. Thus, airbursts result in less potential for residual radiation exposure to personnel at the testing area from the debris, although there may be some residual radiation fission products from rapid settling of large particles and short-lived radiation coming from activated surface materials under the burst (if the burst altitude is sufficiently low for neutrons to reach the surface).

Underwater nuclear detonations are muffled by the great mass of water that surrounds them. Initial nuclear radiation is absorbed by the water surrounding the device and the intense heat vaporizes the water near the burst. This forms a bubble beneath the surface of the water that expands as the energy released in the explosion works against the mass of water. This expansion continues until the energy is expended, at which point the bubble begins to collapse as it rises toward the surface. Depending upon the depth of the burst and the size of the bubble (which in turn depends on the detonation yield, or total energy released), the bubble may break the surface of the water near its fully expanded size or smaller. Some radioactive products (including activated salt) are vented into the air as the bubble breaks the surface, but most of the device debris and activation products remain trapped in the volume of water that collapses on the bubble. This volume of water is called the radioactive pool.
When the burst is close enough to the bottom, as in the BAKER shot of CROSSROADS, an underwater crater may be formed, and the material excavated from it will be radioactive and contribute to the residual radiation inventory.

The primary source of personnel exposures from the BAKER shot was not the radioactive pool of water, however, but from contact with the target ships, which had been bathed in the radioactively contaminated water, sand, and coral that rained down upon them from the cloud and from the radioactive mist (base surge) that rolled out from the base of the underwater explosion column.

A nuclear explosion produces three types of radiation that posed a potential hazard to CROSSROADS participants: alpha, beta, and gamma radiation. When any of these encounters living tissue, it transfers some of its energy to the target atoms, tearing off some or all of their electrons. This leaves the atoms with a positive electrical charge. The process is called ionization. This tearing off of the electrons destroys the bonds holding together the complex molecules making up living tissue and leaves the tissue damaged to some extent. At low levels of radiation, the damage is minor and probably does not adversely affect the individual's health or longevity. At higher levels, the reverse is true.

Gamma rays are electromagnetic radiation, differing from the more familiar radio waves and x-rays in that they have higher frequency and shorter wavelength. They are produced in great quantities and with very high energy during a nuclear explosion. They are also given off during the decay of the radioactive isotopes produced by a nuclear explosion. They can travel long distances and can readily penetrate clothing and skin. Because the personnel conducting Operation CROSSROADS were miles from the two detonations, the gamma hazard to them came from radioactive isotopes left in the target area or carried from it by wind or tide or on the participating ships or planes or even on the bodies of the personnel themselves. The radiation detection instruments used during CROSSROADS readily detected gamma rays.

Beta particles are electrons. Like gamma rays, they are given off by a nuclear explosion or by the radioactive isotopes produced by the explosion. Unlike gamma rays, however, beta particles do not travel far and, except at high energies, are stopped by clothing or the outer layers of skin. They are a greater hazard if isotopes emitting them are taken into the body or are left in contact with skin for a long period. Beta radiation was measured fairly well by several types of safety instruments used during CROSSROADS.

Alpha particles are made up of two protons and two neutrons. With the addition of two electrons, each becomes a helium atom. Alpha particles are given off by some radioactive isotopes created in a nuclear explosion and by unfissiioned uranium or plutonium. Because alpha particles are relatively massive, they do not travel far, about 1 or 2 inches in air. The skin, clothing, or even a piece of paper will stop them. However, if the material emitting them enters the body and lodges there, the alpha particles can do great harm because they cause a high rate of ionization. The decay time of many alpha emitters is long. Plutonium only loses half of its alpha particles in 24,000 years! As described in detail in Chapter 2, the safety instruments available at CROSSROADS for detecting alpha particles directly were few in number and would not operate
outside the controlled conditions of the laboratory on the ship housing the radiation safety organization. Therefore, the only expedient way to estimate alpha radiation was to assume that some relatively stable ratio existed between alpha emitters and gamma or beta emitters. One could then measure gamma or beta radiation and calculate the alpha hazard. As beta and gamma radiation decreased, however, alpha radiation remained because of the long decay time of the plutonium and other alpha emitters.

EFFECTS EXPERIMENTS

Central to the test series was the experimental program. This program and its requirements dictated the form of the test organization and the detail of personnel participation. CROSSROADS had two experimental programs. The first was to determine the effects of nuclear detonations on animals and on military equipment such as ships, aircraft, and various supplies. The second program was to measure weapon phenomena such as heat, blast, radiation, and wave action. CROSSROADS was not a weapon development operation; the bombs used were of the same design as the one dropped on Nagasaki.

Effects experiments were intended to acquire urgently needed military data. These experiments may be classed into two general kinds. The first class of measurements was made to document the hostile environment created by the nuclear detonation. The second class of effects experiments documented the response of systems to the hostile environment; these measurements are termed systems response experiments.

Environmental Measurements

The purpose of environmental effects measurements was to gain a comprehensive view of the hostile environment created by a nuclear detonation to allow military planners to design survivable military hardware and systems and to train personnel to survive. Examples of environmental measurements taken at CROSSROADS include static (crushing) and dynamic (blast) pressure, heat generated by the detonation, and fall-out radiation. Measurement techniques employed for CROSSROADS varied with the effects being measured, but usually measuring devices were placed at a variety of ranges from surface zero and their measurements recorded in some way. Many types of gauges and data-recording techniques were used. Measuring devices or instruments were airborne, underwater, on shore towers, or on a technical support vessel; the majority were placed on target vessels (Reference C.9.208, p. 2).

Rugged, self-recording gauges were developed for blast and thermal radiation measurements so that complete loss of data from a project would not occur if instrument recovery were delayed, for example, by heavy fallout. For nuclear radiation measurements, however, early data recovery was still desirable as the gauges might be thin aluminum foil meters that could be made radioactive by the initial neutrons. Early observation was necessary before the information contained in the induced radiation pattern decayed to undetectable levels.

The potential for radiation exposure of personnel responsible for environmental measurements in general depended on the proximity of the instruments to
the device and the time that elapsed between detonation and instrument recovery; the nearer in space or time to the detonation, the greater the potential for exposure.

Systems Response Experiments

To document the response of systems to the hostile environment, military hardware (aircraft parts, ammunition, radar, petroleum, tanks, field stoves, clothing, and medical equipment) was exposed to nuclear detonation effects. Techniques used for these experiments were conceptually simple: exposure of the system of interest and observation of its response. Actual conduct of the experiments was far more complex. The level of threat to which the system was exposed almost always required measurement to properly understand the response, necessitating an environmental experiment along with each systems response experiment. It was often not enough to know whether the system survived, but rather what the effects were on the component parts and their interactions. This required the placement of extensive instrumentation and recording devices throughout the test area.

While the potential radiological exposure of personnel during these systems response experiments was governed primarily by the proximity of personnel in space or time to the detonation, an additional problem arose. Often, when the exposed object was recovered for closer examination, it could be contaminated by device debris or even be radioactive itself due to neutron activation. Personnel recovering or handling such objects could be exposed to radiation. For this reason, reboarding parties who inspected vessels, aircraft, and equipment after each detonation were given published guidelines and radsafe instructions (see Appendix B).

MARSHALL ISLANDS SETTING

The Marshall Islands are in the easternmost part of the area known as Micronesia ("tiny islands"). The Marshalls are spread over 770 thousand mi\(^2\) (2 million km\(^2\)) of the Earth's surface, but of this area only about 70 mi\(^2\) (180 km\(^2\)) is land. Two parallel chains form the islands: Ratak (or Sunrise) to the east, and Ralik (or Sunset) to the west; Bikini is in the Ralik chain at its northern extreme. Figure 1 shows these islands in the Central Pacific; Figure 2 is a map of Bikini Atoll.

A typical atoll, Bikini is a coral cap set on truncated, submerged volcanic peaks that rise to considerable heights from the ocean floor. It consists of 27 small islands that encircle a broad lagoon 25 miles (40.2 km) long and 15 miles (24.1 km) wide, with a maximum depth of about 200 feet (61 meters). The dry land area, 2.72 mi\(^2\) (7 km\(^2\)), is covered with low, scrubby brush and coconut and pandanus trees. The land area is concentrated in the eastern islands, from Bikini to Eneu islands, which form about 53 percent of the land total, with 24 percent taken up by the southern section of Enidrik to Aerokoj.

Climate is tropical marine, generally warm and humid. Temperature changes are slight, ranging from 70\(^\circ\) to 90\(^\circ\)F (21\(^\circ\) to 32\(^\circ\)C). Rainfall is moderate, and prolonged droughts may occur. North of the atoll is open ocean for a thousand miles, the only inhabited island being Wake. East of Bikini are
several atolls, with Rongelap at 80 nmi (148 km) the closest. Storms are infrequent, although typhoons occur; nevertheless, both wind and sea are continuous erosional agents. Although possible at any time, most tropical storms occur from September to December. Cumulus clouds are abundant in the area.

The Bikini region incorporates three basic wind systems. Northeast trade winds extend from the surface to 25,000 to 30,000 feet (7.6 to 9.1 km), upper westerlies from the top of the trades to the base of the tropopause at 55,000 to 60,000 feet (16.8 to 18.3 km), and Krakatoa easterlies from the tropopause up into the stratosphere. These systems are all basically east-to-west or west-to-east air currents. Day-to-day changes reflect relatively small north-south components, which are markedly variable. Greatest variation occurs in the upper westerlies, particularly during late summer and fall.

Steady northeast trade winds in the lower levels cause water at the surface of the lagoon to flow from northeast to southwest, where it sinks to the bottom and returns along the lower levels of the lagoon. rises to the surface along the eastern arc of the reefs and islands, and is moved by winds to the southwest again. Lagoon waters moving in this closed loop also mix with those of the open ocean, resulting in a flushing action.

At Bikini, ocean water flows in over northern and eastern reefs and flows out of the western portion of Eneu Channel. Water exchanges over the western reefs with the tides, ocean water flowing in and mixing with the flood and lagoon water flowing out with the ebb. The net rate of flushing of Bikini waters is such that one-half of the lagoon waters is replaced by ocean water in 22 days and the original volume will account for only 10 percent of the lagoon volume after 2-1/2 months (Reference C.9.209, p. F-25).

During CROSSROADS, the Marshall Islands were under the jurisdiction of a U.S. military governor who reported to the Chief of Naval Operations and ultimately to the Secretary of the Navy. Since July 1947 these islands have been part of the Trust Territory of the Pacific Islands, a strategic area trusteeship of the United Nations, administered by the United States (Reference A.8, pp. 507-551).

In order to prepare Bikini Atoll for test operations, a considerable amount of work was required in the lagoon and on the principal islands. First, it was necessary to clear the lagoon of Japanese mines. On 10 March a survey unit arrived and began hydrographic and land surveys to augment the data recorded on the available Japanese charts. After the survey several coral heads were blasted out to permit safe navigation of large ships and to permit proper placement of ships in the proposed target arrays. Navigational and mooring buoys were laid in the lagoon and beacons placed on shore. On the islands, photographic towers (Figure 7), recording stations, recreational facilities (Figure 8), and landing facilities were constructed. This work was started on 20 March with the arrival of the 53rd Special Naval Construction Battalion, assisted by elements of the service groups and minesweeping units of the Pacific Fleet (Reference C.9.206, p. V-(B)-4).
Figure 7. Erection of photo towers on Bikini, prior to CROSSROADS, 1946.
Figure 8. Bikini recreation area during CROSSROADS.

LOGISTICS PROBLEMS IN THE CROSSROADS TESTS

The remoteness of BIKINI ATOLL posed significant logistical problems in procuring and transporting personnel, materials, and supplies to the new test site. Special security arrangements were also required to transport the nuclear weapons from the United States to the test area. However, there were many advantages to testing at BIKINI. It offered a large, uninhabited area for test activities and nearly steady directional winds to clear the airborne test debris.

Another major problem was design, procurement, and installation of the many scientific instruments required to measure effects of the detonations. These included instruments for observing shock waves, water pressure, airblast, wave action, deformation of structures, and radioactivity. Remotely controlled (dropped) boats and aircraft had to be provided to obtain important measurements in radioactive zones without endangering personnel. Laboratories had to be
installed on ships and on shore to repair instruments and carry out test analyses (Reference C.9.206, p. I-(B)-7).

In addition, CROSSROADS posed other problems (Reference A.1, pp. 20 through 23):

- Scientific resources were declining from wartime peaks
- The number of nontechnical Service personnel was diminishing
- Civilian scientists participating from universities were insistent upon returning by early September
- Army and Navy budgets were expected to become smaller after the war
- Obsolete target vessels could not be held available indefinitely.

JOINT TASK FORCE ONE

JTF 1 was organized on 11 January 1946. It followed the basic principles employed during World War II to develop amphibious task forces, but incorporated needs of the scientific program. The joint task force staff comprised Army, Navy, and civilian scientific personnel. This joint staff maintained liaison with the War and Navy Departments, the Manhattan Engineer District, and other government agencies.

CJTF 1 maintained liaison with two boards of special interest, the JCS Evaluation Board and the President's Evaluation Commission. The Evaluation Board was to advise CJTF 1 during preparation for the tests and evaluate test results. The Evaluation Commission was to cooperate with the War and Navy Departments in conducting the tests, and to undertake a study of the tests and to submit its observations to the President along with findings, conclusions, and recommendations (Reference C.9.206, pp. VI-(B)-1 and VI-(B)-2).

JTF 1 was subdivided into eight task groups, each of which performed some specific function. Figure 9 details the structure of JTF 1, which was headquartered on USS Mount McKinley (AGC-7).

Task Group 1.1 (Technical Group)

Task Group (TG) 1.1 was responsible for instrumenting all target ships and target areas. Selected ships assigned to the group were equipped with laboratory facilities to service scientific instruments and record all data. The primary mission of its Drone Boat Unit (Task Unit [TU] 1.1.3) was to obtain early samples of radioactive water after each test and conduct remotely controlled radiological reconnaissances of the lagoon area after shot BAKER. TG 1.1 also did the following:

- Operated and performed technical services
- Observed and measured physical phenomena
- Furnished technical advice and assistance.
TG 1.1 had the following three task units, listed below with the ships on which they were based.

- **TU 1.1.1 (Laboratory Unit)**
  - USS Albemarle (AV-5) (Flagship)
  - LCT-1359
  - LSM-60 (BAKER surface zero vessel)

- **TU 1.1.2 (Instrumentation Unit)**
  - USS Avery Island (AG-76)
  - USS Burleson (APA-67)
  - USS Cumberland Sound (AV-17)
  - USS Haven (AH-12)
  - USS Kenneth Whiting (AV-14)
  - USS Wharton (AP-7)

- **TU 1.1.3 (Drone Boat Unit)**
  - USS Begor (APD-127)

**Task Group 1.2 (Target Vessel Group)**

TG 1.2 did the following:

- Prepared and placed target vessels for tests
- Salvaged and provided rescue assistance to damaged, strained, or distressed vessels
- Evacuated ships at time of tests
- Furnished boats and boat crews to the boat pool
- Provided boats from target vessels for radsafe reconnaissance and transport of initial inspection parties.

TG 1.2 was composed of seven task units during the testing period; their respective ships are listed in Table 1. **USS Fall River (CA-131)** was the flagship for TG 1.2. Not all TG 1.2 ships were target ships, although most were. Nontarget ships listed supported preparation, placement, and salvage of the targets. An eighth task unit, **TU 1.2.12 (Kwajalein Maintenance Force)**, provided radiological decontamination and ammunition removal and disposal services for the JTF 1 ships moved from Bikini to Kwajalein during August and September 1946. Other activities included rollup of operations at Bikini, radiological survey of marine life around Wotho, Rongerik, and Rongelap islands, preparation of ships for movement to other shipyards, and aid in the training of radiological safety school graduates who had been sent to Kwajalein for practical experience. The unit initially consisted of about 1,500 men based ashore and on assorted small craft as well as the following vessels:
Table 1. Task Group 1.2 (Target Vessel Group) ships participating in CROSSROADS.

<table>
<thead>
<tr>
<th>Task Group 1.2</th>
<th>Task Unit 1.2.3</th>
<th>Task Unit 1.2.4</th>
<th>Task Unit 1.2.5</th>
<th>Task Unit 1.2.6</th>
<th>Task Unit 1.2.7</th>
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<tbody>
<tr>
<td>Flagship</td>
<td>Destroyer Unit</td>
<td>Submarine Unit</td>
<td>LST Group 9</td>
<td>Transport Unit</td>
<td>Salvage Unit</td>
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<td>USS Montana (CA-131)</td>
<td>USS Anderson (BB-411)</td>
<td>USS Sturtevant (CA-131)</td>
<td>USS LST-52</td>
<td>USS Beaver (APA-66)</td>
<td>ATV-40d</td>
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<td>Task Unit 1.2.1</td>
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<td>USS Bunker (APA-50)</td>
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<td>Battleship and Cruiser Unit</td>
<td>Destroyer Division 31</td>
<td>Submarine Division 111</td>
<td>USS LST-128</td>
<td>USS Blume (APA-66)</td>
<td>ATV-105d</td>
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<td>USS Pennsylvania (BB-38)</td>
<td>USS LST-220</td>
<td>USS LST-345</td>
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<td>Destroyer Division 2</td>
<td>Submarine Division 112</td>
<td>USS LST-368</td>
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<td>USS Texas (BB-36)</td>
<td>USS Oregan (DD-406)</td>
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<td>USS LCI-327</td>
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<td>USS Pennsylvania (BB-38)</td>
<td>USS Stack (DD-406)</td>
<td>USS Entuna (DD-406)</td>
<td>USS LCI-329</td>
<td>USS Dauphin (APA-91)</td>
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<td>Cruiser Division 23</td>
<td>USS Weihait (DD-406)</td>
<td>USS Parche (DD-406)</td>
<td>USS LCI-620</td>
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<td>USS Tennessee (CA-24)</td>
<td>USS Melwin (DD-406)</td>
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<td>USS LCI-620</td>
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<td>USS Salt Lake City (CA-28)</td>
<td>USS Wilson (DD-406)</td>
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<td>USS LCI-620</td>
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<td>Aircraft Carrier Unit</td>
<td>Destroyer Division 3</td>
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<tr>
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<td>USS Magnot (DD-406)</td>
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<tr>
<td>USS Independence (CVL-22)</td>
<td>USS Trippe (DD-406)</td>
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<td>USS LCI-581a</td>
<td>USS Delawar (APA-68)</td>
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</tbody>
</table>

NOTES:
1. Non-target vessels.
2. Two PBY-5A Coronado seaplanes were also moored in the target array. They were not assigned to any task unit.
3. BAKIR target only.
USS Conserver (ARS-39)  APL-27
USS Current (ARS-22)   LCI-329
USS Geneva (APA-86)  LCI(L)-549
USS Haven (AH-12)  LCI(L)-615
YF-753

Task Group 1.3 (Transport Group)

TG 1.3 transported personnel and equipment to Bikini Atoll as well as evacuating personnel of the Target Vessel Group. It also furnished boats and boat crews to the boat pool, supplied two AKAs and two LSTs for the construction unit, and transported and quartered the press and observers. This task group was composed of three task units; their respective ships are listed below.

TU 1.3.1 (Transport Group)

Transport Division 31

USS Bayfield (APA-33)  USS Ottawa (AKA-101)
USS Bexar (APA-227)  USS Rockbridge (APA-228)
USS Bottineau (APA-235)  USS Rockingham (APA-229)
USS George Clymer (APA-27)  USS Rockwall (APA-230)
USS Henrico (APA-45)  USS Rolette (AKA-99)
USS LST-817  USS Saint Croix (APA-231)
USS LST-881

TU 1.3.2 (Press Unit)

USS Appalachian (AGC-1)

TU 1.3.3 (Observer Unit)

USS Blue Ridge (AGC-2)
USS Panamint (AGC-13)

An alphabetically arranged list of participating target and support ships, which includes a summary of their activities, forms Appendix A of this report.

Task Group 1.4 (Army Ground Group)

TG 1.4 was responsible for determining damage to selected Army equipment exposed at varying distances from the detonation point and measuring radii of effectiveness for each detonation. Each of the operating task units had Army equipment on certain ships and on Bikini Island for exposure to the nuclear detonations. Figure 10 shows the TG 1.4 organization. Each unit had inspection teams that were assigned to target ships and responsible for loading, securing, maintaining, and inspecting assigned test items. These teams also instructed crews of each target ship concerning exposed test items. Teams were to reboard
ships after the tests when ships were radiologically cleared and safe for boarding (Reference C.9.149, p. 3). TG 1.4 was composed of a headquarters and the following six operating task units:

- TU 1.4.1 (Engineer Unit)
- TU 1.4.2 (Signal Unit)
- TU 1.4.3 (Ordnance Unit)
- TU 1.4.4 (Chemical Unit)
- TU 1.4.5 (Quartermaster Unit)
- TU 1.4.6 (Air Unit).

Task Group 1.5 (Army Air Group)

TG 1.5, the Army Air Group, composed of provisional Army Air Forces units, was assigned the mission of dropping the ABLE weapon on the target array in Bikini Lagoon. In addition, it furnished aircraft, facilities, and crews for photography, weather reconnaissance, air-sea rescue, cloud sampling, pressure gauge drops, and air transport. Table 2 lists the Army aircraft used during CROSSROADS. B-29s and F-13s, which were modified B-29s, have become intermingled at some points in the historical accounts of Army Air Group operations. The totals for each shown here are correct by most accounts. TG 1.5 was composed of the following 10 task units (as shown in Figure 11).

**TASK UNIT 1.5.1 (TACTICAL OPERATIONS UNIT).** TU 1.5.1 trained crews, prepared equipment for the tests, airdropped the test ABLE weapon, set up the air search radar in the Bikini area, and provided radar analyses of practice bomb
### Table 2  Army aircraft, CROSSRCADS.

<table>
<thead>
<tr>
<th>Task Unit</th>
<th>Type</th>
<th>Quantity</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5.1</td>
<td>B-29</td>
<td>1</td>
<td>Command</td>
</tr>
<tr>
<td></td>
<td>B-29</td>
<td>1</td>
<td>Bomb drop</td>
</tr>
<tr>
<td></td>
<td>B-29</td>
<td>2</td>
<td>Pressure gauge drop</td>
</tr>
<tr>
<td></td>
<td>F-13(^a)</td>
<td>2</td>
<td>Radiological reconnaissance</td>
</tr>
<tr>
<td></td>
<td>B-29</td>
<td>3</td>
<td>Spars</td>
</tr>
<tr>
<td>1.5.2</td>
<td>C-54</td>
<td>2</td>
<td>Photographic</td>
</tr>
<tr>
<td></td>
<td>F-13(^b)</td>
<td>8</td>
<td>Photographic</td>
</tr>
<tr>
<td>1.5.3</td>
<td>B-17</td>
<td>10</td>
<td>Drone samplers</td>
</tr>
<tr>
<td></td>
<td>B-17</td>
<td>6</td>
<td>Drone controllers</td>
</tr>
<tr>
<td>1.5.4</td>
<td>C-46(^c)</td>
<td>20</td>
<td>Transport</td>
</tr>
<tr>
<td></td>
<td>C-54(^c)</td>
<td>10</td>
<td>Transport</td>
</tr>
<tr>
<td>1.5.6</td>
<td></td>
<td></td>
<td>This unit was combined with TU 1.5.3 before ABLE and BAKER tests.</td>
</tr>
<tr>
<td>1.5.7</td>
<td>WB-29</td>
<td>3</td>
<td>Weather reconnaissance</td>
</tr>
<tr>
<td>1.5.8</td>
<td>B-29</td>
<td>2</td>
<td>Radio broadcast, press, observation</td>
</tr>
<tr>
<td></td>
<td>C-54(^d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5.9</td>
<td>B-17</td>
<td>2</td>
<td>Air-sea rescue</td>
</tr>
</tbody>
</table>

Notes:
- \(^a\) Borrowed from TU 1.5.2.
- \(^b\) B-29s modified for photography.
- \(^c\) Includes those used to carry supplies to and from the continental United States.
- \(^d\) Borrowed from TU 1.5.4 on shot days.

Source: Reference C.9.189, p. VII-E, Appendix II.
Figure 11. Task Group 1.5 organization, Operation CROSSROADS.

runs. It also operated two B-29s that dropped pressure gauges during each test. In addition, after each detonation it tracked the radioactive clouds and sampled air around the clouds. The unit was based on Kwajalein Island.

TASK UNIT 1.5.2 (ARMY AIR PHOTOGRAPHIC UNIT). TU 1.5.2 conducted air photographic operations and furnished aircraft for radiological reconnaissance flights. It was stationed on Kwajalein Island.

TASK UNIT 1.5.3 (INSTRUMENTATION AND TEST REQUIREMENTS UNIT). TU 1.5.3 and TU 1.5.6 (Army Drone Unit) were combined before the operation began. It was responsible for providing the B-17 drone and B-17 drone-controller aircraft for cloud-sampling operations. The drone mission required that the unit provide and maintain special equipment for sampling and for drone control operations. This included special cameras mounted in the drones. This unit was located on Eniwetak Island.

TASK UNIT 1.5.4 (AIR TRANSPORT UNIT). TU 1.5.4 provided airlift for personnel, supplies, and equipment between Roswell Army Air Field, New Mexico, and the Pacific Test Area. It also provided air shuttle service among Kwajalein, Bikini, and Eniwetak islands. Both C-46s and C-54s were available. This unit, stationed on Kwajalein Island, was responsible to assist in evacuating Eniwetak Island in case of radiological danger to personnel on that island.

TASK UNIT 1.5.5 (AIR SERVICE UNIT). TU 1.5.5 serviced and maintained Army aircraft at Kwajalein Island. In addition to service and maintenance personnel, the task unit had engineers, military policemen, and weather-forecasting personnel.

TASK UNIT 1.5.7 (ARMY AIR WEATHER RECONNAISSANCE UNIT). TU 1.5.7 had three WB-29 aircraft with crews trained in weather reconnaissance. It flew long-range weather reconnaissance missions before each test. This unit was located on Kwajalein Island.

TASK UNIT 1.5.8 (AIR ORIENTATION UNIT). TU 1.5.8, based on Kwajalein Island, was responsible for accommodating visitors, observers, the press, and
news broadcasters. It flew these groups in two B-29s and two borrowed C-54s to witness CROSSROADS detonations.

**TASK UNIT 1.5.9 (AIR-SEA RESCUE UNIT).** TU 1.5.9 was initially part of TU 1.5.3 but was made a separate unit before testing started. It had two B-17 aircraft (called "Dumbos") for air-sea rescue and provided coverage between Enewetak and Bikini. The unit was based on Enewetak Island.

**TASK UNIT 1.5.10 (HEADQUARTERS, AIR UNIT).** TU 1.5.10 contained the command and staff elements of TG 1.5. It was based on Kwajalein Island and operated the task group headquarters. It was also known as Hq TG 1.5 (Reference B.5.1).

Task Group 1.6 (Navy Air Group)

TG 1.6 had three different functions: drone plane and drone boat control, aerial photography, and seaplane transportation. TG 1.6 was composed of four task units:

- **TU 1.6.1 (Drone Carrier Unit)**
  - **TE 1.6.11**
    - **USS Shangri-La** (CV-38)
  - **TE 1.6.12**
    - **USS Charles P. Cecil** (DD-835)
    - **USS Furse** (DD-882)
    - **USS Newman K. Perry** (DD-883)
    - **USS Turner** (DD-834)
  - **TE 1.6.13** (Navy Field Recovery Subunit, NAB Roi-Namur, Kwajalein)
  - **TE 1.6.14**
    - Air Development Squadron 2 (VX-2)

- **TU 1.6.2 (Photo Carrier Unit)**
  - **USS Saidor** (CVE-117)
  - Plane guard destroyers from TE 1.6.12 as assigned.

- **TU 1.6.3 (Seaplane Unit, NAB Ebeye Island, Kwajalein)**
  - Patrol Seaplane Squadron 32 (VPB-32)
  - Air-Rescue Squadron 4 (VH-4)
  - Carrier Aircraft Service Unit (Fleet) 34 (CASU[F]-34)

- **TU 1.6.4 (Seaplane Tender, Bikini)**
  - **USS Orca** (AVP-49).

Shangri-La carried drone aircraft and operated off Roi Island, Kwajalein, where an airfield was used for landing and experimenting with drone planes.
Between tests, Saidor operated from Bikini Lagoon with drone boat control and photographic unit personnel on board. Except on ABLE and BAKER days, Orca was stationed at Bikini as a terminal and service unit for transport seaplanes. The ship maintained seaplane runways and furnished overhaul servicing required for all planes on turn-around service (Reference C.9.206, p. V-B-10).

Task Group 1.7 (Destroyer Surface Patrol Group)

TG 1.7 performed the following tasks during CROSSROADS:

- Furnished radsafe patrols
- Anchored one ship at Bikini Atoll lagoon entrance, except when it was evacuated, and supplied arrival information to incoming vessels
- Advised the Senior Officer Present Afloat (SOPA) about each arrival and departure from Bikini Lagoon
- Deployed two destroyers to act as approach markers for the bombing aircraft in test ABLE.

TG 1.7 was composed of only one task unit, TU 1.7.1 (Destroyer Squadron Unit), and contained the following ships.

Destroyer Division 71

- USS Barton (DD-722) (Flagship)
- USS O'Brien (DD-725)
- USS Laffey (DD-724)
- USS Walke (DD-723)
- USS Lowry (DD-770)

Destroyer Division 72

- USS Allen M. Sumner (DD-692)
- USS Moale (DD-693)
- USS Ingraham (DD-694)
- USS Robert K. Huntington (DD-781)

Task Group 1.8 (Service Group)

This task group had the following responsibilities:

- Base facilities and services including repair, fuel, water, mail service (USS LST-861): general supply, provisions, hospital, and recreation (USS LST-388)
- Island commander functions for land areas of Bikini Atoll, such as policing recreational areas, conducting shore patrol, and controlling boat traffic at landings
- Boat services
- Medical and hospital services
- Quarters and laboratory facilities on USS Fulton (AS-11) for the Oceanographic Wave Measurement Group
- Surveys in accordance with the Oceanographic Survey Plan
- Construction in accordance with Logistic Plan
- LCI shuttle service between Bikini and Kwajalein atolls
- Evacuation of Rongerik Atoll population if necessary.

TG 1.8 was composed of the following six task units (Reference B.0.1, pp. 5 and 6).

**TU 1.8.1 (Repair and Service Unit)**

<table>
<thead>
<tr>
<th>USS Ajax (AR-6)</th>
<th>USS Sioux (ATF-75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARD-29</td>
<td>USS Sphinx (ARL-24)</td>
</tr>
<tr>
<td>ATA-124</td>
<td>USS Telamon (ARB-8)</td>
</tr>
<tr>
<td>ATA-187</td>
<td>USS Tombigbee (AOB-11)</td>
</tr>
<tr>
<td>USS Cebu (ARC-6)</td>
<td>USS Wenatchee (ATF-118)</td>
</tr>
<tr>
<td>USS Chikaskia (AO-54)</td>
<td>USS Wildcat (AW-2)</td>
</tr>
<tr>
<td>USS Chowanoc (ATF-100)</td>
<td>YF-1009</td>
</tr>
<tr>
<td>USS Coasters Harbor (AG-74)</td>
<td>YF-385</td>
</tr>
<tr>
<td>USS Creon (ARL-11)</td>
<td>YF-733</td>
</tr>
<tr>
<td>USS Dixie (AD-14) (Flagship)</td>
<td>YF-734</td>
</tr>
<tr>
<td>USS Enoree (AO-69)</td>
<td>YF-735</td>
</tr>
<tr>
<td>USS Fulton (AS-11)</td>
<td>YF-752</td>
</tr>
<tr>
<td>USS Hesperia (AKS-13)</td>
<td>YF-753</td>
</tr>
<tr>
<td>USS Limestone (IX-158)</td>
<td>YF-754</td>
</tr>
<tr>
<td>USS LST-388</td>
<td>YF-990</td>
</tr>
<tr>
<td>USS LST-661</td>
<td>YF-991</td>
</tr>
<tr>
<td>USS Munsee (ATF-107)</td>
<td>YF-992</td>
</tr>
<tr>
<td>USS Phaon (ARB-3)</td>
<td>YO-132</td>
</tr>
<tr>
<td>USS Pollux (AKS-4)</td>
<td>YO-199</td>
</tr>
<tr>
<td>USS Quartz (IX-150)</td>
<td>YOG-63</td>
</tr>
<tr>
<td>USS Severn (AO-61)</td>
<td>YOG-70</td>
</tr>
<tr>
<td></td>
<td>YW-92</td>
</tr>
</tbody>
</table>

**TU 1.8.2 -- No units assigned**

**TU 1.8.3 (Dispatch Boat and Boat Pool)**

<table>
<thead>
<tr>
<th>USS Gunston Hall (LSD-5)</th>
<th>LCT-1361</th>
<th>PGM-29</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCI(L)-977</td>
<td>LCT-1461</td>
<td>PGM-31</td>
</tr>
<tr>
<td>LCI(L)-1091</td>
<td>PGM-23</td>
<td>PGM-32</td>
</tr>
<tr>
<td>LCI(L)-1062</td>
<td>PGM-24</td>
<td>USS Presque Isle (ARL-44)</td>
</tr>
<tr>
<td>LCI(L)-1067</td>
<td>PGM-25</td>
<td>USS San Marcos (LSD-25)</td>
</tr>
</tbody>
</table>

42
TU 1.8.4 (Medical Unit)
USS Benevolence (AH-13)
USS Bountiful (AH-9)

TU 1.8.5 (Survey Unit)
USS Bowditch (AGS-4)
USS James M. Gillis (AGS-13)
USS John Blish (AGS-10)
YMS-354
YMS-358
YMS-413
YP-636

TU 1.8.6 (Construction Unit)
53rd Construction Battalion (later, Construction Battalion Detachment 1156)

TU 1.8.7 (Rongerik Evacuation Unit)
USS LST-871
USS LST-989

POST-OPERATION ORGANIZATION AND ACTIVITIES

After 7 September all survey and construction activities at Bikini were rapidly brought to a close, and the atoll was evacuated by 26 September 1946. Following a meeting on the West Coast from 17 to 20 September concerning decontamination procedures, some officers from JTF 1 were ordered to temporary duty under Commander Western Sea Frontier to follow up and coordinate the decontamination, monitoring, and clearance of exposed ships. On 24 September, in a joint speedletter, the Bureau of Ships and the Bureau of Medicine and Surgery assumed responsibility for giving final radiological ship clearances and prescribed detailed decontamination and clearance procedures. JTF 1 was formally dissolved on 1 November; its successor was a JCS committee, the Joint CROSSROADS Committee, whose task was to oversee the final test activities, publish the final reports, and supervise the Bikini Resurvey Operation of summer 1947, described in Chapter 6 (Reference C.9.206, pp. V-(D)-5 through V-(D)-7).
Proposals to test atomic weapon effects on ships were made at the end of World War II, but the first discussion of radiological safety appears to have occurred at a meeting held 8 December 1945. Among those attending were the commanding general of the Manhattan Engineer District, the chief of the District's Medical section, and a Navy officer closely associated with the atomic bomb project and trained in chemical warfare technology. This officer became Safety Advisor to Commander Joint Task Force 1 (CJTF 1) and headed the task force safety organization. The chief of the medical section, an Army medical officer, became Radiological Safety Advisor to CJTF 1 and headed the task force Radiological Safety Section within the safety organization (Reference A.1, pp. 9, 48, and 49; Reference B.0.1; Reference C.9.206, pp. VII-(C)-1 and VII-(C)-2).

During the next several months, training of radiological safety (radsafe) personnel, organization of the radsafe unit, and writing of the radsafe plan went forward. By 15 December medical officers from the Army, Navy, and Public Health Service had been selected for training in radiological safety. The Manhattan Engineer District took responsibility for radiological safety as the result of a meeting on 7 January 1946 between the joint task force commander designate and the commanding general of the Manhattan Engineering District. The Safety Advisor, the Radiological Safety Advisor, and the Radiological Safety Section were part of the joint task force from the time of its formal establishment on 11 January 1946. By April 15 a radsafe plan was submitted to CJTF 1. The plan was approved with revisions on 28 April. The plan underwent no significant revisions until after shot ABLE (Reference C.9.206, pp. VII-(C)-1 and VII-(C)-2). Relevant portions are reproduced in Appendix B.

Radiological safety, however, was only part of the task force’s comprehensive safety program. It also included protecting personnel from fire, explosions, and toxic material. By exposing a fleet of warships, many loaded with ammunition, fuel, and lubricants, to nuclear explosions, the task force added nuclear safety to the many concerns damage control officers had faced for years.

The radsafe plan emphasized detection and avoidance of radiation to protect personnel. Systematic reconnaissance was to begin shortly after each detonation. Navy patrol seaplanes (PBMis) were to conduct aerial surveys over the lagoon and destroyers were to patrol the open ocean upwind and downwind of the atoll. Drone patrol boats were to enter the lagoon first to take water samples. Radsafe monitors aboard gunboats (PGMs) and landing craft (LCPLs) were to measure the lagoon's radioactivity. D-29s were to track the nuclear cloud. Radsafe monitors were to accompany all units and working parties reentering the target area to recover data or work on the target vessels.
Although the Manhattan Engineer District had taken responsibility for radiological safety at CROSSROADS, the District's role actually consisted of providing radsafe equipment and senior radsafe personnel. CJTF 1 was in command at Bikini and major radsafe orders were issued in his name. A Radiological Safety Section was established to advise CJTF 1 in this area and to implement his orders. Its chief was also CJTF 1's Radiological Safety Advisor. During test operations the section operated directly under the JTF 1 Assistant Chief of Staff for Operations. For the purposes of technical advice and instrumentation, the Radiological Safety Section reported to the Technical Director. This dual chain of command caused no difficulty during CROSSROADS (Reference C.9.206, p. VII-(C)-2).

The mission of the Radiological Safety Section was (Reference B.0.1, p. E-II-1):

... to protect personnel from the hazards peculiar to the use of the atomic bomb during Operation CROSSROADS and to enable personnel to return safely to the target area at the earliest possible moment.

The task force operation plan specified the following elements for the Radiological Safety Section (Reference B.0.1, p. E-II-1):

1. Radiological Safety Control Unit
2. Radiological Safety Advisory Board
3. Radiological Safety Reconnaissance Units
4. Radiological Safety Monitor-Advisors
5. Radiological Safety Technical Service Units.

Documents written during CROSSROADS provide additional details on the section's organization. Figure 12 gives a composite picture based on information from the available sources.

The section chief, his staff, and supporting personnel, such as clerks and radiomen, made up the Radiological Safety Control Unit, based aboard USS Mount McKinley (AGC-7), the task force flagship. They were to (1) receive, plot, and analyze radiological data from all sources, (2) control the radsafe reconnaissance units, and (3) advise CJTF 1 on the location and amount of radioactivity. They were also to predict the path of the radioactive cloud and the pool of radioactive water.

The Committee for Review of Radiological Safety Measures functioned during most of its existence at Bikini under the title of Medico-Legal Board. It was convened on 15 June 1946 by the chief of the Radsafe Section, after which it met irregularly at his call or when one or more of its members felt a matter required its attention. Initially, it served to evaluate the regulations and safety measures adopted to protect personnel from radiological hazards. Later the board initiated a number of investigations, believing itself warranted in defining its own field of action. A total of 14 men served on the board at one time or another. All were medical doctors, specializing in radiology or with
JOINT TASK FORCE 1
SAFETY OFFICER

RADIOLOGICAL SAFETY
CONTROL UNIT

SECTION CHIEF*

ADVISORY BOARDS

ADVISORY BOARD

MEDICO-LEGAL
BOARD**

PERSONNEL

OPERATIONS

TECHNICAL
SERVICES

LOGISTICS

INSTRUMENTS

PHOTOMETRY

ANALYSIS

TECHNICAL SERVICES UNITS


** THIS BOARD CONVENED AS THE COMMITTEE FOR REVIEW OF RADIOLOGICAL SAFETY MEASURES. BUT SOON BEGAN TO USE THE TITLE MEDICO-LEGAL BOARD. IT WAS APPOINTED BY THE RADIOLOGICAL SAFETY CHIEF TO PROVIDE PERSONAL ADVICE.

Figure 12. Organization of the Radiological Safety Section, CROSSROADS (sources: References C.9.206, B.0.2, B.0.4, and B.0.7).

radiation safety experience. The board held 14 meetings and considered such topics as the plutonium hazard, permissible beta exposure, fission products in the air, decontamination of personnel, control of overdoses, urinalyses, blood counts, monitoring procedures, and removal of equipment from target vessels (References B.0.7, C.0.5, C.0.6, C.0.7, C.0.8, and C.0.9b).

Planning called for each radsafe reconnaissance unit to consist of a monitor and one or more assistants. Initially, units were assigned as follows: two for PBMs, two for HSO-1 helicopters, nine for destroyers, six for PGMs on lagoon patrol, twenty for LCPLs on lagoon patrol, six for cloud-tracking aircraft, and two for drone boat operations (Reference B.0.1, p. E-II-1). However, as ABLE shot approached it became clear that many more monitors would be needed; in fact, over 225 monitors were used for each of the two shots (Reference C.9.206, p. VII-C-5).

Radsafe monitor-advisors were assigned to commands and aircraft likely to encounter radioactivity. The major function of these monitors was to advise their commands and pilots on radiological safety. In addition, they had a reconnaissance function. Thus, they could quickly communicate with the radsafe control unit to report radiation levels and receive advice on safety measures (Reference B.0.1, p. E-II-8).
The Radiological Safety Technical Service Units were composed of instrument repair personnel, photometrists, and analysts. The instrument repair personnel maintained, repaired, and calibrated all instruments used by the radsafe section. They supplied monitoring equipment to all aircraft operating in the test area that did not carry monitors, and they trained pilots in use of that equipment. The photometrists (dosimetry technicians) calibrated film dosimetry badges, prepared casualty and personnel badges, processed film from badges that had been worn, calculated exposure from film data, and recorded the results. Analysts collected and analyzed samples of water, soil, and marine life for radioactivity (Reference B.0.1, p. E-II-8; Reference B.0.4).

PERSONNEL PROTECTION

Tolerance Exposure

The Operation Plan set the maximum allowable dose or tolerance for exposure over a long period at 0.1 roentgen (R) per 24 hours (Reference B.0.1, p. E-I-3). The National Bureau of Standards had established that limit in 1934, and it was used in manufacturing plants in the United States (Reference B.0.8). The Chief of the Radsafe Section stated that this dosage was based on 2 to 2-1/2 years of experiments with dogs, mice, and fruit flies, and on experience with a workforce of 8,000 people (Reference B.0.9). The Operation Plan also stated that an individual was not to have a total exposure of over 50 or 60 R in 2 weeks. If an individual received 10 R in 1 day or 60 R in 2 weeks he was to be withdrawn from active participation in the operation (Reference B.0.1 p. E-I-3). Such action was never required. The highest accumulated recorded exposure for the operation was 3.72 R, which was received by an Army assistant radsafe monitor badged for 6 days. The highest number of badges issued to a single individual was 19. He also was a radsafe monitor and his cumulative exposure was 2.48 R.

Provision was made for special situations (Reference B.0.1, p. E-II-9) that might:

... permit the assuming of a calculated risk in order to let certain key personnel enter a hazardous area to make highly desirable observations when the total amount of radiation to be received is less than 10 roentgen units. This may be permitted only on direct instructions from Radiological Safety Control. Details of the situation and clearance therefore will be carefully logged by the accompanying monitor and at Radiological Safety Control.

There is no record that this special provision was invoked during the operation.

On 5 August the Medico-Legal Board recommended that three monitors refrain from monitoring for 1 or 2 days because of badge readings in excess of 0.1 R (Reference C.0.10). Later, monitors who exceeded the tolerance were removed from work on USS Salt Lake City (CA-25) (Reference C.0.11).
film Badges

Two types of film badges were used at CROSSROADS. One type, called a personnel or mission badge, had a range from 0 to 2 R. Badges were issued to some of the men about to enter possibly radioactive areas and most badges were collected after the men returned, usually the same day. Some badges were worn for 2 or 3 days, and a few worn for as long as 9 days have been noted. Each badge contained a piece of Kodak Type K double-coat film in a dental film packet holder. Strips of lead were crossed over the film at right angles, leaving the film's corners without lead covering. Each badge was sealed in a tropical weather-proof envelope to protect it against the hot, humid Bikini climate (Reference C.0.5, p. 2-2).

The badges were designed to measure both beta and gamma exposure, but the beta readings obtained and recorded are now considered questionable (Reference C.13.2). There are several reasons for this. One is that the response of the double-coated film dosimeter emulsions depends on the energy of the beta particles they are exposed to. Unless additional thin metal foils are used over the films to filter or sort the beta radiation into known energy groups, or unless the energy distribution of the beta radiation is otherwise known, very large errors in interpreting the film darkening can result. There also appear to have been some incorrect assumptions made concerning whether gamma as well as beta would darken the unfiltered areas (Reference C.13.2). Despite the doubtfulness of the validity of the beta readings, the values as originally assigned have been accepted and used in total dose assignment in the NTPR program (Reference C.13.2).

After a badge was returned to the Radsafe Section, the photometrists of the Radiological Safety Technical Service Units developed the film in it and measured the film's optical density. This was a measure of the amount of radiation to which the film had been exposed. The film number, the wearer's last name, and the exposure date and time were written on a line on the left-hand page of an open ledger book of the type then widely used by Federal agencies. Sometimes the individual's first name, initials, or rank were written in. Sometimes the name of the ship where he was quartered or, more often, the target ship on which he had worked that day was entered. If the badge had been used on an island or ship as a radiation recorder, the location information was recorded instead of a person's name. Optical densities under the lead cross and on the corners of the badge were entered on the right-hand page. The radiation exposure was calculated from these densities and recorded as the final beta and gamma readings at the page's far right. Years later, the pages were removed from the ledgers and microfilmed. Information from badges worn during September, October, November, and December of 1946 was recorded on large (5- x 8-inch) cards for each individual.

Neither the detached pages nor the microfilm is easy to work with. The penmanship of the radsafe staff is not always legible, and incomplete identification of the badge wearers and inconsistent ship identifiers are additional problems. In 1968 the Reynolds Electrical and Engineering Company (REECo) transferred the information from the ledgers to a computer data base, allowing easier manipulation and analysis of the material. The REECo list is used as the basis of the personnel exposures in this report.
Multifilm badges, called casualty badges, were used to record high-range exposures. They were placed aboard a small number of ships and aircraft that might enter areas of high radiation. Casualty badges were also placed aboard target ships as part of the scientific program to determine exposure from the detonations.

Radiological Safety Instruments

CROSSROADS requirements for radsafe instruments turned out to be far greater than had been expected when planning for the operation began. No comprehensive program existed for development and manufacture of rugged instruments for use under field conditions; thus, the head of the Radsafe Section had to make do with what the Manhattan Engineer District could provide from its inventory and what the Victoreen Instrument Company could manufacture quickly (Reference C.11.1; Reference C.0.12, p. 18).

Each monitor unit or monitor-advisor was equipped with a Geiger-Mueller counter (X-263 Survey Meter) and an ionization meter (Model 247 Survey Meter), as well as other equipment, depending on the nature of the mission (Reference B.0.1, pp. E-II-2 through E-II-8).

The X-263 measured beta and gamma radiation from about 0.001 R/24 hours to about 0.4 R/24 hours (References B.0.10 and C.0.13). This range made the meter too sensitive for some radiation fields encountered during CROSSROADS (Reference A.2, pp. 7 and 8). The X-263 proved too delicate to function consistently under field conditions (Reference C.0.14, p. 3). Three hundred twenty of these instruments were available 2 days before BAKER (Reference C.0.12, p. 9). Every monitor tried to have three or four of them to assure that at least one would be working when he reached his post (Reference C.0.15, p. 3).

The 263 G.M. Set, an older version of the same instrument, also was used at Bikini, but information is lacking on the number available. Experienced monitors preferred it whenever accurate and reliable data were required (Reference C.0.12, p. 18).

The 247 Survey Meter measured gamma radiation only. Its range was from 0.5 to 200 R/24 hours, and it was often used for measuring intensities beyond the range of the X-263. It was rugged, spray resistant, and held its calibration well (Reference A.2, pp. 7 and 8; Reference C.0.12, p. 23). Twenty of these were available for monitoring after the BAKER detonation (Reference C.0.14, p. 3).

Pocket dosimeters were designed to measure cumulative gamma dose up to about 0.3 R. About 160 were issued for the BAKER test. They were relatively rugged and easy to repair. Apparently they were often issued to divers (Reference C.0.12, pp. 27 and 28).

Several other instruments were available to the monitors, although in numbers smaller than the X-263, the 247, and the pocket dosimeter. The L&W Survey Meter measured between 0.001 and 25 R/24 hours. Twelve were in service following BAKER. They were used mostly by boarding parties and by special groups, such as the target monitor group. The head of the monitor group wrote
that the L&W meter was the most reliable instrument for these measurements because it was energy-independent and insensitive to temperature and humidity changes (Reference C.0.16). Six assault meters, brought out by individual monitors, were used during the operation. They were very rugged and ideal for quick and rough determination of radiation levels from 0.1 to 10 R/24 hours. They proved useful for boarding ships and similar operations (Reference C.0.12, p. 3). The "cutie pie" survey meter was a small instrument capable of measuring beta and gamma radiation up to 100 R/24 hours. Few of these were available for CROSSROADS, but a monitor aboard PGM-32 after BAKER used one and decided it was an excellent portable rate meter (Reference C.0.15, p. 4).

The task force had several instruments for measuring alpha contamination. None, however, proved reliable for field surveys. Photographs of task force activities show the Zeus counting meter, the Zeuto, and the X-323. These three instruments were mentioned in training lectures for monitors (References C.0.17 and E.0.11). One of all may have been the Poppy or Walkie Poppy referred to in radsafe reports after BAKER. The three devices appear to have been small, and each had a carrying handle, but apparently they did not work well outside of USS Haven's (AH-12) air-conditioned laboratories in the hot, humid Bikini climate (Reference C.C.14, p. 4). In addition, the Radsafe Section had five Filter Queen Air Samplers. Basically, these were tank-type vacuum cleaners with an alpha detector and filter paper mounted in the intake tube. Samples collected in the filter papers aboard the target ships had to be returned to Haven where alpha counts were made. Initially, the alpha detectors worked well, but humidity, along with personnel opening the detectors improperly, caused them to fail (Reference C.0.12, pp. 8 and 9).

Personnel Decontamination

Personnel working in radioactive areas sometimes picked up radioactive particles on their bodies and their clothing. Procedures were established to minimize the spread of this contamination and potential internal and external exposure from these radioactive sources. The procedures spelled out for the USS Ajax (AR-6) crew working on repair of Salt Lake City following BAKER were typical and are summarized in the following paragraphs.

Ajax crewmembers slated for work on Salt Lake City left their own compartments wearing only their own shoes. These shoes were removed and left in a compartment adjacent to a designated head (bathroom) where the men donned work clothing. They then left Ajax via a Jacobs ladder into a small boat while carrying canvas gloves and shoe covers. The gloves and shoe covers were put on immediately before boarding the target ship for work and were taken off just before leaving.

Upon return to Ajax, the men boarded by Jacobs ladder and went to the upper deck where they were monitored. They walked only on a deck covering, which presumably was disposed of after use. The men first washed their hands and forearms with hot water and salt-water soap. Then each man washed his own clothing. These were first scrubbed in hot water and salt-water soap and then rinsed in a special hot rinse and rinsed again in plain hot water. The clothes were hung on lines to dry on the upper deck.
Clothing so contaminated that it read more than 0.10 R/24 hours (gamma) was placed in paper bags, and radiation was allowed to decay for a period of time before the clothing was washed. If the radiation did not decrease to less than 0.10 R/24 hours, the clothing was disposed of at sea.

After the clothing had been washed or put aside to cool, the men took a shower in the decontamination head in a designated stall with hot water, thoroughly soaping themselves with salt-water soap. They then proceeded to a second stall where they again showered with ordinary soap. The men were monitored again and if free of contamination could return to their own compartments; otherwise they continued showering (Reference B.0.12).

Commander Task Group (CTG) 1.2 set a slightly lower radiation level, 0.05 R/24 hours, above which the clothing was to be disposed of at sea. The contaminated clothing was to be bundled and weighted and the Radsafe Section was to be notified. An LCT picked up the bundles the next day and dumped them 10 nmi (18.5 km) from Bikini at sea.

Clothing in small lots was laundered in separate buckets (like the Alax procedure above) or done in the ships' laundry if in large lots. If the ships' laundry were used, however, the clothing had to be separately done and the laundry machinery had to be specially cleaned after use (Reference C.10.8).

Urine Testing

The discovery of alpha emitters, including plutonium, led to urine tests for personnel thought to have been exposed to determine whether any had taken these substances into their bodies. The water-testing laboratory on Haven was converted for testing urine. By 15 August, 2,600 samples had been tested. The men doing the work had to use instruments that were on hand and develop techniques as they worked. The widespread presence of radioactive material led to high background counts and made it difficult to determine whether an individual had low levels of alpha emitters in his urine. On 15 August the Radsafe Section reported slight beta activity had been found in the urine of 2,600 men checked (Reference A.2, pp. 117, 118, and 121 through 125; Reference C.10.9; Reference C.10.15). Despite all the concern and discussion about it, there is no indication in CROSSROADS documentation that positive alpha counts were found in any urine samples.

Eye Protection

Eye protection from the ABLE flash was a major concern. Approved darkened goggles were provided to personnel on ships 25 nmi (46 km) or less from the ABLE detonation and to all observers on the press and observer ships. Men without goggles within 30 nmi (56 km) were to turn away from surface zero, look down at the deck, close their eyes, and cover their eyes with their arm (Reference B.0.1, pp. E-I-1, E-I-2, and E-IV-2). Pilots airborne at the time of the detonation were to wear approved goggles and turn their heads away from the detonation. In addition, each copilot was to close his eyes and cover them with his arm so that he would be ready to fly the aircraft if the pilot was flashblinded (Reference B.0.1, p. F-XII-5).
EXCLUSION AREAS AND OPERATIONS LIMITS

Surface Operations

To reduce the chance of exposing task force personnel to radiation, several surface areas were defined by the Operation Plan to which access was forbidden or restricted (Reference C.9.206, p. VII-(C)-9):

1. Surface Survey Sector. This was a forbidden surface area outside the lagoon. It was bounded by two bearings drawn from the detonation point and by a radius that increased with time after the detonation.

2. Red Line. This line surrounded the lagoon area within which the radiation level was 1 R/24 hours or higher. This boundary was separate from the Red Arc that defined airspace limits.

3. Blue Line. This line marked the boundary between the lagoon area with a radiation level more than 0.1 R/24 hours and the area with a lower level. Vessels could operate in the lagoon area between the Blue and Red Lines only for specified periods of time with permission from the Radiological Safety Control Unit. Vessel movement outside of the Blue Line was governed only by regular Navy rules.

4. Anchorage Area Able. Ships could anchor in this area, provided they were ready to get underway on 1 hour notice.


In addition, certain operational limits were specified. No manned ships were to be closer than 10 nmi (18.5 km) from the ABLE detonation, and most were to be 20 nmi (37 km) away (Reference B.O.1, p. E-IV-1). In case of fallout on the ships, nonessential personnel were to be sent below decks, the ship closed up, and exposed personnel were to strip off their outer clothing before taking cover. If necessary, men in coveralls and gas masks were to decontaminate contaminated areas of the ship after fallout ended (Reference B.O.1, p. E-IV-7).

Before each test all ships were to have full freshwater tanks. Distilling plants and heat exchangers were not to be operated until the Radiological Safety Section had declared the saltwater to be used was radiologically safe. If the equipment had to be operated before radiological clearance had been given, special monitoring attention was required (Reference B.O.1, p. E-IV-10).

In order to gain access to classified or radioactive areas, the leader of a work party was required to present an identification card and a letter of authority. There were letters for damage control, instrumentation, observer, press, and radsafe parties, among others (Reference B.O.3).

Aerial Operations

Initially Joint Task Force One Operation Plan 1-46 (OpPlan 1-46) prescribed certain general safety precautions for air operations. It specified that all aircraft aloft from H-2 hours to H+30 minutes carry a radiation monitor with monitoring equipment. Exceptions were the bomb-drop and pressure-gauge-drop
B-29s, single-seated aircraft, and those other aircraft so designated by CJTF as exempt. The crewmembers of all aircraft aloft during that period were to wear film badges, and each aircraft was to carry at least one casualty badge capable of recording radiation much higher than personnel film badges. In actuality, these plans were modified somewhat for both shots. For shot ABLE, radiation monitors were aboard all photographic aircraft, reconnaissance aircraft, drone control aircraft (except the Navy F6Fs), air-sea rescue aircraft, and press/observer aircraft. The F6Fs were single-seated, fighter-type aircraft in which radiation monitoring equipment was installed for the pilot's protection. On shot BAKER, radiation monitors were aboard all photographic aircraft, reconnaissance aircraft, and press/observer aircraft (Reference C.9.206, pp. VII-(C)-10 and VII-(C)-19).

The prohibited airspace for aircraft was defined separately for each of the two tests and was a function of time and range. For the first 6 minutes after detonation, no aircraft was to approach closer than 10 nmi (18.5 km) to surface zero. From H+6 to H+30 minutes, a radiation danger sector (radex) was defined, consisting of two bearings drawn from surface zero, e.g., 320° clockwise to 120°. From H+6 to H+18 minutes, the aircraft exclusion area consisted of all space in this sector within the Red Arc. From H+18 to H+30 minutes, the exclusion area was all space in this sector within the Blue Arc. The Red and Blue Arcs were decided upon based on wind speeds the morning of each detonation. The morning of each shot, the radex sector was updated from the one predicted the previous evening. The Red Arc was, by definition, nearer surface zero than the Blue Arc. Specific values for radex sectors and the Red and Blue Arcs for the ABLE and BAKER shots are discussed in Chapter 4 (Reference B.0.6). In addition, no aircraft without radiation detection instrumentation was to approach closer than 20 nmi (37 km) to the visible column or downwind clouds. From H+30 minutes to H+30 hours, no aircraft was to be within 30 nmi (56 km) of surface zero unless engaged in radsafe work or cleared by the Deputy Commander for Aviation (Reference B.0.1, p. F-XII-3).

All aircraft, manned and drone, airborne from H-hour until H+30 were to be monitored upon landing. Aircraft oil filters and any surface oil spots were to receive special monitoring attention. All drones were considered heavily contaminated until proven otherwise (Reference B.0.1, pp. E-IV-3 and E-IV-4).

STAFFING AND TRAINING
Selection of Personnel

When the Radiological Safety Section was established in January 1946, it was believed that 50 to 60 monitors would be needed. Between 20 and 30 were to be experienced radsafe practitioners from the Manhattan Engineer District and thirty were to be doctors from the Army, Navy, and U.S. Public Health Service. The latter group, including a chemical warfare officer, reported to Oak Ridge National Laboratory on 15 January for an intensive 11-week course. The course included the physics of radioactivity, nuclear safety techniques, biological effects of radioactivity, field training, and hazards of ingested radionuclides. Experts from Oak Ridge and Los Alamos laboratories and from the universities of Rochester, Chicago, and California at Berkeley provided instruction (Reference C.9.206, p. VII-(C)-4).
As the Chief of the Radiological Safety Section and his staff continued work on the radsafe plan, they realized that a much larger group of monitors and other experts would be required than would be available from the Manhattan Engineer District. To fill this gap, the section chief called on a number of scientists who had already returned to civilian life from wartime service with the government. Few were eager for another extended period of government service, and they and the universities or laboratories employing them demanded, and received, promises of strict limits on the duration of their CROSSROADS service. Apparently, all were to be back in the United States by late August or early September (Reference C.9.206, p. VII-(C)-4).

On 23 March 1946, efforts to staff the Radiological Safety Section were dealt a major setback when the President announced that the first test was to be postponed from 15 May to 1 July (Reference B.12.1, p. 1), with the result that the second test also was delayed. This change raised the prospect that personnel from colleges and universities would not be back on campus for the start of the fall semester. The Chief of the Radiological Safety Section struggled to hold his civilian recruits, but many resigned and he was forced to search for replacements. He asked for more military officers and was supplied with 55 from the Navy and 15 from the Army, almost all of whom were reservists. He also was able to obtain some additional civilians (Reference C.9.206, p. VII-(C)-5; Reference B.0.5).

Bikini Activities

Most of the Radiological Safety Section reached Bikini on 12 June aboard Haven (Reference A.2, p. 11). Some personnel, however, did not arrive until after the ABLE shot or the BAKER rehearsal, and some civilians left Bikini before the BAKER detonation. The Radiological Safety Section was able to muster over 300 personnel for ABLE. Over 225 monitors were available for each of the two shots, but they were stretched thin. During ABLE there were more monitors than during BAKER (Reference A.1, p. 31; Reference C.9.206, p. VII-(C)-5).

Training of Radiological Safety Section personnel had three phases. First, intensive training for the original group of military and public health personnel at Oak Ridge and other locations beginning in mid-January; second, training of the entire section aboard Haven on the way to Bikini; and, third, additional training for the section and for later arrivals once at Bikini.

One of the monitors, a medical doctor drafted into the Army late in the war and assigned to CROSSROADS, characterized the group aboard Haven as follows (Reference A.2, p. 5):

Most are older men. Some are well-known scientists. Some have worked with radiation in the Manhattan District, but the majority come with little more than a scientific background. Test ABLE is only one month away. Since this group is to have the responsibility for protecting task force personnel from the invisible dangers of radioactivity, the problem of briefing them on the fundamentals and the practical aspects of radiation is acute.

Training for the entire section began aboard Haven on 31 May as the ship steamed for Bikini. It consisted of lectures and work with radiation detection
instruments. The 12-day curriculum is shown in Table 3. On the seventh day, personnel were divided into groups by job: destroyer monitors, aircraft monitors, PGM monitors, etc. They were issued instruments, and radium sources in lead "pigs" (containers) were used to give the men experience calibrating and reading their instruments under a semblance of field conditions (Reference A.2, p. 7: Reference C.9.206, pp. VII-(C)-6 and VII-(C)-7).

Haven arrived at Bikini on 12 June, and a task-force-wide rehearsal, called Queen Day, was held on 14 June. Two problems for the radsafe section became immediately apparent. First, because of a shortage of electronics technicians, radios on Mount McKinley used by the Radiological Safety Control Unit could not be kept operating adequately under the heavy load put upon them. Second, the 24 landing craft assigned to the Radiological Safety Section were in very poor repair and their radios were even worse. Only six of the twenty-four landing craft could participate in this first exercise, and four of them broke down within 3 hours. Neither Mount McKinley's radios nor the landing craft were fully ready for the ABLE rehearsal. Their first completely satisfactory performance was on ABLE day (Reference C.9.206, p. VII-(C)-8).

Task force personnel had various means of learning about the upcoming operation and the safety procedures and the problems that might be encountered. Ships' newspapers and Plans of the Day carried many articles on CROSSROADS. The Operation Plan was available on each ship and formed the basis for indoctrination of the ship's force about what to expect and what safety precautions were to be taken. A bulletin addressed to the officers and men of USS Wharton (AP-7) and signed by the Director of Ship Materials (DSM) gave a description of the projected detonation and the arrangement of the target fleet. The bulletin also included the statement that from time to time members of the staff would give lectures on various aspects of the bomb tests that would be of general interest (Reference B.0.14). This bulletin probably was typical of the briefing materials used throughout the task force. In addition, there was a full-scale rehearsal stressing safety before each test. Most of the scientific personnel collecting data on phenomenology and blast effects were probably fairly well-versed in radiation safety from their service with the Manhattan Engineer District. Units designated to enter possibly radioactive areas received briefings from members of the radsafe staff, usually the unit's assigned monitor, on radsafe procedures needed for their particular assignment (for example, see Reference B.0.1, p. F-XII-3). The radsafe monitors were responsible for the safety of personnel reboarding target ships. Task force personnel received general indoctrination on radiation safety and nuclear effects.

Continuing Need for Radiological Safety Personnel

Even after ABLE and BAKER had been detonated and the first phase of CROSSROADS drew to a close, the need for radsafe monitors and other radsafe personnel continued. The contaminated target and support ships presented a relatively long-term problem, and CHARLIE, the third test in the CROSSROADS Series, was still planned. Moreover, the series' first phase had brought home to the military leadership the need for a substantial military radsafe organization.

August saw the beginnings of activity designed to begin meeting these long-term needs. On 5 August, CJTF 1 asked the Navy Bureau of Ships for 100 naval
Table 3. Basic intensive courses for CROSSROADS radiological safety monitors.

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0830-0920</td>
<td>Introduction: Mission of the Radiological Safety Section</td>
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<tr>
<td></td>
<td>0930-1020</td>
<td>Mechanics, Force, and Energy</td>
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<td></td>
<td>1030-1120</td>
<td>Electricity</td>
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<td></td>
<td>1300-1400</td>
<td>The Atom Speaks</td>
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<tr>
<td></td>
<td>1430-1520</td>
<td>Casualties at Hiroshima</td>
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<td></td>
<td>1530-1620</td>
<td>Conference</td>
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<td></td>
<td>1900</td>
<td>Physical Damage at Hiroshima</td>
</tr>
<tr>
<td>2</td>
<td>0830-0920</td>
<td>Atomic Structure</td>
</tr>
<tr>
<td></td>
<td>0930-1020</td>
<td>The Bohr Theory</td>
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<tr>
<td></td>
<td>1030-1120</td>
<td>Ionization and Quantum Concepts</td>
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<td></td>
<td>1300-1520</td>
<td>Group Seminar</td>
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<td></td>
<td>1530-1620</td>
<td>Instruments Demonstration</td>
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<td></td>
<td>1900</td>
<td>Radioactivity</td>
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<td>3</td>
<td>0830-0920</td>
<td>X-rays; Alpha, Beta, and Gamma Rays</td>
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<td></td>
<td>0930-1020</td>
<td>Mass and Energy</td>
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<td></td>
<td>1030-1120</td>
<td>Nuclear Composition</td>
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<td></td>
<td>1300-1520</td>
<td>Demonstration and Group Seminar</td>
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<td>1530-1620</td>
<td>Demonstration of the X-263</td>
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<td>1900</td>
<td>Thermal Radiation</td>
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<td>0830-0920</td>
<td>Artificial Radioactivity</td>
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<td>0930-1020</td>
<td>Fission Process</td>
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<td>1030-1120</td>
<td>Fission Products</td>
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<td></td>
<td>1300-1520</td>
<td>Demonstration and Group Seminar</td>
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<tr>
<td></td>
<td>1530-1620</td>
<td>Demonstration of the 247</td>
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<td></td>
<td>1900</td>
<td>Effect of Radiation on the Human Body: Radiation Sickness and Other Pathology</td>
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<td>5</td>
<td>0830-0920</td>
<td>Chemistry of Plutonium, Uranium, and Fission Products</td>
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<td>0930-1020</td>
<td>Nuclear Cross-Section and the Production of Plutonium</td>
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<td>1030-1120</td>
<td>Mesons and the Synchro- or Frequency-Modulated Cyclotron</td>
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<td>1300-1520</td>
<td>Demonstration and Group Seminar</td>
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<td></td>
<td>1530-1620</td>
<td>Demonstration of the Pocket Dosimeter</td>
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<tr>
<td></td>
<td>1900</td>
<td>Physical Damage to the Principal Hospitals and First-Aid Stations in Nagasaki</td>
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(continued)
Table 3. Basic intensive courses for CROSSROA radiological safety monitors (continued).

<table>
<thead>
<tr>
<th>Day</th>
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<th>Course Title</th>
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<tr>
<td>6</td>
<td>0830-0920</td>
<td>Ionization Chamber and Geiger-Mueller Counter</td>
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<td>0930-1020</td>
<td>Tolerance Dose</td>
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<td>1030-1120</td>
<td>Radiobiology</td>
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<td>1300-1520</td>
<td>Practical Problems of Radiation Exposure</td>
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<td></td>
<td>1530-1620</td>
<td>Proteximeters [radiation detectors used in aircraft]</td>
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<td></td>
<td>1900</td>
<td>Physical Damage at Nagasaki</td>
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<td>7</td>
<td>0830-1120</td>
<td>Calibration of the X-263 and the Pocket Dosimeter</td>
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<td>1300-1620</td>
<td>Practical Exercise with the X-263</td>
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<td>1900</td>
<td>Thermal Radiation</td>
</tr>
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<td>8</td>
<td>0830-1120</td>
<td>Calibration of the 247 and the Pocket Dosimeter</td>
</tr>
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<td>1300-1620</td>
<td>Practical Exercise with the 247</td>
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<td>1900</td>
<td>Radioactivity from a Nuclear Blast</td>
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<td>9</td>
<td>0830-1020</td>
<td>Principles of Radiological Survey</td>
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<td>1030-1120</td>
<td>Radiological Operations</td>
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<td>1300-1400</td>
<td>Air Monitoring</td>
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<td>Sea Monitoring</td>
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<td>Land Monitoring</td>
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<td>Biological Studies</td>
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<td>0830-0920</td>
<td>Initial Boarding Party Monitoring</td>
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<td>0930-1020</td>
<td>Target Ship Clearance</td>
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<td>1030-1120</td>
<td>Analysis of Radioactive Water</td>
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<td></td>
<td>1300-1520</td>
<td>Laboratory Analysis of Radioactive Water</td>
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<td>1530-1620</td>
<td>Instrument Repair</td>
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<td>1900</td>
<td>Biological Studies</td>
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<td>0830-0920</td>
<td>Principles of Health Physics</td>
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<td>Protection Against Radioactive Hazards</td>
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</tr>
<tr>
<td>12</td>
<td>0830-0920</td>
<td>Ventilation Clearance</td>
</tr>
<tr>
<td></td>
<td>0930-1020</td>
<td>evaporator Clearance</td>
</tr>
<tr>
<td></td>
<td>1030-1120</td>
<td>Ship Clearance</td>
</tr>
<tr>
<td></td>
<td>1300-1620</td>
<td>Field Exercise</td>
</tr>
</tbody>
</table>
officers with technical or scientific backgrounds to be assigned to radsafe work. The officers were to be available by 1 September to begin intensive training designed to prepare them to replace the existing monitor personnel no later than 1 November so that study of the BAKER results and decontamination of the ships for test CHARLIE would not be delayed (Reference C.10.10). On 10 August, CJTF 1 ordered his rear echelon element in Washington to secure approval from the Chief of Naval Operations, Navy Bureau of Personnel, and the Navy Surgeon-General for a program to be set up by JTF 1 to train 100 new monitors. He also indicated that these new radsafe personnel might be needed to help monitor the drydocking of task force ships returning to the United States (Reference C.10.12). Most radsafe personnel left Bikini for the United States on 16 August aboard USS Henrico (APA-45), leaving a much reduced radsafe organization on Haven to continue radsafe work at Bikini (Reference C.9.206, p. VII-(C)-24). Personnel traveling on Henrico probably were mostly civilians returning to their campuses and laboratories or military officers at the end of their terms of service. Under discussion by 20 August was a proposal to add 25 members from West Point's class of 1946 to the group to undergo monitor training (Reference C.10.13). The training program was to start on 9 September at the Navy Department in Washington, with field work at Alamogordo and on the target ships at Kwajalein or Bikini. After their training, the new monitors would be assigned to JTF 1 (Reference C.0.2). One attendee wrote he received 4 weeks of instruction in "basic radiology" in Washington, D.C., and did laboratory work at the Radiation Safety Laboratory, San Francisco Naval Shipyard, Hunters Point, California, before reporting to the Radiological Safety Section at Kwajalein (Reference B.0.8).

The potential radsafe needs created by Test CHARLIE disappeared, however, when President Truman cancelled that test on 7 September.

OCEANOGRAPHIC SURVEY

While radsafe planning and organization of the Radiological Safety Section went forward in the United States, important radsafe preparations also took place at Bikini. Beginning on 10 March 1946, civilian and military scientists at Bikini aboard USS Bowditch (AGS-4) conducted detailed oceanographic, biological, and geological surveys of the atoll. From the radsafe perspective, their most important work was an effort to chart the currents in the atoll's lagoon. This information was needed to estimate what might happen after BAKER when a large amount of radioactive contamination would be dispersed in the lagoon and perhaps into the surrounding ocean. The safety of the task force and the ability of its recovery teams to reenter the target area were involved (Reference A.1, p. 92).

After the shots, the radsafe section monitored the radiation level in the lagoon water through the use of drone boats, PCMs, and LCPLs (Reference A.2, p. 100). Monitors accompanied scientists collecting fish, coral, and samples of the bottom. On 9 August, a monitor with a collection party found the first bottom sample so radioactive he ordered it pitched over the side (Reference A.2, p. 108). Highest recorded activity on a bottom core sample was 0.292 microcuries/gram in newly deposited sand and mud from the first 6 inches of the core (Reference C.9.209, Annex J, Figure 7).
WEATHER PREDICTION

Accurate weather predictions at least 24 hours in advance were needed to allow the task force to complete the complex final preparations for a detonation and to give reasonable assurance that radiological safety could be maintained. Cloud cover had to be at a minimum for the ABLE airdrop to allow the bombardier to see the target ship. Wind direction, not only near the surface but up to 60,000 feet (18.3 km), had to be such that it would not carry fallout over the task force. Moreover, wind direction had to be fairly steady so that fallout areas would be predictable. Tropical meteorology was not well developed at that time, and detailed data of past weather patterns at Bikini were lacking. The exacting forecasting requirements for CROSSROADS posed a major challenge.

The official forecast issued the day before a planned detonation and used as a major element in the decision to proceed included: the amount, in tenths of sky coverage, of low, middle, and high clouds; the altitude of the base and top of the low clouds and the altitude of other cloud layers; precipitation (if expected); the wind direction and velocity in 5,000-foot (1.5-km) increments from the surface to 60,000 feet (18.3 km); height of the tropopause; and visibility, temperature, and relative humidity (Reference C.9.207, p. VII-(O)-17).

Responsibility for furnishing weather forecasts or weather advice for task force operations was vested in the Staff Aerological Unit located on Mount McKinley. The unit was to prepare special forecasts for the Radiological Safety Unit to help anticipate movement of the radioactive cloud (Reference B.O.1, p. T-2). Because of lack of space on Mount McKinley, a significant portion of the personnel doing weather data analysis was stationed on Kwajalein at the Weather Central. To supply upper air and surface data, aerological units of from four to six personnel were stationed on USS Shangri-La (CV-38), USS Saidor (CVE-117), USS Fall River (CA-131), and USS Albemarle (AV-5). These personnel also provided weather briefings to task group commanders and aircrews. To gather surface data, one-man aerological units were stationed aboard USS Orca (AVP-49), Bowditch, USS Kenneth Whiting (AV-14), USS Blue Ridge (AGC-2), and USS Appalachian (AGC-1). Weather Central received reports daily or more often from weather stations on Wake, Nuketak, Majuro, Kwajalein, and Marcus islands and from two weather ships northeast and northwest of the Marshall Islands at 12°45'N, 180°W and 12°N, 153°40'E, respectively (Reference C.9.207, p. VII-(O)-22). Data from more distant U.S. and foreign weather stations funneled through Fleet Weather Central in Hawaii were also used.

At least one B-29 and one PB4Y-2 flew out of Kwajalein each day for weather reconnaissance. the B-29s usually toward the east and the PB4Y-2s toward the west. More flights were scheduled as necessary. On ABLE and BAKER days, three flights passed through the Bikini area.

The weather forecast for the following day was presented to CJTF 1 each day at 0830. From that he decided if the weather would allow the next day's planned operations. A second briefing for the commander was held daily at 2200. On the basis of this briefing, he decided whether to hold to the morning's decision or alter it. Continued weather input was provided the commander (Reference C.9.207, pp. VII-(O)-9, through VII-(O)-19).
RADIOLOGICAL SAFETY PREPARATIONS FOR BAKER

Because BAKER was the first underwater detonation of a nuclear weapon, neither the participating scientists nor the task force leadership could predict with certainty how the lagoon water would react to and modify the explosion cloud. Spread of radioactive contamination and creation of damaging waves were major concerns. Simulation using conventional explosive charges was one approach to estimate the effects. In one effort to predict the spread of radioactivity, 1,000-lb charges of TNT were detonated and the results extrapolated upward to the expected 20-KT yield of the BAKER device (Reference B.0.15, pp. 13 through 16).

During the period March to May 1946, several organizations under the supervision of a professor from the University of California carried out experiments for the task force on wave action in shallow water (Reference C.0.18; Reference C.0.12.3, p. 6). In 1946, computer simulations were still in the future, but various scientists applied their slide rules and scientific imagination to the forecasting problem. One study analyzed the possibilities largely on the basis of the height to which the column of contaminated water might rise. A rise of only 10,000 feet (3.1 km) would present the greatest hazard because most of the contamination would fall on the target ships or back into the lagoon. Reboarding some target ships within 1,000 yards (9.1 meters) of the detonation might be dangerous for weeks because of the contamination deposited from the water column (Reference C.0.19, pp. 5 and 9).

In an early overview of the operation, CJTF 1 offered the opinion that following BAKER (Reference B.0.16, p. 7)

It will be undoubtedly be some weeks before the lagoon and target ships are again habitable. During this period, some of the task force ships may be sent to anchor at Kwajalein. If it should turn out that the target ships will not be habitable for months, other arrangements will be made.

On 18 June, an appendix was added to the Operation Plan that gave a description of the underwater detonation’s expected effects (Reference B.0.1, pp. E-X-1 through E-X-17 and E-IX-1 through E-IX-4). The ball of fire or steam caused by the detonation was predicted to rise to an altitude of from 10,000 to 60,000 feet (3.1 to 18.2 km). The most likely altitude was predicted to be 30,000 feet (9.1 km) (Reference B.0.1, p. E-IX-1, Change No. 6). However, a postoperation document indicates that planning was based on a prediction of maximum altitude of 15,000 feet (4.6 km) (Reference C.9.206, p VII-(C)-18).

The appendix further predicted that a plume of water might rise, extend for several thousand feet above the surface, and then fall back into the lagoon. Radioactive material would be deposited initially in the lagoon within boundaries represented by a cylinder several hundred yards in diameter and extending from the surface to the bottom of the lagoon. The trail of water and steam following the ball of fire would be heavily contaminated. Distribution of radioactive material in the water was anticipated to be more widespread than following ABLE and would persist for a longer period. Target ships within 1,500 yards (1.4 km) of the explosion would be seriously contaminated. Downwind serious contamination would occur beyond 1,500 yards (1.4 km). It was expected that
some target ships might be so heavily contaminated they could not be boarded safely for an indefinite period (Reference B.0.1, pp. E-IX-1 and E-IX-2).

Following conferences attended by senior radsafe personnel, a new appendix to the CJTF 1 Operation Plan radsafe annex was issued in 15 July. Under the revised radsafe plan, the Radiological Safety Section retained its five major elements. Since radioactivity from the underwater explosion was expected to be last longer and be more intense than from ABLE, personnel were added to the Radiological Safety Control Unit for around-the-clock operation (Reference C.9.206, p. XII-(C)-16). Some additions and subtractions were made to the radsafe reconnaissance units. A third PBM unit and one upwind destroyer unit were added to improve lagoon reconnaissance. Three cloud-tracking units were dropped, presumably because the underwater explosion was not expected to create a cloud as high and far-reaching as ABLE (Reference B.0.1, pp. E-X-1 and E-X-5).

The total number of civilians and military officers in the Radiological Safety Section changed between ABLE and BAKER as follows (Reference C.9.206, p. VII-(C)-5):

<table>
<thead>
<tr>
<th></th>
<th>ABLE</th>
<th>BAKER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civilians</td>
<td>130</td>
<td>93</td>
</tr>
<tr>
<td>Navy Officers</td>
<td>77</td>
<td>102</td>
</tr>
<tr>
<td>Army officers</td>
<td>96</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>303</td>
<td>258</td>
</tr>
</tbody>
</table>

The number of monitors probably decreased, but more than 225 were available for BAKER (Reference A.1, p. 31).

The distribution of radsafe monitors was changed for BAKER: fewer were put on LCPLs and more were assigned to the DSM. Sixty-one were placed under the control of the DSM with duties as follows (Reference B.0.1, pp. E-X-14 and E-X-15):

1. The DSM and his deputy each were to have a monitor acting as his technical advisor and administrative assistant on radsafe matters
2. Six monitors were to have radsafe duties in support of emergency firefighting and salvage operations as directed by the DSM or his radsafe advisor
3. Two monitors were to accompany each of the ten initial boarding teams and to act as radsafe advisors to the team captains
4. Thirty-three personnel were to act as monitors for the target ship crews when they reboarded their ships and as radsafe advisors to the ships' captains

Monitor duties were basically the same for ABLE and BAKER. For BAKER, however, monitors were admonished to (Reference B.0.1, p. E-X-16):
frequently check radioactivity of various parts of their own ship or craft including underwater hull and all intakes, particularly condensers, boilers and other places where there may be a concentration from contaminated water.

Definitions of the radex area and surface survey sector were changed so that no real difference between them existed (Reference B.0.1, p. E-X-3). Both names were retained, however, since operational personnel were familiar with them. The definitions of the Red and Blue Lines remained the same, but a few special salvage vessels with senior monitors aboard were allowed to operate independently between the Red and Blue Lines. The definitions of the anchorage areas remained unchanged, but a boating area was established where unrestricted movement of small boats was allowed. By implication, small boat traffic beyond that area was more strictly controlled (Reference C.9.206, p. VII-(C)-18).

As before ABLE, training was an important feature of the radsafe organization's activities. Newly arrived monitors were given instruction by experienced personnel. Daily communication drills were held by the Radiological Safety Control Unit using the PGM, LCPL, and drone boat circuits. On 16 July the Radiological Safety Control Unit held a drill on Mount McKinley to train new members of its expanded staff. On 19 July the entire radsafe organization participated in William Day, the joint task force rehearsal for BAKER. So that radsafe personnel would not be caught unaware by major new hazards, they met on several occasions with scientists in charge of the BAKER test and were briefed on the expected results (Reference C.9.206, p. VII-(C)-17). The monitors met with the commanders of the LCPLs and PGMs between William and BAKER days. Two more communications drills were held and by 22 July all radsafe personnel and equipment were considered ready (Reference C.9.206, p. VII-(C)-18).

Radsafe operations immediately before and after the BAKER detonation are described in Chapter 4, "Test Operations." Chapter 5, "Post-BAKER Operations: Bikini, Kwajalein, and the United States," continues the discussion of radsafe operations as the contaminated target ships are moved to Kwajalein Atoll and, later, as some of them are returned to the United States for final examination and disposition.
CHAPTER 3
CROSSROADS EXPERIMENTAL PROGRAM

INTRODUCTION

In late 1945 and early 1946 several conferences were held by the Manhattan Engineer District Project with the military services. It was agreed that the CROSSROADS program should gather data:

- On the nature, range, and duration of radiation danger
- On bomb efficiency, burst location, wave formation, and ship movement
- For ship designers and ordnance designers to aid in assessing damage from and designing protection against nuclear weapons
- That would be helpful in learning to detect nuclear detonations.

As a result, CROSSROADS had two experimental programs. The first was to determine nuclear weapon effects on military equipment, such as ships, planes, and supplies, and on animals. The second was to measure weapon phenomena such as blast, heat, radiation, and wave action. The ABLER and BAKER tests were not weapon development tests; in fact, the bombs used were of the same design as the one dropped on Nagasaki, Japan.

The Deputy Task Force Commander for Technical Direction had responsibility for both experimental programs. To accomplish this mission he had two organizations under his control. The first was the Ship Material and Inspection Division, headed by the Director of Ship Material (DSM), and the second was the Instrumentation Division, headed by the Technical Director.

EFFECTS ON MILITARY EQUIPMENT

The Ship Material and Inspection Division was responsible for determining weapon effects on military equipment. The organization of the Ship Material and Inspection Division contained both Army and Navy elements (see Figure 13). Responsibilities included preparing the ships, aircraft, equipment, supplies, and animals for each test and determining the exact cause and extent of damage. Decontaminating ships and material after the second test also became a responsibility of this group. Duties included distinguishing between damage caused by the direct effects of the explosion and damage caused by indirect effects such as fires and flooding. Table 4 shows the exposures received by personnel in each of the groups under the DSM.

The DSM set up a two-phase program to accomplish his mission. The first phase was readying the target ships, aircraft, and equipment and included conditioning, loading, instrumenting, and preparing specific equipment, and
Figure 13. Organization of Ship Material and Inspection Division, Operation CROSSROADS (source: Reference C.9.206).
Table 4. Ship Material and Inspection Division recorded personnel exposures, CROSSROADS.

<table>
<thead>
<tr>
<th>Element</th>
<th>No. of Persons Listed</th>
<th>No. of Persons Badged</th>
<th>Exposure Ranges (R)</th>
<th>High (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of the Director</td>
<td>31</td>
<td>9</td>
<td>0 0.001-0.5 0.5-1</td>
<td>0.590</td>
</tr>
<tr>
<td>Army Group</td>
<td>322</td>
<td>7</td>
<td>1 6</td>
<td>0.310</td>
</tr>
<tr>
<td>Bureau of Aeronautics Group</td>
<td>15</td>
<td>11</td>
<td>2 9</td>
<td>0.230</td>
</tr>
<tr>
<td>Bureau of Ships Group</td>
<td>113</td>
<td>55</td>
<td>12 40</td>
<td>0.650</td>
</tr>
<tr>
<td>Bureau of Ordnance Group</td>
<td>116</td>
<td>68</td>
<td>20 48</td>
<td>0.420</td>
</tr>
<tr>
<td>Medical Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damage Control Safety Section</td>
<td>17</td>
<td>11</td>
<td>5 6</td>
<td>0.220</td>
</tr>
<tr>
<td>Medical Research Section</td>
<td>117</td>
<td>71</td>
<td>44 27</td>
<td>0.340</td>
</tr>
<tr>
<td>Electronics Group</td>
<td>411</td>
<td>56</td>
<td>23 32</td>
<td>1 0.600</td>
</tr>
</tbody>
</table>

Note:
* Data taken from Reynolds Electrical and Engineering Company exposure list. Since personnel were not badged all the time, these figures should be recognized as a partial statement of potential total exposure for these groups.

Sources: References C.13.4 and B.O.17.

Inspecting, mooring, and anchoring the target ships before each test. The second phase of his program was the inspection of ships, aircraft, and equipment after each detonation. Detailed instructions were published to provide the necessary guidance to boarding parties who were to inspect the equipment after each shot. Extensive use was made of photography to permanently record "before" and "after" conditions of the ships, aircraft, and equipment. Most of the equipment was packed and shipped to continental U.S. locations for further analysis after Test BAKER (Reference C.9.208, p. 7.3). Six subordinate groups under the DSM were responsible for carrying out the details of the experimental program.
Army Ground Group

The exposure of Army equipment was a mission of Commander, Army Ground Group. Under his command were engineer, signal, ordnance, chemical warfare, quartermaster, and air units. Personnel from these units were berthed on USS Wharton (AP-7). They exposed a wide variety of equipment on both tests ranging from ammunition, radar, trucks, petroleum, and tanks, to field stoves, clothing, and medical equipment. Figure 14 shows armored vehicles and other equipment on board USS Saratoga (CV-3) before the test. While most equipment was positioned on board the target vessels, some was placed on nearby islands of Bikini Atoll to provide a better range of effects. Members of the Army Ground Group were evacuated from the Bikini Lagoon on Wharton the day before each test and planned to return the afternoon of each test day. Inspection of equipment after ABLE began on 2 July and was completed by 12 July. The heavy concentration of radioactivity in the lagoon after BAKER slowed inspection efforts. Inspections were not begun until 30 July and were not completed until 10 August. Items on USS Nevada (BB-36) and the concrete drydock, ARDC-13, remained too contaminated to be inspected. The drydock was finally scuttled with all equipment.

Engineer equipment was exposed on three attack transports (APAs). Signal equipment was exposed aboard ships and on nearby islands. Several different items of ordnance equipment were on the decks of four target battle ships and on four tank landing ships and one oil barge. Chemical equipment was exposed.

Figure 14. Armored vehicles and other Army equipment aboard USS Saratoga (CV-3), ready for exposure to atom bomb, CROSSROADS.
only on shot ABLE. Sample kits of food and clothing were stored in normal storage spaces aboard Nevada, USS Arkansas (BB-33), USS Carteret (APA-70), and Saratoga. Test lots of over 150 items of food and clothing were exposed on the decks of 11 target vessels. Field equipment, lubricants, and fuels were exposed on four tank landing craft and on the concrete drydock, ARDC-13.

Aircraft parts were placed on the decks of target ships. Several types of wing panels made of various materials were secured to the decks. In addition, wing tanks, stabilizers, a P-47 fuselage, an altimeter, and several fire extinguishers were exposed. No aircraft parts were exposed on BAKER test (Reference C.9.208, p. 7.10).

Bureau of Aeronautics Group

The Navy Bureau of Aeronautics (BuAer) Group was responsible for providing, exposing, and inspecting Navy aircraft and aeronautical equipment. It also provided special instruments to be placed in the Navy F6F aircraft drones to determine radiation intensities and blast effects. Velocity and acceleration gauges were installed on various target aircraft located on the target ships. The BuAer group, berthed on Wharton and USS Avery Island (AG-76), was evacuated with the ships the day before each shot and planned to return to the lagoon the afternoon after each shot. Inspection of equipment commenced on 2 July for ABLE and 30 July for BAKER. Records of F6F drone aircraft reaction to the detonations were removed from the aircraft after they landed at Roi Island, Kwajalein, and aircraft were inspected for damage (Reference C.9.208, pp. 3.51 and 7.8).

Bureau of Ships Group

This group was responsible for preparing target ships (and certain non-target ships) to determine effects of the detonations on the ships and carrying out decontamination activities. The group prepared Op Plan 1-46 Annexes W and X entitled "Ship Preparation Plan" and "Reboarding and Inspection Plan," respectively. Preparing the target ships for the tests took place initially in shipyards at Philadelphia: Terminal Island, Long Beach, California; San Francisco, California; Mare Island, Vallejo, California; Bremerton, Washington; and Pearl Harbor, Hawaii. Target ship crews did much of this work, both at Pearl Harbor and on site at Bikini.

Members of the Bureau of Ships (BuShips) Group were berthed on Wharton. They were aboard that ship when it sortied from Bikini the day before each test and returned after each test. Ship inspection began on 2 July after ABLE and on 26 July after BAKER. Interim repairs after ABLE to prepare ships for BAKER were completed by 5 July; however, ship inspections continued for several more days. The ship inspection program was broken down into six categories: hull, ship stability, machinery, electrical, electronics equipment, and measurement of any change in magnetic fields within the ship. Inspection of ships after BAKER was hampered by radioactivity on the ships and in the lagoon. Five attack transports, one destroyer, two infantry landing craft, and four submarines were reboarded and manned in August and September and were sailed back to U.S. ports. The remaining target ships, however, were too contaminated to be boarded except for short visits and were towed to Kwajalein during August
and September. By 26 September, Bikini Atoll was cleared of the target fleet and all personnel were evacuated. Eight target ships and two target submarines were subsequently towed from Kwajalein to Pearl Harbor. Six of these were towed to U.S. west coast ports in 1946 and 1947 for further radiological examination (Reference C.9.208, pp. 3.51 and 7.5). The disposition of the target fleet is summarized in Chapter 9.

Bureau of Ordnance Group

The Bureau of Ordnance (BuOrd) Group was responsible for obtaining and exposing naval ordnance equipment and for appraising the damage after each detonation. The group was organized into six sections: fire control, gun mounts, explosives, aviation ordnance, underwater ordnance, and armor metallurgy. The group was berthed on Wharton. Its personnel left Bikini Lagoon the day before each shot and reentered after each shot. Inspection of equipment after ABLE shot was easily and quickly accomplished, but high levels of radioactivity after BAKER severely restricted activities (Reference C.9.208, pp. 3.52 and 7.10).

Medical Group

The Medical Group was comprised of two sections: Damage Control Safety Section and Medical Research Section. Personnel of the Damage Control Safety Section were to reboard target ships with the initial boarding party and evaluate and reduce nonradiological hazards to boarding parties. Hazards that had to be addressed included falling objects, slippery decks, weak ladders, drowning, fires, steam, electrical shock, chemical hazards, and ammunition hazards. The personnel trained extensively, and in turn trained members of designated boarding parties both on the U.S. west coast and at Bikini. There were no incidents on either test day. This section was berthed on USS Haven (AH-12) (Reference C.9.208, p. 3.52).

The Medical Research Section was responsible for the biological research program, which involved exposing animals, seeds, bacteria, and medical and dental materials, and for studying the resulting damage and injury. Principal animals used were pigs, goats, guinea pigs, rats, and mice.

For ABLE, the animals and other biological samples were placed on USS Geneva (APA-86), USS Niagara (APA-87), USS LST-133, LCI-327, and LCI-329. Goats in exposure position are shown in Figure 15. They were retrieved by section personnel operating from USS Burleson (APA-67) at approximately 1600 on 1 July.

For BAKER, the animals and samples were on USS Gasconade (APA-85), USS Briscoe (APA-65), USS Catron (APA-71), and USS Bracken (APA-64). Section personnel could not retrieve animals and samples from Bracken until 1351 on 28 July (D+3). At 1447 the same day, about one-half the animals were removed from Catron. Daily radiation tolerances prohibited the personnel from continuing to work on Catron. On 29 July, animals and samples remaining on Catron and on Briscoe were recovered. On 30 July, animals and samples on Gasconade were recovered (Reference C.9.206, pp. VI-B-12 and VI-D-30 through D-44; Reference C.9.208, pp. 3.54 and 25.3).
Electronics Group

This group and the 0130 Electronics Group in the Technical Director's organization (see the section on Nuclear Weapon Phenomena below) were one and the same. They performed a dual function in working for both the DSM and the Technical Director.

As planned initially in January 1946, this group's primary responsibility was to determine the damage to electronic equipment aboard ships after exposure to each detonation. After a series of meetings in February 1946, the group's responsibilities were significantly expanded. It took over electronic equipment responsibilities from BuAer and the Army Signal Corps. It assumed full responsibility for execution of electronics instrumentation projects as specified in the Instrumentation Plan (Annex G, Op Plan 1-46) and the Communications and Electronic Plan (Annex C, Op Plan 1-46). It carried out most of the studies associated with the electromagnetic propagation program and provided support to wave motion, blast pressure, shock, drone ball, and telemetering projects. As a result of all these added responsibilities, the size of the group was expanded and liaison officers from several other groups were assigned. Also because of these added responsibilities, the group became accountable to the Technical Director, although it maintained close liaison with the DSM.
Specific projects included preparation and inspection of shipboard electronic equipment; provision of technical communications for the flagship USS Mount McKinley (AGC-7), press ships, and instrumentation ships; electromagnetic propagation studies and provision of sonobuoys for pressure recording; telemetry of technical data from certain target ships; television recording of wave motion and wave heights; provision of timing signals for most projects (excluding bomb detonation timing signals); and provision of electronics equipment necessary for operation of the drone boats. The types of shipboard electronic equipment that had to be prepared and inspected included radios, radiosondes, radars, Identification Friend or Foe (IFF) systems, sonars, radar repeaters, homing devices, radar beacons, and interior communications systems.

The Electronics Group was berthed aboard Avery Island. USS Coasters Harbor (AG-74) was designated as an electronics repair ship for this group. Group personnel were evacuated from Bikini Lagoon the day before each shot and returned to the lagoon after each shot. For ABLE, group members were not part of initial boarding teams, but began their inspections when general reboarding was authorized. After BAKER, radioactivity delayed most inspections until mid-August. In fact, on 7 August the Target Inspection Section of the Electronics Group was reberthed aboard USS Fulton (AS-11), and Avery Island returned to the United States with most of the Electronics Group personnel. The Instrument Repair Unit also remained behind aboard Wharton and Haven to repair and maintain radic instruments (Reference C.9.208, p. 3.43; Reference C.9.190, pp. 192-225).

Army Air Group (Task Group 1.5)

Although not under the control of the DSM, Task Group (TG) 1.5 assisted the DSM in determining the bombs' effects on in-flight aircraft. In addition to its several missions as TG 1.5, this group carried out blast and radiation experiments using B-17 drone and B-29 and F-13 aircraft. The drones were equipped with flight analyzers that recorded acceleration, airspeed, and overpressure. Some data were telemetered by a television arrangement. Upon landing at Enewetak, the instrumentation was removed for analysis. The drones were monitored for radiation and inspected for damage. The B-29 and F-13 aircraft had similar instrumentation except for the television system. Additional information on TG 1.5 is found in Chapter 8.

Table 4 is a tabulation of badging and exposures of personnel in the various groups of the Ship Material and Inspection Division. Since personnel were not badged all the time, these figures should be recognized as a partial statement of potential total exposure for these groups. Dose reconstruction techniques, discussed in Chapter 12, provide a way of estimating total dose figures.

NUCLEAR WEAPON PHENOMENA

The program to measure and record the various effects produced by the ABLE and BAKER nuclear detonations was the responsibility of the Technical Director, who headed the Instrumentation Division. The Instrumentation Division was responsible for measuring and recording weapon diagnostic data (blast, heat, radiation, etc.). The plan to measure and record the weapons' effects
was broken down into numbered programs, categorized and described in Table 5. For control reasons, the Technical Director set up an administrative organization (see Figure 16) and a functional organization (Figure 17). The administrative organization was used for personnel assignments. Personnel rosters were maintained using this organizational breakdown. The functional organization was used for grouping experimental projects. Table 5 and the functional organization in Figure 16 show the similarity between the programs. Over 130

Table 5. Instrumentation Division programs and responsible groups, CROSSROADS.

<table>
<thead>
<tr>
<th>Program</th>
<th>Title</th>
<th>Responsible Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Bomb Preparation</td>
<td>Los Alamos Laboratory</td>
</tr>
<tr>
<td>II</td>
<td>Blast Pressure and Shock</td>
<td>Navy Bureau of Ordnance, Los Alamos Laboratory, Navy Bureau of Ships, Army Air Forces, Navy Air Group</td>
</tr>
<tr>
<td>IV</td>
<td>Propagation of Electromagnetic Waves</td>
<td>Navy Bureau of Ships, Army Air Forces, Los Alamos Laboratory, National Bureau of Standards, Federal Communications Commission</td>
</tr>
<tr>
<td>V</td>
<td>Radiological Safety</td>
<td>Los Alamos Laboratory</td>
</tr>
<tr>
<td>VI</td>
<td>Radiometry</td>
<td>Army Air Forces, Navy Bureau of Ordnance</td>
</tr>
<tr>
<td>VII</td>
<td>Radiation Measurements</td>
<td>Los Alamos Laboratory</td>
</tr>
<tr>
<td>IX</td>
<td>Technical Photography</td>
<td>Army Air Forces, U.S. Navy, Los Alamos Laboratory</td>
</tr>
</tbody>
</table>

Figure 16. Instrumentation Division (administrative organization), CROSSROADS (source: Reference C.9.210, N 138A).
projects were associated with Programs II through IX. Appendix C lists these projects by title and shows which group in the Instrumentation Division was responsible.

Table 6 presents exposure information for the groups in the Instrumentation Division. The Remote Measurements Group is not shown in the table because its personnel were not present in the Bikini area and had no one badged during CROSSROADS. The highest exposures recorded were for personnel in the Radiological Safety Group. These personnel monitored the contaminated ships and other areas to determine dangerous radiation levels. The accumulated high individual exposure in this group was 3,720 R. This monitor was badged six days.*

* Since personnel were not badged all the time, these figures reflect only a part of the total potential exposure. Dose reconstruction techniques discussed in Chapter 12 can be used to produce an estimate of total dose.
Table 6. Instrumentation Division personnel exposure, CROSSROADS.a

<table>
<thead>
<tr>
<th>Element</th>
<th>No. of Persons Listed</th>
<th>No. of Persons Badged</th>
<th>Exposure Ranges (R)</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>0.001-0.5</td>
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<tr>
<td>Office of the Director</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Air Blast Group</td>
<td>9</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Wave Motion and Oceanography Group</td>
<td>93</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>BuShips Instrumentation Group</td>
<td>58</td>
<td>36</td>
<td>3</td>
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<tr>
<td>Electronics Groupb</td>
<td>411</td>
<td>56</td>
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<td>Radiological Safety Group</td>
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<td>316</td>
<td>88</td>
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<tr>
<td>Bomb Operation Group</td>
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<td>3</td>
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<tr>
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<td>24</td>
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<td>6</td>
</tr>
<tr>
<td>Tech Photo Group</td>
<td>36</td>
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<td>6</td>
</tr>
<tr>
<td>Army Air Forces Instrumentation Groupc</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

aData taken from Reynolds Electrical and Engineering Company List. Since personnel were not badged all the time, these figures should be recognized as a partial statement of potential exposure for these groups.

bSame as the Electronics Group in Ship Material and Inspection Division.

cPersonnel almost entirely supplied by Army Air Group, Task Group 1.5.

Sources: References C.13.4 and 8.0.17.
The nine programs managed by the Instrumentation Division are discussed in the following paragraphs. Where appropriate, individual projects within each program are discussed.

Program I -- Bomb Preparation

Agency:
Los Alamos Laboratory

Operations: The bomb for ABLE was prepared at Kwajalein and loaded onto the B-29 drop aircraft at Kwajalein airfield. The bomb for BAKER was prepared on Kwajalein and on medium landing ship LSM-60 in Bikini Lagoon. It was placed in a waterproof caisson and lowered 90 feet (27 meters) under the LSM.

Staffing: Seventy Los Alamos Laboratory employees worked on this program. The radioactivity of the nuclear components of the bombs presented a very low risk of exposure. Personnel in this program were not required for reentry operations so they should not have been exposed to significant amounts of radiation. According to exposure records only three individuals were badged (see Table 6).

Program II -- Blast, Pressure, and Shock

Agencies: Los Alamos Laboratory
Navy Bureau of Ordnance (BuOrd)
Navy Bureau of Ships (BuShips)
Army Air Force
Navy Air Group
Air Blast Group (013A)

Operations: This program had 28 projects, some with several subprojects (see Appendix C). Except for Project II-12, which measured fireball growth using cameras, all these projects were associated with pressure, blast, and shock measurements. A variety of self-recording airblast gauges were placed on Bikini islands, in the lagoon, on target ships, and on aircraft aloft in the area above the target area. Condenser gauges were dropped from two B-29 aircraft just before each detonation and they transmitted readings to recorders in the two B-29 aircraft. Water-shock gauges were also used. All B-29, F-13, and B-17 aircraft participating in either shot carried instrumentation also.

Staffing: Personnel from the Air Blast Group, Los Alamos Laboratory Group, Electronics Group, and the BuOrd Instrumentation Group worked on projects in Program II. Although there were probably more, 51 personnel have been identified with this project from existing records. 35 of whom were badged. The highest exposure of these 35 was 0.99 R for an individual working on Project II-18 who got all of his exposure the first week in August.

Placement of gauges in aircraft, target ships, islands, etc. should have provided little or no exposure to project personnel. Removal of gauges after ABLE should have been relatively easy as radioactivity was limited to a few target ships and decayed rapidly. BAKER, however, contaminated islands due north of the detonation, the lagoon, and most of the target
ships. Gauge removal was closely monitored by radiological safety (radsafe) personnel.

**Project Report:** Reference C.9.209, Enclosure C.

**Program III -- Wave Motion Oceanography**

**Agencies:** Smithsonian Institution  
U.S. Geodetic Survey  
U.S. Fish and Wildlife Service  
Woods Hole Oceanographic Institution

**Operations:** This program had 20 separate projects to measure and record wave motion and to study detonation effects in the area of Bikini Lagoon. Some instrumentation was placed on the bottom of the lagoon, some suspended in the water from target ships, and some on nearby islands.

**Staffing:** Program III personnel were from the Wave Motion and Oceanography Group of the Instrumentation Division. Ninety-three personnel were assigned, 30 of whom were badged. Recorded exposures during the periods they were badged were all less than 0.5 R.

Removal of instrumentation from target ships, particularly after BAKER, exposed personnel to radioactivity on the ships. Removal of instrumentation from the lagoon bottom also exposed recovery personnel to some radiation after BAKER since the water in some areas of the lagoon was radioactive. However, recovery times apparently were relatively short and this minimized radiation exposure. Some islands were also contaminated after BAKER and instrument recovery there created exposure potential depending on recovery date and stay time.

**Project Report:** Reference C.9.209, Enclosure F.

**Program IV -- Propagation of Electromagnetic Waves**

**Agencies:** Los Alamos Laboratory  
Army Air Forces (AAF)  
Electronics Group  
National Bureau of Standards (NBS)  
Federal Communications Commission (FCC)

**Operations:** There were 18 separate projects in Program IV. Radars and radios, some operating at detonation time, were placed on selected islands at Enewetak, Kwajalein, Bikini, and on selected target ships. Television cameras were installed on B-17 drones and controllers. Two projects provided timing and firing signals for BAKER. Four projects measured electromagnetic properties from remote locations in Hawaii, Germany, Manila, Alaska, and the United States. One project telemetered air- and water-pressure readings from target ships to receivers on Avery Island.

**Staffing:** Personnel from the Electronics Group of the Instrumentation Division accomplished all the projects in this program except for IV-9 through IV-13, which were done by Los Alamos Laboratory and the Army Air Forces.
NBS and FCC personnel involved were not in the Bikini area. This Electronics Group was the same as that in the Ship Material and Inspection Division under the DSM. The highest recorded exposure in the Electronics Group was 0.6 R.

Since the experiments measured interference with electromagnetic waves at and after detonation time there was no urgency to recover equipment in radioactive areas such as the Bikini islands and target ships.


Program V -- Radiological Safety

Agency: Radiological Safety Group

Operations: There were 12 projects in this program (see Appendix C). The first eight involved radsafe monitors who measured radioactivity in the air, water, and on ships to obtain data on radiation in order to protect personnel. The eight monitor groups were: destroyer, seaplane, boat, boarding party, fixed base, gunboat, Bikini Lagoon channels, and airborne. Monitoring instruments used were: 275 Victoreen Geiger counters (Model No. 263), 150 Victoreen ionization chambers (Model No. 247), 12 alpha meters, and an unknown quantity of self-reading dosimeters. All monitors also wore film badges whenever there was a probability of encountering radioactivity. Film badges were normally exchanged daily. All monitor groups had Geiger counters and ionization chambers except the Bikini Lagoon Channel Group which used battery-operated, deep-channel counters with submersible probes. Project 9 (Photometric Film Badges) measured radiation at various locations in the target array and recorded radiation received by all who wore film badges. They used 5,000 sulfur and calcium triphosphate capsules in addition to a large number of film badges. Projects 10 and 11 measured gamma radiation over a period of time on several target ships. Project 12 personnel measured total gamma intensity on several target ships.

Staffing: As shown in Table 6, 436 personnel of the Radsafe Group have been identified (Reference B.0.19). Of these 316 were badged at least one time (see Table 21 for badging summary). Personnel in all 12 projects on the Radsafe Program had a high potential for exposure because of their assigned duties. Monitors who received ships with boarding parties (Project 4) after Test BAKER accumulated the highest exposures. The highest individual accumulated recorded exposure was 3,720 R. Most of those badged in Program V were military personnel serving monitoring duties.


Program VI -- Radiometry

Agencies: Navy Bureau of Ordnance (BuOrd) Army Air Forces (AAF)

Operations: Measurement of the bombs' radiant energy was attempted from several locations. For ABLE, instruments were installed on one ship 18 nmi
from the detonation and on an aircraft flying 18 nmi (33 km) from the detonation. For BAKER, instruments were installed on a ship positioned 10.9 nmi (20 km) from the detonation and spectroscopes were placed on an aircraft flying 7.2 nmi (13 km) from the burst.

**Staffing:** BuOrd Instrumentation Group personnel manned the projects in this program with some help from AAF. Potential for exposure of Program VI personnel was quite low. Aircraft and ships involved remained clear of radioactive areas in and downwind of the Bikini Lagoon. BuOrd Instrumentation Group personnel had low exposures as can be seen from Table 6. Most personnel working in Program VI were not badged and those that were had readings less than 1.0 R.

**Project Report:** Reference C.9.209, Enclosure H.

**Program VII -- Radiation Measurements**

**Agency:** Los Alamos Laboratory

**Operations:** The first of the three projects in this program was the measurement of fast neutrons on ABLE test by placing sulfur samples on several target ships.

The second was measurement of gamma-ray emissions from BAKER detonation. During this project, gamma-ray measurement signals were transmitted from the bomb case to USS Cumberland Sound (AV-17) just before the transmitters were destroyed.

The third project was collection and measurement of air and water samples to determine the efficiency of the detonations. This included the use of drone aircraft (B-17 and F6F) and drone boats to obtain radioactive air and water samples.

The Army B-17 drones were guided from Enewetak to Bikini by B-17 controller aircraft. On ABLE they sampled at 12,000, 18,000, 24,000, and 30,000 feet (3.66, 5.49, 7.32, and 9.14 km) between 6 and 15 minutes after the detonation. On BAKER they sampled at 6,000 and 10,000 feet (1.83 and 3.05 km) between 5 and 10 minutes after the detonation. Each B-17 drone aircraft had a filter box mounted in place of its top turret and a large inflatable rubber bag in its bomb bay. The air filter unit with its special filter paper was designed to filter 90 cubic feet (7.5 cubic meters) of air in 30 seconds. The rubber bag was opened on command of the controller in the B-17 control aircraft when the drone entered the cloud. It automatically closed 30 seconds later, capturing 90 cubic feet (7.5 cubic meters) of air. The drones were guided back to Enewetak where they were landed by ground controllers. Los Alamos Report No. 613 (Reference C.1.1) describes removal of the filter unit:

The AAF filter unit was fixed to the top turret of a drone B-17. A lanyard ran from the unit down along the outside fuselage and ended in a handle fixed near the door of the plane. One sharp pull on the lanyard brought the filter unit tumbling down. Each door of the unit itself was fitted with a short lanyard. One sharp pull of this lanyard, and the door leaped
off in an amazing shower of springs and bolts. The filter papers sandwiched between their screens could then be picked up, a few wires snipped to separate the screens, and the paper removed.

Figure 18 shows a drone B-17 landed at Enewetak after shot ABLE. A monitor is shown walking away from the rubber bag in the background. The bag had been dropped from the bomb bay into a wheeled contrivance and was pulled away from the B-17 with long ropes. The top filter unit is visible on the top of the B-17 fuselage. Los Alamos personnel removed the filter papers from the boxes and flew to Kwajalein on the waiting C-54 with the filter papers and the large rubber bags filled with air samples. The samples were analyzed at Kwajalein.

Navy F6F drones were guided to Bikini from the carrier USS Shangri-La (CV-38) by drone control F6Fs. For ABLE, three drones sampled at 10,000, 15,000, and 20,000 feet (3.05, 4.57, and 6.1 km) approximately 8 to 15 minutes after the detonation. For BAKER, three drones sampled at 5,000, 9,000, and 14,000 feet (1.52, 2.74, and 4.27 km) 5 to 10 minutes after the detonation. After the sampling was complete they were guided to the island of Roi-Namur in Kwajalein Atoll and were landed there by ground control pilots. The F6F drones had a single unit with filter paper mounted under the left wing. A 10-foot (3.05-meter) pole with a hook was used to unhook and drop the unit from the wing. Six bolts were then removed on the doors.
by specially adapted 10-foot (3.05-meter) poles. The doors were then pulled off with another special 10-foot (3.05-meter) pole. The filter paper and securing screens were attached to the doors and came out of the unit with the doors. The filter papers were picked up with long-handled tongs (Figure 19) and placed in special lead receptacles. They were then flown by C-54 to Kwajalein for analysis.

Drone boats from USS Begor (APD-127) collected radioactive water samples throughout the target array. Radioactive samples were taken from Begor to Kwajalein and then to Los Alamos Laboratory for analysis.

Staffing: Los Alamos Laboratory supplied the personnel for the projects in this program. Removal of sulfur samples from target ships on ABLE test would have exposed men to low-level radiation on those ships that were near surface zero, viz. Sakawa (a captured Japanese cruiser), USS Crittenden (APA-77), USS Carlisle (APA-69), and USS Arkansas (BB-33) (Reference C.9.210, p. N-212). Measurement of gamma rays at detonation time for BAKER should not have created any radiation exposure to personnel. Removal of radioactive air and water samples from planes and boats was a very sensitive operation with a high exposure potential. Only 12 of 70 personnel in

Figure 19. Removal of filter papers from the 161 filter units at Rot-Namur Island following shot ABLE, CROSSROADS.
the Los Alamos Laboratory Group were badged and their exposures were very low (see Table 6).


Program VIII -- Remote Measurements


Operations: This program consisted of 18 projects. Experiments were conducted at sites around the world to measure changes produced by the detonations. Measurements were made of tides, wave action, atmospheric reflectivity, atmospheric pressure, atmospheric ionization, atmospheric noise, radioactivity, and long-range radio waves. Only Project 14 used locations in the Bikini area, specifically Eneu Island and USS Kenneth Whiting (AV-14).

Staffing: Organizations involved in each of the projects are listed above. Names of individuals associated with these organizations cannot be separately identified. Except for Project 14, which had instrumentation on Eneu Island and Whiting, exposure potential was extremely low for everyone working with this program. The Eneu site was not contaminated after ABLE, but the beach was contaminated after BAKER. Eneu was visited on 25 July (BAKER day) and all experiments removed during the afternoon. Three days later it was radiologically cleared and reopened for troop use.


Program IX -- Technical Photography

Agencies: Los Alamos Laboratory Army Air Forces (AAF) U.S. Navy Technical Photography Group

Operations: There were 19 projects in Program IX associated with technical photography. Project 1, operated by Los Alamos Laboratory, used high-speed cameras to record the growth rate of the ABLE fireball. Half of the cameras were in a tower on Bikini Island and half in a tower on Eneu Island. Projects 2 through 7 used cameras mounted in six camera towers to observe water waves, ship motion, burst location, light intensity, and record damage. There were two camera towers each on Bikini, Eneu, and Aomen islands. These six projects were operated by the Technical Photography Group of the Instrumentation Division. Projects 8, 9, and 10 consisted of technical photography from AAF planes. Cameras were mounted in B-17 drones, C-54s.
and F-13s. Pictures were taken of fireball development, nuclear cloud formation, the target area, and radar scopes inside the aircraft. Projects 11 through 14 consisted of technical photography from U.S. Navy aircraft. A variety of cameras were installed in PBMs, TBMs, F6Fs, and F6F drones to photograph wave motion, target array, target damage, and detonation effects on ships in real time. Project 15 used 20 cameras placed on target ships and nearby islands for shot ABLE and 24 cameras on target ships and nearby islands for shot BAKER to observe ship reaction to the detonation. Project 16 consisted of mounting high-speed cameras in a C-54 to measure the ABLE fireball growth. Project 17 consisted of mounting 50 icaroscopes on nine observer ships to observe bomb flash intensities (Reference C.9.190, p. 207). Project 18 mounted two drum spectographs in a camera tower on Eneu to record the light's spectrum as a function of time. Projects 15 through 18 were conducted by the Technical Photography Group of the Instrumentation Division. Project 19 used a high-speed camera on Bikini to photograph ABLE fireball development. This project was accomplished by the BuOrd Group of the Instrumentation Division.

Staffing: Personnel in the Technical Photography Group consisted of officers and enlisted men from the U.S. Navy and civilians. Of the civilians assigned, at least one was from Los Alamos Laboratory. The Navy Photographic Unit was aboard USS Saidor (CVE-117). In addition to the Technical Photo Group, the Army Air Task Group, TG 1.5, had one task unit devoted completely to photography. Army Air Photo Unit, TU 1.5.2, with several photographic aircraft, provided substantial support to this program.

For ABLE there was little chance for exposure on any of the projects except for Projects 8, 13, and 15, where cameras had to be recovered from B-17 and F6F drones and target ships. The drones were contaminated; however, none of the target ships with cameras were contaminated on shot ABLE. For BAKER, recovery of several projects created an exposure potential. Projects 2 through 7 required recovery of film from contaminated islands around the lagoon after BAKER. Projects 8 and 13 required recovery of film from contaminated B-17 and F6F drones. Project 15 required recovery of film from contaminated target ships after BAKER. Projects 18 and 19 required recovery of film from Eneu and Bikini, the beaches of which were contaminated after BAKER.
CROSSROADS was primarily a sea-based operation. The islands of Bikini Atoll were used as sites for instrument locations and as recreation areas. However, a Navy Construction Battalion had quarters for its men on Bikini Island. Joint Task Force 1 (JTF 1) personnel lived at Kwajalein, Enewetak, and aboard ships in Bikini Lagoon. They commuted to their work sites in the target array or at island-based measurement sites.

In Test ABLE, the weapon was dropped from an Army Air Forces B-29 (nicknamed "Dave's Dream") based at Kwajalein. The bomb burst in the air 520 feet (158 meters) over the target ships. In the BAKER test the weapon was suspended in a waterproof container 90 feet (27 meters) below LSM-60, anchored at the center of the target fleet. A third test, to have been called CHARLIE, would have been a deep underwater test, but it was cancelled after Test BAKER.

The target fleet was unmanned for both tests and was anchored in the northeastern area of Bikini Lagoon off Bikini Island. For ABLE 22 landing craft and for BAKER 24 landing craft were beached on the lagoon side of this island, simulating boats in an amphibious operation. Military equipment (including airplanes), animals, and scientific instruments were aboard the target ships. Two anchored seaplanes were also part of the target fleet.

The manned JTF 1 support ships withdrew from the lagoon before the tests and remained east of the atoll or were at other atolls until it was safe to reenter the lagoon. Nontarget small craft were moored (unmanned) in the lagoon off Enew Island about 5 nmi (9.3 km) south of the test area. Among these were several drone boats equipped to be remotely controlled. After each detonation the drones were guided by aircraft and USS Begor (APD-127) to areas in the target array to collect water samples and take radiation readings. After the water samples were collected, the drones were guided back to Begor where they were hosed down to remove radioactive contamination (Figure 20) and the samples removed. After each test the drones were followed by six patrol motor gunboats (PGMs) and twenty landing craft (LCPLs) with radiation monitors aboard. Radiation intensity measurements were sent by radio to the Radsafe Control Center. From this information and that gathered from aircraft equipped with radiation detectors, it was determined when a safe reentry to the lagoon by the main body of the fleet could be made.

PRE-TEST OPERATIONS

Preparation for the tests began in January 1946 when the atoll was surveyed by USS Allen M. Sumner (DD-692) and USS Bowditch (AGS-4). The survey was finished in April.

* The islands of Bikini Atoll and their various transliterations and synonyms are listed in Appendix D.
On 7 March 1946, 167 Bikinians embarked aboard USS LST-1108 and were taken to Rongerik Atoll. At the same time the Navy 53rd Construction Battalion began arriving to build the various phototowers, instrumentation sites, workshops, and recreation facilities on the islands of the atoll. One hundred tons of dynamite were used to clear coral heads in the lagoon. Five naval mines were discovered and disposed of during March.

Movement of participating ships from eastern U.S. shipyards and ports toward Bikini also began in March. Movement from closer ports began later, and by mid-May there were over 100 CROSSROADS-bound ships stopping over in Pearl Harbor on their way to Bikini. Interior spaces of some support ships were modified as laboratories or machine shops, and USS Burleson (APA-67) was being converted to a "great dirtless farm" (Reference A.1), a living place for the experimental animals that were used during CROSSROADS.

The target ships also required special preparation. For Test ABLE, 93 target vessels were assembled. For Test BAKER, 92 target vessels were arrayed. The target fleet was led by older U.S. capital ships like the famous USS Saratoga (CV-3) and the old battleships USS Nevada (BB-36), USS Pennsylvania (BB-38), and USS New York (BB-34). The German battle cruiser Prinz Eugen and two major captured Japanese ships, the battleship Nagato and the cruiser Sakawa, were also targets. All target vessels were accurately moored and made ready for the
tests. This involved a great deal of work by Task Group (TG) 1.2 in making the ships watertight so that pumping would not be required to keep them afloat. Many of the target ships could be classed as "war weary," making this task difficult. For the sake of the experiment, the ships were to be in as near to fighting condition as was reasonable, which included loading them with ammunition, torpedoes, fuel, radar equipment, etc.

The target ships also required close pretest inspection since the aim of the tests was to measure the effects of the nuclear detonations. This was done by inspection teams of the Ship Material and Inspection Division and ships' crews and was documented extensively with photographs. Instrument placement aboard these vessels also was extensive. Compartments in nearly every target vessel were inspected and the condition recorded before and after each test. An aerial view of the target array is shown in Figure 21.

ABLE OPERATIONS

By mid-June the task force was in place. Burleson, with its cargo of experimental animals, was one of the last arrivals (14 June). Several small-scale rehearsals and one major rehearsal on 24 June 1946 (Queen Day) preceded the test. For the Queen Day rehearsal a number of non-self-propelled or slow-moving vessels were evacuated to Kwajalein, some not to return to Bikini until after ABLE. Projected ABLE Day remained 1 July.

At the morning weather conference on 30 June 1946, favorable weather was forecast for the following day, so Commander JTF 1 (CJTF 1) set 0830, 1 July, as shot time. At the evening weather conference, conditions still appeared
favorable. However, fairly heavy cloud cover was reported early on the morning of 1 July, and shot time was changed to 0900.

Evacuation of task force support ships began soon after CJTF 1 set the hour for ABLE. All destroyers except USS Moale (DD-693) got underway and were clear of the lagoon by early afternoon on 30 June. Most of the support ships of TG 1.2 were out of the lagoon shortly thereafter, except for the TG 1.2 flagship USS Fall River (CA-131) and three small support ships. Throughout the afternoon the vessels of TG 1.8 cleared the lagoon. Three tugs towed barges to Kwajalein and USS Chowanoc (ATF-100) towed YO-130 to the open sea, more than 20 nmi (37 km) northeast of Bikini Atoll. Small craft had evacuated task force personnel from Enidrik and Eneman islands and transferred them to Fall River, which then left the lagoon along with the smaller ships of TG 1.2. Ten ships remained in the lagoon after 1800 hours.

Preparations ashore had included removal of the roofs of buildings to prevent blast damage and removal of the pontoon-supported docks and causeways that had been installed on the islands. Machinery such as refrigerators, generators, and water-distilling units had been covered by tarpaulins.

USS Chilton (APA-38) evacuated 691 nonessential U.S. personnel and natives from Enewetak before the test. Provision had been made to evacuate essential U.S. personnel on Enewetak if necessary, and five C-54 air transports were at Enewetak for this purpose. The Marshallese on Rongerik to the east had been taken aboard USS LST-989 in case evacuation was necessary there.

Two additional C-54s were sent from their Kwajalein base on 30 June, one to Enewetak and one to Roi Island. These were scheduled to receive the radioactive cloud samples to be collected by the B-17 drone samplers based at Enewetak and the F6F drone samplers returning to Roi following the shot.

At 0512 on 1 July, PGM-23 had all task force personnel from Iroij, Nam, and Aomen islands embarked and was underway for the fleet assembly area. At 0524 USS Kenneth Whiting (AV-14) had all personnel from Bikini and Enew islands aboard and was underway. The last ship out of the lagoon was USS Mount McKinley (AGC-7). These ships joined the other JTF 1 ships in operating areas east of Bikini. These operating areas were designated by the names of automobile manufacturers.

The first airborne aircraft were three B-29s that had made weather reconnaissance flights in the shot area and northeast and northwest of Bikini Atoll. At 0540 CJTF 1 ordered the drop aircraft to take off from Kwajalein. This was a specially modified B-29 on which the bomb had been loaded about midnight (Figure 22). At 0555 the bomber was reported as being airborne. The four F6F drones and sixteen F6F controllers from USS Shangri-La (CV-38) were airborne shortly after 0700. In all, 79 aircraft were airborne on the morning of ABLE. By 0800 all aircraft and ships were on station. One F6F drone went out of control and crashed in the sea just as the B-29 began its live run at 0850. The bombing aircraft had made one practice run before the live run. Aircraft participation in Test ABLE is summarized in Table 7, and Table 8 summarizes the designated obitining points for these aircraft.
Figure 22. "Dave's Dream," the B-29 from which the CROSSROADS, ABLE weapon was dropped.

All other air operations within 500 nmi (927 km) had been suspended 12 hours before the shot.

Observers included Congressmen, the President's Evaluation Commission, the Joint Chiefs of Staff (JCS) Evaluation Board, United Nations representatives, and media correspondents. The live run was made at 28,000 feet (8.5 km). The bomb was released at 0859 and detonated with a yield of 23 KT 15 seconds before 0900, 1,500 to 2,000 feet (457 to 610 meters) west of the planned surface zero (Figure 23).

An Army doctor trained as a radiological safety (radsafe) monitor made the following observation from a PPM aircraft 20 nmi (37 km) away (Reference A.2, p. 55):

At 20 miles it gave us no sound or flash or shock wave. . . . Then, suddenly we saw it -- a huge column of clouds, dense, white, boiling up through the strato-cumulus, looking much like any other thunderhead but climbing as no storm cloud ever could. The evil mushrooming head soon began to blossom out. It climbed rapidly to 30,000 or 40,000 feet, growing a tawny-pink from oxides of nitrogen, and seemed to be reaching out in an expanding umbrella overhead. . . . For minutes the cloud stood solid and impressive, like some gigantic monument over Bikini. Then finally the shearing of the winds at different altitudes began to tear it up into a weird zigzag pattern.

An aerial view of the cloud from the southeast is shown in Figure 24.

The radiological danger sector (radex) designated for aircraft at 0730 on the shot day predicted the downwind danger area to be between 325° clockwise
Table 7. Aircraft participation, Test ABLE, CROSSROADS.

<table>
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<td>3</td>
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</tr>
<tr>
<td>B-17</td>
<td>4</td>
<td>Drone samplers</td>
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<tr>
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<td>B-29</td>
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<td>Command</td>
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<td>WB-29</td>
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</tr>
<tr>
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<td>4</td>
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</tr>
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</table>

Notes:

a A B-29 modified for photography.
b One F6F drone crashed in the ocean 10 minutes before the shot.

Table 8. CROSSROADS, Test ABLE aircraft orbit points.

<table>
<thead>
<tr>
<th>Orbit Designation</th>
<th>Bearing From Surface Zero (°)</th>
<th>Horizontal Range$^a$ from Surface Zero (nmi)</th>
<th>Horizontal Range$^a$ from Surface Zero (km)</th>
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</thead>
<tbody>
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<td>37</td>
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<td>Charlie</td>
<td>170</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>Dog</td>
<td>80</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>Easy</td>
<td>90</td>
<td>25</td>
<td>46</td>
</tr>
<tr>
<td>King</td>
<td>125</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>Love</td>
<td>315</td>
<td>30</td>
<td>56</td>
</tr>
<tr>
<td>Nan</td>
<td>0</td>
<td>20</td>
<td>37</td>
</tr>
<tr>
<td>Peter</td>
<td>240</td>
<td>35</td>
<td>65</td>
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<tr>
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<td>Tare</td>
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<tr>
<td>Uncle</td>
<td>40</td>
<td>30</td>
<td>56</td>
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<tr>
<td>Victor</td>
<td>315</td>
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<td>William</td>
<td>270</td>
<td>20</td>
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</tr>
<tr>
<td>Zebra</td>
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<td>40</td>
<td>74</td>
</tr>
<tr>
<td>I.P.</td>
<td>225</td>
<td>30</td>
<td>56</td>
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</tbody>
</table>

Note:

$^a$Slant ranges of aircraft vary with aircraft-orbiting altitude. Orbiting altitudes were from 1,000 feet (305 meters) to 31,000 feet (9.5 km).
Figure 23. CROSSROADS, ABLE target ship locations.
to 125° from surface zero. At 1000 it was changed to 350° clockwise to 180°. The Red Arc was set 16 nmi (30 km) downwind from surface zero, and the Blue Arc 22 nmi (41 km) downwind from surface zero. Radsafe monitors were placed aboard all aircraft airborne in the vicinity of Bikini at shot time except in the single-seat F6Fs. The F6F pilots had Geiger counters whose clicking signals were fed into their earphones to warn of increasing radioactivity (Reference C.9.206, Part VII, p. C10).

Two radiological reconnaissance PBMs began making passes over the target area at 0952, starting at an altitude of 2,000 feet (610 meters) and working down to 500 feet (152 meters). They continued until 1427 and then returned to Ebeye Island, Kwajalein. The two radiological reconnaissance B-29s began tracking and photographing the cloud at 1000 and were relieved during the day by two other B-29s. Four TBM aircraft were launched from USS Saidor (CVE-117) between 0910 and 0918. Two developed engine trouble and returned; the remaining two took stations upwind from the drone boats and transmitted boat locations to Begor, which was controlling the drone boats. They completed their mission and departed the area for Saidor at 1238.

Army and Navy aircraft involved with photography and cloud sampling accomplished their missions before 1000. B-17 sampler drones penetrated the cloud at altitudes of 13,000, 18,000, 24,000, and 30,000 feet (3.96, 5.49, 7.32, and 9.14 km) about 20 minutes after the detonation, obtained their samples, and were guided back to Enewetak Island. Three remaining Navy F6F drones sampled the radioactive cloud between 0906 and 0920 at altitudes of 10,000, 15,000 and 20,000 feet (3.05, 4.57 and 6.10 km). All three drones were guided back to Roi and were landed without incident. C-54 aircraft waiting at Enewetak and Roi transported the cloud samples in airbags and filters to Kwajalein. The samples were analyzed as soon as they were removed from the drones by Los Alamos.
Laboratory personnel. Filters were then sent to Los Alamos Laboratory for further analysis.

The drone control ship Begor started two of the drone boats and, using instructions from the TBMs, guided the boats into the target area. Both boats took several water samples based on radiation readings they transmitted back to Begor. Both drones departed the target area before 1200. Begor met the two drones in the anchorage area in the lee of Eneu and removed samples. Samples were transferred to Moale, which steamed to Kwajalein at 1255 (Reference C.9.206, Part VII, p. R19 through R22).

Reentry into Bikini Lagoon commenced at H+2 when six manned PGMs and twenty LCPLs entered to conduct radiological reconnaissance. They carefully approached the area around the target vessels and measured radiation. Information from these boats was used to define the Red and Blue lines. Boarding teams and salvage units for the target vessels entered the lagoon at H+4 and proceeded with operations as the radiological situation permitted, remaining outside the Blue Line except for designated ships. At 1430 on 1 July the lagoon was declared safe and task force ships reentered and anchored in the southern part of the lagoon. By 2030, 18 target ships had been boarded and reported radiologically safe. By the evening of 2 July, 47 ships had been radiologically cleared. The Red Line was eliminated early on the morning of 2 July, indicating that the maximum intensity of the water fell below 1 R/24 hours during the night. The Blue Line was eliminated at 1008 on 2 July.

Two F6Fs took off at 1615 on 1 July to conduct an oceanographic survey of the Bikini Lagoon by taking photographs with strip cameras (Reference C.9.206, Part VII, pp. E141 through E175). At 2039 and 2047 on 1 July, two P-29s took off and sampled the remnants of the radioactive cloud. Both obtained good samples. However, both aircraft were too contaminated to permit maintenance crews to perform postflight inspections. Several WB-29 weather flights with monitors on board plus a low-altitude photo mission over the target area were flown on 2 July (Reference C.9.206, Part VII, p. C14).

The Marshallese at Rongerik disembarked from LST-989 the afternoon of 1 July (Reference C.9.206, Part VII, pp. C10 through C15). Burleson picked up caged animals from five target ships shortly after 1600 on 1 July (Reference C.9.206, p. 189). At 2142 on 1 July all ships in the lagoon were ordered not to use their evaporators (saltwater-to-freshwater converters) because of possible radioactive contamination (Reference C.9.206, Part VI, p. B14). At 1332 on 2 July CJTF 1 lifted this restriction (Reference C.9.206, p. VI-B-16). Also on 2 July the submarine USS Skate (SS-305) was beached to prevent sinking. The islands of Eneu and Bikini were inspected and declared safe the same day. By 4 July all target ships had been "initially boarded" by one of the ten initial-boarding teams (Reference C.9.206, pp. V-C-6 and VII-10 through VII-15).

Damage to ships and aircraft of the target array was as follows (References C.9.2, C.9.3, and C.9.157):

- 5 ships sunk
- 6 ships seriously damaged
- 8 ships seriously impaired efficiency
• 9 ships moderately damaged
• 43 ships negligible damage
• 22 landing craft beached at Bikini Island, no damage
• 14 aircraft destroyed
• 30 aircraft seriously damaged
• 10 aircraft lightly damaged
• 19 aircraft no damage.

In general all target vessels within 500 yards (457 meters) of actual surface zero were sunk or seriously damaged. Those beyond 1,500 yards (1.37 km) received minor damage (Reference C.9.206, Part V, p. C6). Those ships beyond 750 yards (686 meters) had little induced activity or contamination; they were reboarded on 1 July and were used for crew quarters beginning on 2 and 3 July. Figure 25 shows a group of VIPs and CJTF 1 inspecting New York after ABLE. By 5 July all target vessels (except those sunk) had been rehabilitated to the extent necessary for the upcoming BAKER event.

More than 50 percent of the test animals within 1,000 yards (914 meters) died, between 15 and 30 percent died between 1,000 and 2,000 yards (0.91 and 1.83 km), and between 5 and 15 percent died outside 2,000 yards (1.83 km). Airblast was the principal cause of injury and death. However, radiation exposure was the principal cause of death for those animals who died after the first few hours.

During Test ABLE, 200 cameras, 300 5-gallon (18.93-liter) cans, 400 photographic radiation badges, 5,000 sulfur capsules, 850 ball-crusher gauges, and over 5,000 other gauges of various types were used to measure and record the detonation effects (blast, heat, and radiation). The timing signal relied on to start a number of instruments was sent out about 10 seconds late because of errors by the timing signal operator. The following instruments obtained no data as a result of this 10-second delay: free-piston gauges, shock wave velocity cameras, O'Brien and Bowden cameras on Bikini, Fastex cameras on Bikini and Eniwetok, and the drum spectrograph.

PREPARATION FOR BAKER

As soon as the extent of damage from ABLE had been determined, CJTF 1 tentatively set 25 July for BAKER. The news media ship USS Appalachian (AGC-1) returned to Pearl Harbor to allow some media people to depart and others to join the group. Some observers were taken on a cruise to Ponape, Truk, Majuro, and Guam Islands while the task force prepared for BAKER (Reference C.9.206, Part V, p. C7).

Several target ships had sustained boiler and/or stack damage. Wreckage was cleared and repairs made so that every target ship (except those sunk) was able to steam under its own power on at least one boiler. USS Independence (CVL-22) needed considerable work to ensure watertight integrity. The submarine Skate needed superstructure repairs, including a temporary bridge (Figure 26). One by one the target ships were moved to their positions in the new target
Figure 25. VIPs and Commander Joint Task Force 1 inspect USS New York (BB-34) following test ABLE.
array for BAKER. Test ABLE blast damage inspections were completed (Figure 27), and new instrumentation and new experiments were set up on these target ships in preparation for Test BAKER (Reference C.9.206, Part VII, p. A73).

Some turnover of task force personnel occurred following ABLE. A continuous training program was in effect after ABLE to train new personnel in preparation for BAKER. A large quantity of radac instruments was received during this period, alleviating a minor shortage experienced during ABLE. The underwater BAKER shot was expected to create a much larger radsafe problem and require more radac meters than did ABLE (Reference C.9.206, Part VII, p. C17).

The Army Air Forces conducted a major rehearsal on 14 July. All Army air units participated. Locations, communications, and coordination were tested.
Figure 27. Inspection of Army vehicle on deck of USS Nevada (BB-36) following Test ABLE, CROSSROADS.
checked, and rechecked. Then on 19 July, JTF 1 conducted a full-scale dress rehearsal, dubbed "William Day." All units of the task force participated fully except the air task units. Heavy cloud cover and rain limited aircraft participation in the rehearsal (Reference C.9.206, Part VII, p. E180).

On D-1 (24 July) CJTF 1 confirmed BAKER Day as 25 July and designated shot time for 0835. Weather forecasts indicated that there would be favorable weather on that day. Evacuation of task force ships and personnel began immediately. Personnel and ships not needed immediately after the shot were evacuated to Rongelap Atoll instead of Kwajalein because it was closer to Bikini. USS Saint Croix (APA-231) evacuated 607 U.S. personnel and natives from Enewetak on 21 July.

The day before BAKER, two C-54s were again sent to Enewetak and Roi islands to transport the cloud samples to Kwajalein on 25 July. Five C-54s were again positioned at Enewetak in case evacuation of essential personnel was necessary. Except for minor changes, the aircraft missions were similar to the ABLE shot missions. Table 9 shows the aircraft that participated in BAKER, and Table 10 summarizes their orbit areas.

By 1735 on 24 July all but 13 support ships were clear of the lagoon. These cleared the lagoon by 0700 the following morning. Task force personnel on the islands at Bikini were evacuated by 1555 on 24 July. Three sailors on USS Gasconade (APA-85), a target ship, were somehow overlooked. They filled the yardarms with bunting (the signal that they needed evacuation) and were picked up by USS Conserver (ARS-39) at 0530 on 25 July (Reference C.9.206, Part VII, pp. H5-H7).

The bomb was suspended 90 feet (27.4 meters) beneath the surface of the lagoon from medium landing ship LSM-60. The LSM had been extensively modified to provide rigging facilities, a laboratory, and special radio receivers and transmitters. The bomb was encased in a strong, watertight, steel caisson and had a coaxial cable running from it to the LSM. The TG 1.1 laboratory personnel associated with the bomb arming were evacuated from LSM-60 at 0545 on 25 July (Reference C.9.206, p. 5.12).

There were 68 target vessels in the array for Test BAKER. Twenty-four small craft were beached on Bikini Island. Their positions are shown in Figure 28. The submarine USS Searaven (SS-196), which had been submerged on 24 July, partially surfaced later in the day. It was finally resubmerged by 2300 on 24 July. Of the eight target submarines, six were submerged and two were on the surface for the test (Reference C.9.206, Part VII, p. F10).

Weather was not quite as important for BAKER as for ABLE because the underwater detonation was expected to limit the cloud height and thus localize the radioactivity. Good visibility, however, was important for photography (Reference C.9.206, Part IV, p. C7).

BAKER TEST

BAKER was detonated on schedule at 0835 on 25 July 1946. The detonation command was sent by radio using coded signals. The weapon yield was 23 KT.
Table 9. Aircraft participation, CROSSROADS, Test BAKERa.

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<thead>
<tr>
<th>Type</th>
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<td>4</td>
<td>Drone samplers</td>
</tr>
<tr>
<td>B-17</td>
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<td>Drone controllers</td>
</tr>
<tr>
<td>B-29</td>
<td>1</td>
<td>Radio broadcast</td>
</tr>
<tr>
<td>B-29</td>
<td>1</td>
<td>Press and newsmen</td>
</tr>
<tr>
<td>B-29</td>
<td>2</td>
<td>Command</td>
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<tr>
<td>B-29</td>
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<td>Pressure-gauge drop</td>
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<td>Radiological reconnaissance</td>
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<td>Photography</td>
</tr>
<tr>
<td>TBM</td>
<td>4</td>
<td>Drone boat control</td>
</tr>
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Notes:
a Does not include aircraft taking off after 1200, 25 July.
b A B-29 modified for photography.

Table 10. CROSSROADS, Test BAKER aircraft orbit points.

<table>
<thead>
<tr>
<th>Orbit Designation</th>
<th>Bearing from Surface Zero (°)</th>
<th>Horizontal Range from Surface Zero (nmi)</th>
<th>(km)</th>
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<tbody>
<tr>
<td>Able</td>
<td>45</td>
<td>20</td>
<td>37</td>
</tr>
<tr>
<td>Charlie</td>
<td>180</td>
<td>10</td>
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<tr>
<td>Dog</td>
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<td>Easy</td>
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<td>Yoke</td>
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<td>13</td>
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</table>

Note:

Slant ranges of aircraft vary with orbit altitude. Orbit altitudes were from 500 feet (152 meters) to 30,000 feet (9.1 km).

Figure 28. Target ship locations for CROSSROADS, Test BAKER.
Observers included United Nations representatives, Congressmen, the President's Evaluation Commission, the JCS Evaluation Board, and media representatives (Reference C.9.206, Part V, p. C8).

The Army radsafe monitor previously quoted was again aboard a Navy PB4 about 15 nmi (28 km) away and described the visual effects as follows (Reference A.2, p. 93):

The flash seemed to spring from all parts of the target fleet at once. A gigantic flash -- then it was gone. And where it had been now stood a white chimney of water reaching up and up. Then a huge hemispheric mushroom of vapor appeared like a parachute suddenly opening. . . . By this time the great geyser had climbed to several thousand feet. It stood there as if solidifying for many seconds, its head enshrouded in a tumult of steam. Then slowly the pillar began to fall and break up. At its base a tidal wave of spray and steam rose to smother the fleet and move on towards the islands. All this took only a few seconds, but the phenomenon was so astounding as to seem to last much longer.

Another aircraft observer reported seeing a major ship "on [its] nose" before it sank and saw a water wave pass over one of the small islands between Bikini and Eneu islands about 2 minutes after the detonation (Reference C.9.206, Part VI, p. D9). Figure 29 shows the BAKER detonation wave as it lifted the stern of Saratoga some 43 feet (13.1 meters). The dark area to the left of Saratoga is believed to be a cavity in the column formed by the hull of USS Arkansas (BB-33). When the air over the fleet cleared, Arkansas, LSM-60, and four LCTs were not in sight. Saratoga was listing to starboard and her stern was low. Figure 30 shows the BAKER cloud as viewed from the manned support ships in their operating areas.

The underwater burst inflicted heavy damage on the target fleet. Eight ships were sunk or capsized (See Table 11). Eight ships were immobilized or seriously damaged. Generally, ships beyond 1,500 yards (1.37 km) were undamaged. Those between 1,100 and 1,500 yards (1.01 and 1.37 km) sustained only slight damage. Those between 900 and 1,100 yards (0.82 and 1.01 km) suffered moderate damage. Those inside 900 yards (823 meters) were seriously damaged or were sunk (Reference C.9.208, p. 23.3).

At 0912, the drone control ship, Begor, began moving two drone boats from the lee of Eneu towards the target array using directions from the orbiting drone control TBMs as in Test ABLE. Each boat took ten 5-gallon (18.93-liter) samples of lagoon water and by 1030 was on route back to its anchorage. The drone boats were so radiologically contaminated that boarding parties from Begor could not go aboard. The drone boats were taken to USS Albemarle (AV-5) where the water samples were finally removed about 1430. Two additional drone boats were guided into the target area the same afternoon using the same combination of TBMs and Begor. Each took 10 samples of water, which were transferred to Albemarle about 1800. Albemarle then headed for Kwajalein with the samples. Four more runs were made on 26 July and two more on 27 July using the same control procedures. The radiation intensities had lessened somewhat, allowing boarding parties from Begor to remove these samples and transfer them to USS Haven (AH-12) (Reference C.9.206, Part VII, p. R28-34).
Figure 29. CROSSROADS, Test BAKER column at about 10 seconds, photographed by remote-control camera on Enew Island.

Figure 30. CROSSROADS, BAKER cloud as viewed from the manned support ships in their operating areas.
Table 11. Target ships sunk at CROS ROADSa.

<table>
<thead>
<tr>
<th>ABLE</th>
<th>BAKER</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Anderson (DD-411)</td>
<td>USS Arkansas (BB-33)</td>
</tr>
<tr>
<td>USS Carlisle (APA-69)</td>
<td>ARDC-13</td>
</tr>
<tr>
<td>USS Gilliam (APA-57)</td>
<td>USS Apogon (SS-308)</td>
</tr>
<tr>
<td>USS Lamson (DD-367)</td>
<td>USS Pilotfish (SS-386)</td>
</tr>
<tr>
<td></td>
<td>Nagato</td>
</tr>
<tr>
<td></td>
<td>USS Saratoga (CV-3)</td>
</tr>
</tbody>
</table>

Notes:

aUSS Dentuda (SS-335), submerged for test, flooded and sank; later it was raised and taken to Pearl Harbor and is not included in the ship sunk category. Six LCTs were sunk at Bikini after Test Able.

bSurface zero ship.

Sources: Reference A.1, pp. 130-132; Reference C.9.2, pp. 32-33.

Three air-sea rescue B-17s patrolled the area between Enewetak and Bikini to protect the six drone-control B-17 crews. Four drone-sampler B-17s took part in the test. Two were flown over surface zero at detonation time, one at 6,000 feet (1.83 km) and one at 16,000 feet (4.88 km). The one at 6,000 feet (1.83 km) had its bomb bay doors warped, its inspection plates blown open, the tail gunners hatch blown inside the aircraft, the canvas cover over the tail wheel split, and the standard aircraft cushions inside split open. The other B-17 drone jumped 300 feet (91 meters) in altitude but sustained no damage. The third B-17 drone sampled in the cloud at 7,000 feet (2.13 km) 5 minutes after the burst, and the fourth B-17 drone sampled above the cloud at 11,000 feet (3.35 km) 7-1/2 minutes after the burst. Three Navy F6F drones and their twelve F6F controllers took off from Shangri-La and sampled at altitudes of 14,000, 9,000, and 5,000 feet (4.27, 2.74, and 1.52 km). Only the drone at 5,000 feet (1.52 km) passed through the cloud. Sampling was completed by 0850 and all aircraft returned safely to base (Enewetak for the B-17s and Rol for the F6Fs). The airbags and filters were removed by Los Alamos Laboratory personnel and transported in the waiting C-54s to Kwajalein for analysis.

Eight B-29s and three WB-29s participated in shot BAKER. The radio broadcast, press, and command B-29s orbited the area accomplishing their missions at a safe distance. The two pressure-gauge drop B-29s dropped their gauges from 24,000 and 25,000 feet (7.32 and 7.62 km) just before the detonation. The two radiological reconnaissance B-29s tracked and photographed the remnants of the cloud until almost 1400 hours when they were relieved by two other B-29s. The three WB-29s were airborne by 0231 the morning of the detonation to report on cloud cover and other weather phenomena north and east of Bikini until 0500, when they returned to Bikini to provide current weather reports at that location. The three C-54 and eight F-13 Army aircraft were involved with transporting observers and photography (Reference C.9.206, Part VII, p. E195 through E207). All aircraft except the F6F had radsafe monitors aboard. As at Test
ABLE, the F6F pilots used earphones connected to Geiger counters to monitor radioactivity.

Early reports from radiological reconnaissance PBMs and drone boats indicated that the lagoon and surrounding atmosphere were intensely radioactive. A drone boat recorded about 730 R/24 hours near the center of the target array. The three PBMs made several passes over the lagoon on 25 July, starting at 4,000 feet (1.22 km), then at 3,000, 2,000, 1,000 and 500 feet (914, 610, 305, and 152 meters); the first pass was made at 0915 and the last at 1615. The preshot radex sector bearings of 360° clockwise to 220° were modified slightly at 0940 to 360° to 270°. The Red Arc was set at 9 nmi (17 km) from surface zero and the Blue Arc at 11 nmi (20 km) from surface zero (Reference C.9.206, Part VII, p. C-19).

Reentry into the lagoon commenced at 0916 when the PCM and LCPL radiological patrol boats with monitors aboard entered. They were closely followed by TU 1.2.8 and Kenneth Whiting. Fall River took up its position at the lagoon entrance at 0947 to control entry and exit. The Salvage Unit (TU 1.2.7) entered the lagoon at 1015 and began checking and boarding target vessels. A total of 49 support ships with 14,920 personnel entered the lagoon by the end of 25 July.

For BAKER, ten initial boarding teams were established, a total of 86 men, including one monitor for each team. These teams were the first groups to return to the target vessels, although five of the firefighting officers may not have actually reboarded unless there was a fire to fight (Reference B.0.1, pp. X-X-1 through X-X-17). In addition, representatives of the groups responsible for the scientific experiments and tests of military equipment returned to retrieve data and materials when given permission by the monitors. Film and other data were recovered from Bikini and Eneu Islands during the afternoon. Twelve target ships were temporarily boarded, ten of which were declared radiologically safe (no radiation measured above 0.1 R/24 hours) before nightfall on 25 July (Reference C.9.206, p. VII-C-53). The remaining target ships were too radioactive to board and the water near the detonation site remained radioactive as well (Reference C.9.206, p. VII-C-54).

The radioactive cloud had apparently moved north of the burst. Radiological reconnaissance F-13s discovered weak radioactivity while flying 43 nmi (80 km) north of the lagoon at 1318 and a highly radioactive cloud at 80 nmi (148 km) almost directly north of Eneu Channel at 1610 (Reference C.9.206, Part VI, p. D13). An F-13 due west of Bikini at 50 nmi (93 km) made no contact with radioactivity by 1415. Apparently based on this information, the alert at Enewetak Atoll west of Bikini was dropped at 1418 and clearance was given to return evacuees there (Reference C.9.206, Part VI, p. D13).

At about 1608 Saratoga sank (Figure 31). Until that time it had been the oldest U.S. aircraft carrier afloat. Saratoga was laid down as a battle cruiser in 1920, but was completed as an aircraft carrier. Radiological conditions prevented any attempt to save the ship.

The radioactivity persisted through 26 July. Films from cameras on Aomen Island were recovered using helicopters. An oil slick with radioactive debris
was observed north of Nam Island (outside the lagoon). Task force ships in the lagoon stayed in the southeast sector near the entrance in order to keep clear of the radioactive water. Their evaporators were allowed to be used on 26 July. The target ship USS Hughes (DD-410) was towed to Eneu and beached by USS Recliner (ARS-42) to prevent sinking. Figure 32 shows a welder aboard Hughes during preparations for towing. Note the respiratory protection device being worn and the nearby monitor. The same situation persisted on 27 July; however, some instrumentation was recovered from the target ships. USS Preserver (ARS-9) attempted to get a line aboard the damaged and heavily contaminated USS Fallon (APA-81) so that it could also be beached beside Hughes. This could not be accomplished until the following day, however.

Because of the persistent radiation in the lagoon, several radiological reconnaissance flights took place over the next few days. Eight missions were flown on 26 July and two on 27 July. Five photography flights were made on 26 July and four on 27 July. Six drone boat control TBMs flew on 26 July and two on 27 July. Photo and radiological reconnaissance flights continued through 30 July, while drone boat control flights were not needed after 28 July (Reference C.9.206, Part VII, S. Encl 13-14).

On 28 July, radioactive water in the lagoon spread southeast to some of the task force ship anchorage areas, forcing some ships to relocate to uncontaminated areas. However, the Red Line (1 R/24 hours) was eliminated at 1455 on 28 July. On 28 July at 2352, Sumner reported readings of 0.156 R/24 hours on outboard bunks and 0.204 R/24 hours at the evaporators. On 29 July it was sent out of the lagoon and into the open sea in an attempt to decontaminate the hull. PGM-24 and PGM-29 had become contaminated earlier, reading 1.56 R/24 hours amidships. Their crews were evacuated to USS Appling (APA-58) and Haven.
Some test animals were recovered from target ships (USS Bracken [APA-64], USS Catron [APA-71], and USS Fillmore [APA-73]) on this date. Also, attempts to surface the submarines that had been submerged were begun. The next day more animals were removed from Catron, USS Briscoe (APA-65), and Gasconade.

By 29 July it was apparent that the target fleet was much more heavily contaminated than had been expected. The inspection and documentation of BAKER's effects -- a major reason for CROSSROADS -- could not proceed if target vessels were too contaminated for reboarding and thorough examination. The effort to develop and apply decontamination methods to the target fleet are described in Chapter 5.

During the fourth night after BAKER, the captured Japanese battleship Nagato sank. The next day, resurfacing of submarines continued, as did the recovery of animals from target ships. The radiological situation improved slightly, allowing a few more target ships to be boarded. Pieces of highly radioactive steel, believed to be SM-60, were found on the quarterdeck of USS Pensacola (CA-24) (Reference C.206, p. VI-D-45). Figure 33 shows a monitor amidship on Pensacola and illustrates the general level of damage on its weather decks.

On 30 July most target ships remained too radioactive for boarding; however, radioactivity of the lagoon waters continued to decrease. The Blue Line (0.1 R/24 hours) was eliminated at 1041 on 30 July (Reference C.9.206, p. VII-C-23), although a report from Burleson stated that between berths 113 and 115 a reading of 0.1 R/24 hours was obtained 3 feet (0.9 meter) above the water's surface on 30 July (Reference C.10.17).
On 30 July the last of the animals were removed from Gasconade and Conserver. Although most animals were located below deck, the great majority of them died by 1 November 1946. In nearly all cases, the cause of death was gamma radiation resulting from Test BAKER's radioactive rainout and base surge (Reference C.9.208, p. 8). Also, many of the fish in the northeast corner of the lagoon were killed by the explosion.

On 31 July, Bikini Island was declared safe and personnel were permitted to go ashore. The beaches were declared off limits, however, because of radioactive debris that may have washed up. Many target vessels still remained too contaminated to board and the persistent radioactivity on these ships made the prospect of reboarding "very discouraging" (Reference C.9.206, Part VI, p. 740). Three submarines remained submerged in the lagoon. The lagoon water, except near the bottom, had reached safe levels by the evening of 31 July. Complete recovery of instrumentation and records was not completed until 1 August (Reference C.9.206, Part VI, p. 754).

On 8 August COTF I requested authority from the Chief of Naval Operations to decommission, or place out of service, 38 target vessels at Bikini. He
argued that the ships were in such radiological condition that with available personnel and equipment they could not all be made safe (Reference C.10.11) for the work needed either to prepare them for movement to Pearl Harbor or to assess their damage fully (Reference C.10.17).

By 11 August it was recognized that post-BAKER contamination was also a continuing and increasing problem for nontarget ships remaining in Bikini Lagoon (Reference C.10.14). Radioactive material from the contaminated lagoon was accumulating in the support ships' evaporators, saltwater piping, and marine growth on the outside of their hulls. Plans were made to move target vessels and support ships to Kwajalein, a convenient location with good anchorages, where the problems resulting from BAKER could be faced free from the environmental contamination present at Bikini. Beginning 19 August, 53 target ships were towed to Kwajalein and by 5 September the last of the target fleet had left Bikini.
CHAPTER 5
POST-BAKER OPERATIONS:
BIKINI, KWAJALEIN, AND THE UNITED STATES

In early August it became apparent that while the radiation levels in the water and on the land areas were below tolerance levels, the accumulation of radioactivity in the remaining ships' evaporators, saltwater piping, and marine growth on their hulls presented an increasing problem. Consequently, the base of operation of the task force had to be moved from Bikini. Kwajalein Atoll was selected for the new base (Reference C.0.22, p. 1). On 19 August 1946, movement of all remaining ships to Kwajalein was initiated, and by 26 September 1946 Bikini Atoll was completely evacuated. Subsequently, a large number of them were sunk, others were returned to naval shipyards in the United States for inspection and additional decontamination.

The experience, problems, and solutions associated with ship decontamination at Bikini and in naval shipyards and a discussion of radiological and other problems associated with off-loading ammunition from target ships and securing them at Kwajalein are addressed in this chapter.

REMANNING LIGHTLY CONTAMINATED TARGET SHIPS AT BIKINI

Five target vessels, attack transports USS Bladen (APA-63), USS Cortland (APA-75), USS Fillmore (APA-83), USS Geneva (APA-86), and USS Niagara (APA-87), were on the outer fringes of the target array and were not heavily contaminated by the rainout or the base surge (see Figure 28, Chapter 4). The crews of Bladen, Fillmore, Geneva, and Niagara returned to their ships on 29 July, and Cortland's crew returned on 30 July (Reference A.3, Bladen, Cortland, Fillmore, Geneva, and Niagara).

The ships needed some decontamination work (Reference C.9.185, pp. 4 and 10). Although the radioactivity on these ships' weather surfaces was not sufficient to prevent reboarding and cleanup work, they were found to have radioactivity on the outside of their hulls at the waterline, apparently because marine growth there was taking up radioactive isotopes from the lagoon water. Radioactivity was 0.4 R/24 hours on the inner surface of Niagara's hull, decreasing to 0.1 R/24 hours 5 feet (1.5 meters) toward the center of the ship (Reference C.2.1). After the waterline areas of the five ships were scraped, they steamed in the open ocean for 24 hours in an effort to reduce contamination. Niagara steamed alone on 1 and 2 August and the other four steamed as a group on 4 and 5 August (Reference A.3, Bladen, Cortland, Fillmore and Geneva). In addition, Geneva's entire bottom was scraped by passing wires under the hull from one side to the other and pulling them toward the stern (Reference C.9.185, p. 18). Upon reaching Pearl Harbor, the small boats of both Cortland and Fillmore were found to be radioactive (References C.2.4 and C.2.5).
DECONTAMINATION OF HEAVILY CONTAMINATED TARGET VESSELS AT BIKINI

Decreasing lagoon radioactivity by 27 and 28 July allowed the Director of Ship Material (DSM) aboard USS Reclaimer (ARS-42) to survey other target ships from a distance of 50 to 100 feet (15 to 30 meters). Of the 92 target vessels, only 10 ships in the target array and 20 landing craft beached on Bikini Islands had readings less than 0.1 R/24 hours by 2000 on 3 August (Reference C.11.19). Since “the nature and extent of contamination of the targets was completely unexpected, no plans had been prepared for organized decontamination measures” (Reference C.9.185, p. 4). As a result, the Technical Director and the DSM could not complete their programs in a timely way unless a means could be found to decontaminate the target vessels.

Washdown of Target Ships

After conferring with members of the Radiological Safety Section, the DSM took the lead in trying to remove contamination from the target vessels with materials and equipment immediately available to the task force at Bikini. First, task force firefighting equipment was used. Use of firefighting equipment is shown in Figure 34 as USS Achomawi (ATF-148) uses its forward monitor to wash down USS New York (BB-34).

Firefighting vessels of Task Unit (TU) 1.2.7, the Salvage Unit, twice attempted to wash down the heavily contaminated USS Hughes (DD-410) with saltwater on 27 July. The first effort produced a 50 percent reduction in radiation levels, but the second did not lower the radiation level. Next, foamite, a foam-like preparation used for smothering fires, was tried. Foamite was plentiful and was hoped to have a detergent action on the contamination adhering to Hughes. Fireboats sprayed Hughes with foamite and then with saltwater. Figure 35 shows the beached Hughes whitened by the foamite as two Salvage Unit ships stand by.

The reduction in radioactivity led to a decision to use foamite and saltwater until a better method was devised. The foamite and saltwater method, however, could be used only after waiting for the lagoon water to become virtually free of contamination. Radioactivity from the lagoon would itself contaminate both target and firefighting ships. Moreover, because the foamite and saltwater method was not totally effective, a search for better methods continued (Reference C.9.185, pp. 5 and 6).

Early Experiments in Decontamination

At a meeting on 27 July, attended by the DSM and members of the Radiological Safety Section, the radiological safety (radsafe) group was directed to study the decontamination problem. It selected pieces of contaminated equipment and blasted them with ground corncobs, coconut shells, barley, rice, ground coffee, rice hulls, and sand. Sandblasting worked best, but it was not suitable for general decontamination of the more than 60 contaminated vessels of the target fleet (Reference C.9.185, pp. 6 and 7).

Observation had revealed that most radioactivity stemmed from radioactive material collecting on painted or rusty surfaces, or on exposed organic materials, such as canvas, life rafts, manila lines, swabs, brooms, wood decks.
Figure 34. USS Achomawi (ATF-148) spraying USS New York (BB-34) with saltwater after BAKER, CROSSROADS.

Figure 35. USS Hughes (DD-410) beached off Eneu Island, covered with foamite following BAKER, CROSSROADS (two Salvage Unit ships are to the right).
and tar and caulk used to plug seams. On 28 and 29 July, the DSM conducted a small-scale laboratory study on painted wood, steel, and canvas using soap powder, and naphtha; acetic, hydrochloric, and sulfuric acids; and flour, starch, activated charcoal, and sandblasting. Removal of the outer layer of paint or removal of the rust proved to be an effective, if laborious, approach. Apparently only acetic acid worked on canvas (Reference C.9.185; Reference A.2. p. 109).

From 28 through 30 July, large-scale experiments were conducted on the target submarine USS Tuna (SS-203). The submarine was sprayed first with diesel oil, which proved ineffective as a detergent. However, a 66 percent reduction in radiation level was observed after much of the submarine's paint was removed by applications of a lye and boiler compound solution followed by a saltwater rinse (Reference C.9.185, p. 8). This encouraged the DSM to issue general instructions on 31 July for preliminary decontamination of target vessels, followed on 4 August with more detailed instructions. The procedure called for the fireboats to spray each contaminated target ship with saltwater and with the lye and boiler compound solution if needed. Once the radiation level was reduced to the point where personnel could remain for at least 2 hours, the ship's crew was to work in relays thoroughly scrubbing the ship. Figures 36 and 37 show ships' forces scrubbing an unidentified submarine and a ship. Clearly, the DSM expected that this procedure would lead to radiation levels low enough to allow continuous habitation of the ships so that they could return to home ports under their own power (Reference C.9.187, pp. 4, 7, and 10).

Figure 36. Work crews scrubbing down an unidentified target submarine. CROSSROADS.
Figure 31. Work crews use a fire hose on the superstructure of an unidentified target ship, CROSSROADS.

Radiological Safety Considerations During Decontamination

Radiation precautions, also promulgated as part of the decontamination procedures, included these instructions (Reference C.9.187, pp. 5 through 7):

1. Monitors were to be present at all times while the work was in progress.
2. Personnel were not to overstay the time limit set by monitors.
3. All personnel were to be fully clothed, and to shower and change clothes after finishing decontamination work.
4. All clothing worn during decontamination work was to be laundered before rewearning.
5. Personnel were to remain upwind of spraying and washing operations.
6. K-rations and water in canteens for decontamination crews were to be brought aboard daily.

7. "Radiological dangers" were to be clearly marked and, if necessary, roped off.

The Chief of the Radsafe Section (who was also entitled Radsafe Advisor) in a memorandum to Commander Joint Task Force 1 (CJTF 1), however, warned on 3 August of various problems and hazards. He wrote that high residual radiation on and in most target ships presented "an extremely difficult and dangerous problem," about which basic decisions had to be made soon. Early radiation surveys and decontamination experiments had led him to the following conclusions (Reference C.0.20):

1. The contaminated decks and superstructures of the target fleet totaled about 100 acres (40.5 ha).

2. In most cases, dangerous contamination remained even after strenuous decontamination efforts.

3. Some ships were badly contaminated below decks, and the task force had no way to deal with it.

4. No practical method had been found to decontaminate wooden or rusty surfaces short of removing the contaminated outer layer of the material.

5. Most decontamination methods possible, other than water washing, were themselves potentially hazardous.

6. The need for thoroughly washing the bodies and the clothes of boarding party members was putting a severe strain on the freshwater supply.

Moreover, the memorandum observed that even after repeated washings decks and superstructures of important target ships remained contaminated to levels between 1 and 10 R/24 hours. Average and maximum readings for CROSSROADS target vessels are given in Appendix F. These levels were high enough to severely restrict the amount of time men could work on ships without risking overexposure. Furthermore, months would pass before natural decay would lower intensities to the point where crews could occupy and operate the ships. Overexposures had been a problem in the work so far and probably would continue to be. The Chief of the Radsafe Section was concerned that even if exposures could be kept at or below 0.1 R/24 hours, over the long term they might cause sterility, anemia, and genetic damage, the latter of particular concern because the majority of the men were young. Finally, the departure on 15 August of 350 monitors and other radsafe personnel would leave about 24 military and a few civilian personnel to protect the many working on the over 70 target ships.

Consequently, to reduce the potential for radiological risk, the Chief of the Radsafe Section recommended that (Reference C.0.20):

1. The time until 14 August be spent working on relatively uncontaminated vessels and those of greatest value to the task force.
2. Other target vessels, such as USS Independence (CVL-22) and USS Pensacola (CA-24), be declared hopelessly contaminated and beached to let their radioactivity decrease by natural decay.

3. Scientific equipment be retrieved where it was safe to do so.

Decontamination Operations

Decontamination operations encountered the same basic obstacle that had been encountered during the program to develop decontamination methods. The radioactive particles were firmly attached. Initial efforts produced significant results by removing lightly attached radioactive particles, but more deeply embedded radioactivity could be reduced only slowly by additional hosing and scrubbing. The exact number of men involved in the decontamination effort cannot now be determined, but 41 percent of the task force personnel was assigned to units involved in decontamination, inspection, towing, or salvaging. Many of these personnel, because of their skills or occupations however, were not directly involved in that work. The brunt of the reboarding and decontamination effort was borne by the 8,463 target ship crewmembers, although it appears that only a portion of them actually worked on contaminated ships. See Chapter 12 for a discussion of personnel exposures.

On 7 August, in another memorandum to CJTF 1, the Chief of the Radsafe Section argued that under the conditions at Bikini it was not possible to decontaminate the target vessels without exposing personnel to a serious radiation hazard. Safety measures on target vessels were deteriorating, and adequate monitoring personnel and instruments were no longer available. Contamination was erratically distributed so that an individual's exposure could not be estimated. The potential of inhalation of contamination was a major concern. Furthermore, the untrained men doing the decontamination work could not be expected to follow safety precautions consistently (Reference C.0.14).

On 8 August, CJTF 1 asked the Chief of Naval Operations (CNO) to allow him to decommission, or place out of service at Bikini, 39 target vessels because with the resources at hand (Reference C.10.11):

They cannot all be made absolutely safe to board in the near future for sufficiently long periods to either prepare them for movement to Pearl Harbor or to assess fully in all cases the damage sustained.

During this period, problems developed in strict enforcement of radsafe regulations. Inadequate supervision of men doing decontamination work on Prinz Eugen and New York was reported (References C.0.11, C.2.2, and C.2.3). Monitors visiting Prinz Eugen noted an apparent indifference among the ship's officers to the 0.1 R/24 hours standard, and the monitors suspected some men had been on the ship overnight (Reference C.2.2). As a result there was concern that unbadged working parties aboard the target ships might have overexposures similar to those recorded by their monitors (Reference C.0.8). No substantiation of these serious allegations about activities on Prinz Eugen can be found in the ship's deck log or that of USS Rockingham (APA-229) where its evacuated
crew was berthed. The decontamination report (Reference C.2.54) written by Prinz Eugen's commanding officer on 13 August appears to indicate a definite concern for radSAFE matters.

The officer in charge of target ship monitors complained that work on the target ships had increased to the point where his men could not adequately protect the decontamination crews. As an example, he described the situation on USS Salt Lake City (CA-25), where from 3 to 7 August four of six monitors received exposures in excess of 0.1 R/24 hours, along with twenty other personnel of the ship's working teams (Reference C.0.11). On 10 August, the Medico-Legal Board recommended that work cease on Salt Lake City until 20 September, and the board's chairman in a minority report called for the ratio of monitors to decontamination personnel be increased from one to sixteen to one to ten and for all personnel working on target ships to be badged (References C.0.8 and C.0.21).

Discovery of Plutonium Contamination

Into this situation a new element was introduced (Reference C.9.185, p. 13):

On 9 August, The Director of Ship Material requested the Radiological Safety Officer and the Commander Target Group to visit ships on which ship's forces were employing the detailed decontamination procedures. During that inspection, samples of materials were obtained from areas of the wardroom of PRINZ EUGEN for which geiger counter readings showed radiation intensities sufficiently low to permit extended personnel exposure [8 hours] without danger of injury. An analysis of the samples revealed the presence of alpha emitters which were not detectable with monitoring instruments in use at Bikini. Further investigation showed probable widespread presence of the alpha emitter [plutonium] in the target area even in spaces not obviously contaminated.

It is unfortunate that this discovery, which so markedly affected subsequent CROSSROADS operations, is so poorly reported in the surviving documents. The only direct reference is the quotation above from the DSM report. It is not mentioned in the portion of the Technical Director's Report devoted to nuclear radiation (Reference C.9.209, Enclosure J), and although allusions to the existence of plutonium contamination and reports of laboratory determinations of the presence of plutonium can be found in the voluminous collection of papers of the Radsafe Section Chief, these do not appear to directly relate to Prinz Eugen.

The Chief of the Radsafe Section and his staff probably did not directly detect alpha emitters on Prinz Eugen. Instead, indirect evidence convinced them the hazard existed.

The difficulty of directly measuring alpha emissions with the field instruments of 1946 has been discussed earlier. The Radsafe Chief in a speech in 1947 said that beta activity was measured and then a ratio used to calculate alpha activity (Reference C.12.4, p. 23). Direct determination of alpha
contamination were made by removing samples to laboratories where analyses could be made. Field assessments were made by assuming that the alpha emitter plutonium was mixed with the other weapon debris, made up of fission products and activated materials. The ratio of this mixture was apparently assumed to be constant so that there was a ratio between the measurable radiations, gamma and beta, emitted by the fission products and activated materials and the unmeasurable alphas from the unfissioned plutonium. Since the emissions from the beta and gamma emitters decayed while the alpha emissions remained nearly constant, this ratio changed with the passage of time -- but in a way that was predictable.

The laboratory on Kwajalein operated by Los Alamos informed the Radsafe Advisor that on BAKER day + 13 (7 August) 4.5 alpha counts {per minute} per square centimeter of contaminated area could be expected when a survey meter gave a reading of 1 R/24 hours (presumably gamma) (Reference C.10.16). This theoretical determination was made in conjunction with samples that had been taken on 7 August from the forward lookout platform of New York. These samples had been collected by using concentrated hydrochloric acid to dissolve the paint and surface material, which were then collected for analysis. The result was forwarded by teletype to the Chief of the Radsafe Section on 10 August and stated that the reading in the collected material was 25 alpha counts {per minute} per square centimeter [of the contaminated platform] for a [gamma] reading of 3 R/24 hours. The laboratory said that this count was twice as high as expected due to "washing." By this it is presumed the laboratory meant that the fission and activation products had been more easily washed away during decontamination activities before 7 August than had the plutonium particles. It should be noted that this analysis took three days from sample collection to report.

The account from the DSM report continues (Reference C.9.185, p. 13):

A conference was called by the Task Force Commander on 10 August to discuss the matter [Prinz Eugen contamination]. As a result of this conference, continuation of detailed decontamination was considered unsafe under the existing conditions, and all further decontamination work on the targets by ship's force was ordered discontinued. Subsequently, all further work on these vessels by Task Force Personnel was limited to recovery of instruments, limited surveys, salvage work and preparations for towing from the area.

Judging from the time required to analyze and report the New York samples, it does not appear that the samples from Prinz Eugen taken on 9 August could have been analyzed by the next day.

There is a further difficulty with this sole surviving account of the discovery. It appears in the last sentence of the first quotation wherein "widespread presence . . . in spaces not obviously contaminated" is deemed "probable." If "not obviously contaminated" means not easily measured with existing field survey meters, then the statement is not confirmed by surviving records of the measurements that were taken of alpha contamination. Reports available after 4 September on alpha contamination in samples taken from the target vessels and sent back to Los Alamos for analysis show that alpha emissions were always reported in conjunction with gamma and beta emissions.
It seems more reasonable to assume that the phrase "not obviously contaminated" refers to more obvious criteria such as visible deposit of coral sand or presence of blast damage. What had actually been discovered was radioactivity in places that, because they were below decks or closed, were not expected to be contaminated. This probably was announced in an undated memorandum from the "Pill Counting Lab" (presumably the laboratory on USS Haven [AH-12] set up to analyze Program VII activation samples) to the Radsafe Advisor. The subject was "Dust Samples Taken in Crew Spaces on Prinz Eugen 9 August 1946." The memo states that B counts (the typewriter perhaps lacked Greek characters and this refers to beta counts) on four dust samples taken from certain given crew spaces were made and the results were from 0.00005 to 0.68 mc (perhaps micro-curies) per gram of dust. This memo further states that the background radiation measured in these spaces by an X-263 meter was 0.10 R/24 hours (Reference C.11.31).

This discovery, along with the assumption of the presence of plutonium wherever there was any radioactive material, led to the inference that plutonium had been discovered. This assumption was perhaps reinforced by the New York data that showed that plutonium was actually present in paint on the lookout platform. That information became available the same day as the CJTF 1 conference.

This interpretation of the events is strengthened by a telegram sent by the Radsafe Section Chief to the United States on 13 August and probably intended for the Oak Ridge Laboratory of the Manhattan Engineer District (Reference C.11.29).

UPON USING RATIONAL [sic] ALPHA BETAS FURNISHED BY YOU FIND INNER COMPARTMENTS ALL TARGET SHIPS HIGHLY CONTAMINATED BY ALPHAS.

The reference to the ratio provided may refer to the results of analysis of ABLE or BAKER cloud samples done at Oak Ridge and made available at some time before 9 August.

In the light of what the surviving records show to be the actual knowledge of the degree of plutonium contamination, the decision to halt all further decontamination work appears to have been prudent and conservative. As the Medico-Legal Board recorded at their 13 August meeting at 1300 (Reference C.0.9.a):

For safe guidance of the Operations from this time onwards,
we need to know:

a. The number of alpha particles per second per square centimeter
b. The alpha tolerance for different types of surfaces.

Furthermore, special clothing and intensive training would have been required if major work on the target ships was to continue. According to a senior radsafe official (Reference C.11.4, p. 2):
In the laboratory, radioactive material was handled by remote controls. At Bikini, it was scattered over the decks of the ships. Men walked through it, tracked it around, and got it on their clothing and hands and faces. There was some tendency on the part of the men to disregard a danger which they could not see, nor touch, nor smell. It was known that the men could not taste the radioactive material. But they could eat it! The situation was fraught with grave danger if the enlisted men could not be trusted to do exactly as he was told. It became apparent that it would be necessary to subject these men to long periods of training before they could be expected to abide by the precautions which are commonplace in a nuclear laboratory.

On 4 September, Los Alamos reported by message an analysis of samples taken from target ships that showed measured levels of alpha contamination. The maximum alpha reading came from USS Skate (SS-305) periscope mast sample, reportedly taken on 19 July. This pre-BAKER test date conflicts with the DSM final report of late 1946, which states that no extensive deposits of alpha emitters were found following Test ABLE (Reference C.9.185, p. 3). This fact, plus additional circumstantial evidence, suggests that the date was a typographical error, and should have read 19 August (Reference C.13.12). The periscope mast sample read 1,830 alpha disintegrations (assumed to be disintegrations per minute per gram [dpm/gm]) and 9,100,000 beta disintegrations for a beta-to-alpha ratio of 5,000 to 1. Other Skate readings were:

- **Bow** -- 28 alpha dpm/gm, 93,400 beta dpm/gm, ratio 3,500
- **Frame 120** -- 0 alpha dpm/gm, beta 9,160 dpm/gm
- **Base of 5-inch gun** -- 50 alpha dpm/gm, 115,000 beta dpm/gm, ratio 2,300.

Four samples from USS Wainwright (DD-419) collected on 18 August show alpha counts of 263 (beta-to-alpha ratio 3,500), 12 (ratio 2,500), and two zero alpha counts, but both of the latter with beta.

Three samples of unknown collection date, two from USS Searaven (SS-196) and one from USS Parche (SS-384), show alpha counts of 38 (beta-to-alpha ratio 1,400), 28 (beta-to-alpha ratio 66,000), and 23 (beta-to-alpha ratio 5,600) (Reference C.11.2).

A later analysis of 31 samples from 23 target ships all indicated the presence of alpha radiation. All but six of the samples had less than 10 dpm/cm². Nine of the samples were 1 dpm/cm² or less. The highest reading was a sample from USS LST-52, at 183 dpm/cm² and a beta-to-alpha ratio of 677. After Test BAKER, it was calculated that LST-52 received one of the highest radiation exposures from deposition of material in the rainout and base surge (Reference C.11.28).
There were also some later determinations at the San Francisco Naval Shipyard of alpha contamination of support ships. These are discussed later in this chapter.

Cessation of Bikini Decontamination Efforts

As a result of the 10 August conference, decontamination efforts stopped but apparently someone proposed at a 12 August conference that the capital ships be entered for the purpose of starting their engines and machinery to pump them out and thoroughly inspecting their internal structures. The reply was a staff CJTF 1 memorandum to Commander Task Group (CTG 1.2), dated 13 August and signed by the Chief of the Radsafe Section. The tone of this document can only described as stern and didactic. It dismisses the argument that the low gamma readings would permit such operations with a terse, "This is not the case," and continues, "The widespread presence of an alpha emitter has been demonstrated." The memorandum then catalogs the sources of possible exposure of personnel on the target ships, introducing the list with the statement, "The following facts have been observed in these vessels." It concludes with several "uncontrollable conclusions." These conclusions amounted to a denial of the request to enter the ships on a large scale (Reference C.11.30).

It was directed that no one go aboard ships after 14 August without a badge. However, while the percentage of badging does increase after 14 August, 100 percent badging was not achieved. Only recovery of instruments, limited surveys, salvage work, and preparations for towing were allowed (Reference C.9.185, p. 13; Reference C.11.3). Virtually no target ships were boarded on 11 August, and only a few on 12 August. Beginning on 13 August some limited decontamination was done as part of the effort to ready the ships for towing. Inspections of target ships were conducted between 13 and 19 August.

CTG 1.2, however, requested that restoration work on USS Carteret (APA-70), USS Conyngham (DD-371) and Wainwright be continued. All surfaces of spaces to be occupied by personnel for working, berthing, or messing were to be painted, presumably to prevent alpha emitters from becoming airborne or being picked up on the men's clothing or skin (Reference C.10.2). In the end, however, only Conyngham was decontaminated sufficiently to be remanned. On 28 August, it departed Kwajalein for Pearl Harbor under its own power, arriving there on 6 September (Reference C.0.3, p. 3; Reference C.9.206, p. V-(D)-6). On advice from the Radsafe Section, all work on Carteret and Wainwright ceased on 18 August. The crews of both ships were transported home on 20 August because of possible overexposure to radiation (Reference C.0.3, p. 3).

Although radiation levels in the lagoon and on the atoll's islands were below tolerance levels, the accumulation of radioactivity in the support ships' evaporators and saltwater piping and in the marine growth and rust on their hulls below the waterline presented an increasing problem. The base of operation had to be moved from Bikini, and Kwajalein was selected (Reference C.10.4).

Contamination made it difficult to prepare most target ships for movement to Pearl Harbor or to systematically study the damage they had sustained. A series of decisions resulted in towing target ships to Kwajalein beginning 19
August. By 5 September the last of the target ships afloat had left Bikini (Reference C.10.11; Reference C.0.3, p. 1; Reference C.0.4, p. 1). By 26 September 1946, Bikini Atoll was completely evacuated. 

All survey and construction activities at Bikini were rapidly brought to a close, and the atoll was completely evacuated. For safety and security reasons, a recommendation was made to CNO to declare Bikini Lagoon a defensive sea area. CNO ordered continued surveillance of this area to restrict entry of foreign, merchant, or private shipping that had not been duly authorized. This restriction was promulgated through a Notice to Mariners declaring the area bounded by latitudes 11°28'N and 11°43'N and longitudes 165°10'W and 165°35'W dangerous to shipping and personnel, and restricting entry except to those duly authorized by proper authority. (Reference C.0.31, p. 6).

TARGET VESSEL OPERATIONS AT KWAJALEIN

All target vessels at Bikini had some ammunition on board to serve as test material. Some ships had a great deal, placed there to determine the effects of the atomic bomb on warships having different loading conditions. For example, USS Nevada (BB-36) had more than 1,100 tons of ammunition. Most of the ammunition was service type and highly stable, but some experimental ammunition and some obtained from foreign navies was included. Some service ammunition had been flooded. There was a presumption that ammunition on certain ships was, or would soon become, unstable from the heat and pose a considerable and growing hazard. Its removal would be necessary, and the longer such operations were deferred the more dangerous the work would become. After careful consideration, it was decided that the total hazard would be less if the work were accomplished in 1946 than if it were deferred to a later year when the radioactivity would be reduced but the explosive hazard increased (Reference C.11.4). Because the ships were contaminated, work parties had to wear special clothes and were accompanied by radsafe monitors when aboard them. When working below deck, the men were required to wear rescue breathing apparatus.

For work on the target vessels, the Kwajalein Maintenance Force, Task Unit (TU) 1.2.12 was formed on 28 August 1946 (Reference C.11.5). The flagship was Haven, on which the radsafe unit had its headquarters and laboratories. Geneva was the hotel ship and APL-27 was the change ship, where working party members donned their protective clothing before going aboard target vessels and where they removed that clothing and showered after their work was done. In addition, the unit consisted of USS Conserver (ARS-39), USS Current (ARS-22), LCI-329, LCI(L)-549, LCI(L)-615, YF-753, and assorted small craft for towing, ammunition disposal, and personnel transportation (Reference C.0.22, pp. 4 and 5). At its peak, the total manpower of the unit was approximately 1,500 officers and enlisted men. Haven departed Kwajalein on 10 October, Geneva on 13 October, and Current departed on 2 December; Conserver remained until February 1947.

On 29 August, CTG 1.2 (Target Vessel Group) directed the removal of the approximately 2,700 tons of unstable ammunition from target ships by personnel of the Ammunition Disposal Unit of JTF 1 (Reference C.11.6). Actual unloading commenced on 4 September. The unit consisted of about 10 officers and 275 enlisted personnel (Reference C.10.18). Its personnel were divided into six working teams (one initial boarding team and five ammunition disposal teams).
each consisting of one or two officers and about 40 enlisted personnel. The
duties of the initial boarding team were to board, make initial inspection for
flooding and other hazardous conditions, obtain current radiological data with
the assistance of radsafe monitors, and obtain information pertinent to ammu-
nition inspection and removal as required. When conditions were satisfactory
for working on a vessel, the initial boarding team proceeded with opening up,
ventilating as necessary, and rigging hoists and other equipment required to
proceed with ammunition removal. Then an assigned ammunition team or teams
would remove and transfer the ammunition to the lighter YF-753 for disposal at
sea or, in certain cases, would leave the ammunition topside and tow the vessel
itself to sea and dump the ammunition directly into the sea (Reference C.11.5,
p. 2).

Ammunition was removed from each target ship without using any of its own
facilities or equipment. Sufficient equipment was obtained to undertake five
ammunition-handling operations at one time, which might be on one to five
ships. The basic plan was to use pneumatic hoists to lift the ammunition top-
side on the ship. Portable lighting was used in the magazines and handling
rooms. Spaces containing concentrated ether fumes or other explosive gases
were ventilated before commencing ammunition removal. Flooded spaces were
pumped out sufficiently so that men wearing rubber boots could work in them.
Wood chutes were used to transfer the ammunition from the ships' topside to
YF-753. To minimize carrying the ammunition across the decks of the ship and
barge, roller sections were used where practicable.

Personnel were transported to and from work in LCMs. Five of these were
each equipped with a gasoline-engine-driven air compressor and generator. These
were connected, respectively, to the portable hoists and the portable lights.
A gasoline drum in each equipment boat held a reserve fuel supply.

Working party members entered the change ship, APL-27, from the clean side.
Each was issued freshly laundered fatigues, canvas or rubber gloves, rubber
boots or field boots with removable canvas covers, and a rescue breathing
apparatus, intended to prevent inhalation of radioactive particles. Members of
the working party then boarded an LCM from the contaminated side of the change
ship for their trip to the target vessel. Upon return to the change ship, each
man showered twice, was checked with a Geiger counter to make sure he had
removed all contamination, and then changed into his regular clothing. Used
canvas gloves and canvas boot covers were thrown overboard. Fatigues were laun-
dered for reuse. The rescue breathing apparatus was checked for contamination
and sterilized. Rubber boots and gloves probably were washed (Reference A.2,
pp. 143 and 144; Reference C.11.5, pp. 1 and 2).

Ammunition removal was exhausting and potentially dangerous work. Personnel
suffered considerably from being required to work fully clothed and wearing
the breathing apparatus in the hot, humid Kwajalein climate. Under these trying
conditions a man could work only about 30 minutes below decks without a topside
break for all. The breathing apparatus restricted their vision, and lighting
inside of the ships was poor. The belief, however, at the command level appar-
ently was that the rate of ammunition deterioration required immediate action
if an even greater overall hazard was to be avoided (Reference C.11.4, p. 3).
Pensacola posed the most urgent removal problem due to the deterioration of the gunpowder for the 8-inch guns in its forward magazines, with resultant concentration of ether-alcohol fumes believed to be within explosive limits (Reference C.O.22, p. 4). The same conditions, to a lesser degree, were felt possible in some of the other target vessels. CTG 1.2 issued supplementary orders to the officer in charge of the Ammunition Disposal Unit covering Pensacola. The progressive opening up of Pensacola preparatory to removal of ammunition was initiated following the procedures laid down by CTG 1.2 (Reference C.O.4, p. 4). In early September ammunition breakout was started on New York, Carteret, and Wainwright.

By mid-September, because of the acute shortage of radiological monitors questions were raised as to the advisability of continuing ammunition disposal at the rate of progress imposed earlier (Reference C.O.23, p. 4). At this time questions were also raised by CTG 1.2 regarding the dangers attendant to leaving large quantities of stable ammunition aboard ships exposed to tropical temperatures in unventilated and uncooled magazines without adequate inspection and surveillance. He cautioned that removal of such ammunition would multiply the difficulties of the ongoing task several times over and should not be considered lightly. Although he felt that the hazard of leaving the ammunition aboard was acceptable in view of the well-established stability of the smokeless powder under the expected range of temperature, he recommended that the advice and recommendations of the Navy Bureau of Ordnance be obtained before a decision was made (Reference C.O.23, p. 6).

The potential for plutonium contamination continued to be a concern, and rescue breathing apparatus was used to reduce the risk. One monitor was especially concerned because as time passed the detectable emissions, "our warning signals," were "dying away," leaving behind the difficult-to-detect alpha emitters (Reference A.2, p. 147). Urine testing continued, apparently on a relatively large scale. This testing failed to produce any positive findings of alpha exposure (Reference C.O.32, p. 4; Reference C.11.12).

On 14 September the concern about alpha emitters manifested itself from another quarter in instructions from the Commander in Chief, Pacific (CINCPAC), prohibiting all hoisting and underwater repairs on boats at Kwajalein. Apparently CTU 1.2.12 was able to get permission to follow instead the 9 September message from CJTF 1 to commanders of nontarget ships suspected of being contaminated, which allowed scraping of underwater portions of the hulls as long as the working area was kept wet (Reference C.9.185, p. 136). Because no copy of the directive could be found, boat repairs at Kwajalein were temporarily curtailed (Reference C.11.5, p. 2).

Despite the severe problems imposed by the shortage of monitors and handling equipment, the ammunition removal and disposal proceeded according to schedule without incident. During the week ending 13 October, radsafe operations were routine, but the instrument situation was becoming critical due to the lack of spare parts. Only ten X-263 Geiger counters were operable, and no spare parts for repairs were on hand. None had been received since 14 August, and it was estimated that within 3 weeks none of the instruments would be operating (Reference C.O.24, pp. 3 and 4). By the week of 19 October, ammunition safety tasks (i.e., removing and disposing of unstable ammunition and
obtaining surveillance powder samples from target ships) were completed. Approximately 1,036 tons of ammunition had been removed from about 35 ships in about 45 days with no serious injuries (Reference C.11.5, p. 1). In the process, 145 rescue breathing apparatus, 900 green fatigue shirts, 900 pairs of green fatigue trousers, 660 pairs of undershorts, 1,500 undershirts, 500 pairs of field shoes, 1,700 towels, 6,180 pairs of canvas work gloves, and 12,500 canvas shoe covers had been discarded. In addition, 150 rescue breathing apparatus were usable but contaminated, as were air compressors, generators, air hoists, and portable blowers used in the operation (Reference C.11.5, pp. 3-4). Exposures for the Ammunition Disposal Unit are discussed in Chapter 12.

In mid-October Commander Marianas requested Commander Service Force, Pacific (ComServPac), to transfer the Ammunition Disposal Unit intact to Guam to dispose of surplus ammunition. In view of the task they were just completing and the length of time they had been in the forward area, Commander Navy Task Group (CNTG) JTF 1 strongly advised against such a transfer and recommended that the entire unit be given leave before reassignment. ComServPac concurred (Reference C.0.24, p. 2).

Concurrent with the completion of this disposal, CNO ordered USS Gasconade (APA-85), USS Fallon (APA-81), USS Crittenden (APA-77), USS Brule (APA-66), Independence, and USS Mayrant (DD-402) towed to San Francisco and Hughes, Pensacola, Salt Lake City, New York, USS Rhind (DD-404), and Nevada towed to the Puget Sound area for examination. The towing was to be in the order listed, with one ship arriving in each area every 2 months. Only six of these twelve ships were ultimately towed to the United States. Brule, Fallon, Rhind, and Mayrant were eventually sunk in the vicinity of Kwajalein. New York and Nevada were towed to Pearl Harbor for inspection and were later sunk off Oahu.

In connection with this, CNO directed that CNTG insure, insofar as practical in the forward area, the removal of all ammunition, including projectiles, before the vessels' arrival at the mainland. This, of course, called for a radical change of plans for the Ammunition Disposal Unit at Kwajalein. The rollup orders already issued for its dissolution on 23 October were cancelled and action was initiated to transfer the entire unit to Atoll Command Kwajalein (AtComKwaj) on 23 October at the same time that the target ship maintenance unit was transferred.

When the rollup plans were cancelled, the officer in charge of the disposal unit flew to Pearl Harbor to confer with CNTG. As a result of this conference, it was decided that removal of powder and small-caliber projectiles before the vessels' departure from Kwajalein would be practical and could be done well within the time limits imposed by the towing schedule. Removal of the large-caliber projectiles however, especially the 14-inch projectiles in New York and Nevada and the 8-inch projectiles in Pensacola, would present a very difficult, if not impossible, problem in view of the limited facilities at Kwajalein, but the task was initiated (Reference C.0.25, p. 1). All unstable ammunition and all pyrotechnics, catapult charges, igniters, detonators, boosters, torpedo expelling charges, and bulk black powder were removed from all target vessels at Kwajalein.

The status of ammunition in the eight target ships that were finally towed from Kwajalein was (Reference C.0.25, p. 12):
USS Crittenden (APA-77) No ammunition aboard
USS Gasconade (APA-85) No ammunition aboard
USS Hughes (DD-410) No ammunition aboard
USS Independence (CVL-22) No ammunition except two-thirds of the unfuzed normal bomb allowance remained aboard
USS Nevada (BB-33) Two-thirds of the normal allowance remained aboard
USS New York (BB-36) Ten percent of the 14-inch projectiles and eight percent of the remaining normal allowance remained aboard
USS Pensacola (CA-24) No ammunition except two-thirds of the 8-inch projectile allowance and two-thirds of the unfuzed bomb allowance remained aboard
USS Salt Lake City (CA-25) Ten percent of the normal allowance remained aboard.

When the initial phase of the ammunition disposal was completed, the last of the experienced radiological monitors departed Kwajalein. When work was resumed to unload the target ships due for transfer to the continental United States, the only available monitors were still receiving additional training at Kwajalein after intensive instruction in Washington, D.C. In addition, serious morale problems were developing in the Ammunition Disposal Unit due to doubts and unanswered fears about the effects of radiation and fatigue due to the long, uninterrupted arduous and hazardous duty.

The officer-in-charge dispatched a letter dated 11 November 1946 to the Chief, Navy Bureau of Medicine and Surgery (BuMed) (Reference C.11.7) detailing the concerns of personnel in his unit regarding radiation hazards. He described the problems in the use of the rescue breathing apparatus and the added hazards in handling heavy ammunition when wearing the apparatus in confined dangerous spaces. He recommended better indoctrination and training for those working under similar conditions, suitable limitation on the length of continuous duty, and -- if it was determined that a protective mask was required -- discontinuance of all unloading until a suitable mask could be developed.

On 29 November the officer-in-charge was advised by the Safety Advisor to JTF 1 (Reference C.11.8) that the answers to some of the questions asked by the men were classified and, in any event, the officer in charge of the Ammunition Disposal Unit should discuss these questions with the Radsafe Advisor and then disseminate the proper information to his personnel. He was further informed that the rescue breathing apparatus was considered necessary by senior radsafe experts and would continue to be worn and that if all safety regulations were complied with no hazard to health was involved in the work. Hence, BuMed did not feel it was necessary to limit the time spent in this type of work (Reference C.11.8).
Clearly, operations at Kwajalein were intense during the early months of the target fleet’s presence. The order from CNO to remove additional ammunition prevented the dissolution of the Ammunition Disposal Unit and forced work to continue, apparently with the same personnel (Reference C.0.26). From 1 September 1946 to 31 December 1946, 5,734 badges were issued to personnel of this unit. The period of heaviest issue was September and October; thereafter, very few badges were issued (Reference C.13.4).

The deck logs of Conserver and Current indicate that these ships were extremely busy during this period in mooring, diving, towing, and housekeeping operations on the target fleet at Kwajalein. Between 31 August and 30 November 1946, 14,532 personnel decontaminations (similar to those described in Chapter 2) were carried out aboard the change ship APL-27, an average of 158 each day (Reference C.13.7).

In October the preliminary examination and securing of target ships at Kwajalein was completed. On 1 October, CNO directed that upon dissolving JTF 1, these ships and their caretaking unit be turned over to CINCPAC.

TARGET SHIP ACTIVITIES AFTER JOINT TASK FORCE 1 DISSOLUTION

In accordance with directives of the Joint Chiefs of Staff (JCS), steps were carried out rapidly to complete the work of the task force and to turn over operational control of all units to appropriate commands. As of 24 October no ships or units remained under the operational control of the CJTF 1, and only staff activities were left. The task force was formally dissolved on 1 November 1946 (Reference C.9.206, pp. V-(D)-5 and V-(D)-6).

In all, 63 target ships (12 were remanned after CROSSROADS) passed through Kwajalein. Of these, 41 remained at Kwajalein until sunk. These ships were radiologically contaminated and could not be disposed of until cleared by CNO and Radiological Section BuShips.

On 31 January 1947, Chief BuMed issued additional safety regulations for work on the target ships. The potential internal radiation hazard was emphasized. The exposure of persons boarding ships was to be kept to a minimum, and their exposure was to be appropriately interrupted to reduce the chance of injurious effects. All persons who were to board target ships and who might encounter radiation were to have a preduty physical examination. All personnel connected with work on target ships were to have monthly physical examinations with special attention to their hands. Each individual was to have a weekly urinalysis, including a gross beta count.

Various measures were to be taken to protect the men while at work. A change house was to be provided where the men would dress in hard hats, coveralls fastened at the neck, canvas or rubber gloves, canvas booties over their boots or work shoes, appropriate breathing apparatus, and goggles. Each man was to have a film badge pinned on the left breast of his coveralls. The tolerance limit was 0.1 R per 8-hour day. A work party could not board target vessels without the permission of the radsafe unit and each party had to be accompanied by a monitor. While aboard a target vessel, the men were not to
eat, drink, smoke, or to chew gum or tobacco. They were to avoid pools of water, dust clouds, and piles of rust, paint chips, or the like since each might be a radiation source. When below decks, the men were to wear the rescue breathing apparatus at all times. Upon returning to the change house they were to turn in their film badges, disrobe, and wash thoroughly. The regulations appear to have broken little new ground but instead codified existing CROSSROADS practice (Reference C.11.9, pp. 1 through 8).

On 3 March 1947, Navy Bureau of Personnel reduced the Kwajalein ships' security detail to 5 officers and 127 enlisted men. Both CINCPAC and AtComKwaj considered this to be a minimum number. However, on 31 March there were only 27 men in the unit. The attempt by Kwajalein personnel to keep up with the towing schedule in spite of the manpower shortage operated to contravene the requirement for radiological safety (Reference C.11.10, p. 2).

In a letter to AtComKwaj dated 9 April 1947, the senior monitor assigned to the radsafe section at Kwajalein on 23 January described violations of radsafe procedures he had seen or had good reason to suspect during his time there. Upon arrival he had been given some instructions about radsafe procedures to be followed in working on the target ships, but he had been shown no written regulations. In his work, this Navy ensign observed men smoking and lounging about the decks of target ships and boarding parties going aboard Pensacola without first passing through the change ship. He believed that personnel sometimes ate aboard the target vessels and that work parties unaccompanied by a monitor sometimes boarded them. He believed looting was common. The monitor was also very concerned that men were not wearing rescue breathing apparatus while on the decks of the target vessels, but the BuMed regulations of 31 January did not make it mandatory in all circumstances (Reference C.0.27, pp. 7 and 8).

When the ensign reported his observations and suspicions to the Medical Radsafe Officer at Kwajalein, the doctor showed him a list of safety precautions for boarding target vessels sent by BuMed. From the monitor’s letter it cannot be determined, however, whether these were the regulations of 31 January as amended or some other document. The doctor apparently had not been aware of the violations of BuMed’s rules. On 13 March the monitor showed the safety precautions to the officer in charge of the change ship. Together they checked fatigues and found "numerous" high readings. The monitor’s letter gives the impression that the officer in charge of the change ship had not previously seen the list of safety precautions.

The senior monitor also showed the precautions to the captain of the salvage vessel from which work parties had boarded Pensacola without passing first through the change ship. The captain visited the radsafe officer to discuss the precautions. The monitor’s revelations led to a meeting on 20 March attended by the Medical Radsafe Officer, the captains of Conserver and Current, AtComKwaj, the monitors, and another official. Greater efforts to follow BuMed’s guidelines apparently followed. The monitor also had been concerned about the unreliability of the radiation detection instruments, but the meeting did not produce actions that relieved his apprehension. He wrote that "our instruments are still very unreliable and I felt unsafe in boarding without proper equipment. I told [the radsafe officer] that I thought operations should cease.
because we knew so little about the dangers we were dealing with" (Reference C.0.78).

The complaints of the senior monitor to AtComKwaj were passed to higher authorities. CINCPAC, in a letter endorsement to Chief BuMed, stated that AtComKwaj had been instructed on 10 April to fully comply with existing safety regulations at the cost of curtailing security measures and, if necessary, falling behind in towing schedules. He noted that a serious health hazard existed if safety regulations were not strictly maintained (Reference C.11.22).

The problem was essentially one of manpower, as less than 200 personnel were assigned to the ship's security detail. This was too few personnel to maintain the desired schedule of preparing ships for tow back to Navy shipyards. This fact and its consequences were acknowledged in a letter from CNO to Chief of Naval Personnel dated 15 July 1947. The letter observed that in many instances certain recognized safety precautions were violated, attributable to the towing schedule, inadequate indoctrination of men, and insufficient supervisory personnel. It stated, however, that in the opinion of responsible persons experienced in the subject that, in fact, no individual actually was subjected to danger. In order to substantiate that opinion, the letter stated that a broad survey of all persons involved had been instituted (Reference C.0.33).

The results of this broad survey have not been located. The survey may refer to the blood tests administered to all Navy CROSSROADS participants (Reference C.11.23). There is evidence that action at Kwajalein in this regard was underway at least by April 1947. A 17 May message from AtComKwaj to BuMed advised that blood tests given at Kwajalein established that exposed personnel were disqualified from additional work detail. He noted that the results had urgent medical implications and impacted on personnel rotation policies (Reference C.11.24).

A standard gamma source to calibrate instruments was provided by 5 June 1947, and the hope was voiced that a suitable alpha counter could be provided "eventually." Moreover, the bureaus concerned were going to supply "essential technical help," apparently meaning more personnel (Reference B.11.1). This last effort probably was related to the monitor shortage at Kwajalein. During April 1947, the radsafe unit was down to one monitor; hence only one working party at a time could enter radiologically suspect areas (Reference C.0.29).

Commencing in June 1947, Kwajalein and all shipyards where target ships were located began monthly reports of personnel film badge exposures. These monthly reports to BuMed continued until November 1948. Until at least July 1948, a ship's security detail existed at Kwajalein to care for the target ships. Protective clothing was apparently worn by U.S. shipyard personnel when working with the CROSSROADS target ships, judging from an inspection photo (Figure 38) of the engine room of Hughes at Puget Sound in April 1948.

CONTAMINATION OF SUPPORT SHIPS

The majority of the support ships did not reenter Bikini Lagoon until after 31 July when the lagoon water was below 0.1 R/24 hours. Within 3 days,
concentrations of radioactive contamination were observed in the marine growth and rust on their hull exteriors at the waterline. Even though the water in which the ships were anchored showed a radiation intensity of only about 0.01 R/24 hours, the radioactivity collected on the hulls to such an extent that several ships had interior readings in the vicinity of the waterline exceeding 0.1 R/24 hours (Reference C.9.185, p. 18).

Decontamination at Bikini

On 29 July, faced with increasing radioactivity in the water where the ships were anchored and hoping to deal with problems of contamination, the support ships and the target ships that had been cleared as radiologically safe were moved to a new anchorage in the southeast portion of the lagoon (Reference C.9.185, p. 19; Reference A.2, p. 101). All ships were ordered to list ship, that is, change ballast, causing them to list and expose portions of their hulls below the waterline for scraping (Reference C.9.185, p. 19). Rather than immerse themselves in the lagoon water, personnel were to use long-handled scrapers (Reference C.10.7). Because the ships' evaporators used to distill freshwater concentrated radiation from the lagoon water in the scale on the inner surfaces of their shells and tubing, radiation levels near some of them exceeded the 0.1 R/24 hours limit.
Orders were issued not to open evaporators without specific authorization of the radsafe section and then only with a monitor present (Reference C.10.3). Experiments showed that the evaporators would not pass radioactivity over into distilled water if they were operated at somewhat reduced rates. Orders to operate at reduced rates were issued, although sources available disagree on whether the approved rate was 75 or 80 percent (Reference C.9.185, p. 19; Reference C.10.6). To remove some of the contaminated scale, ships were to use the "cold-shock" treatment; that is, cold water was run through the hot evaporator tubes that had accumulated radioactive scale. The pipes' rapid contraction caused the scale to flake off and be flushed out (Reference C.10.5). To decrease the formation of new scale, ships were ordered to use a standard scale reduction technique of introducing a mixture of boiler compound and cornstarch continuously into the evaporators (Reference C.10.1). In an effort to reduce contamination on hulls and in evaporators, a number of support ships left the lagoon for one-day trips in the open ocean to flush the sides and interior systems with clear saltwater.

These measures reduced the radiation level inside most ships to 0.1 R/24 hours (gamma) or less. To keep radiation levels down, the ships, where possible, were kept in water indicating 0.001 R/24 hours (gamma) or less. Numerous exceptions to this were necessary, however, to carry out the duties of the task force. Ships used for salvage, radsafe, and survey work sometimes needed to enter waters with higher levels of radioactivity. One source indicated that in some cases a ship's crew was evacuated and the ship was allowed to stand idle, presumably in water with low radioactivity levels, until the readings inside fell below the 0.1 R/24 hours level (Reference C.9.185, p. 20). The source does not indicate the number of ships in this category.

Shift to Kwajalein

On 11 August, CJTF 1 asked the CNO for permission to shift the task force's base to Kwajalein, asserting that the tendency of ships to accumulate radioactivity, especially in their evaporators and in the marine growth on their hulls, mandated leaving Bikini. He emphasized that no hazard to Kwajalein would result and that preparations for CHARLIE (the anticipated third CROSSROADS shot) would not be compromised (Reference C.10.4).

On 19 August the task force was ordered to shift base to Kwajalein. Non-target ships that had reentered the lagoon were monitored before departure and given conditional operational clearances, subject to employing safety procedures to meet each ship's condition. Most were restricted on the amount of time personnel could spend in certain compartments and near certain pieces of equipment (Reference C.9.206, p. V-(D)-4; Reference C.9.185, p. 20).

Commander Joint Task Force 1 Letter of 19 August 1946

Although it was hoped that natural decay and steaming in the open ocean would minimize radioactive exposure of personnel, the Chief of Staff of JTF 1 sent a letter on 19 August to commanding officers of all ships that had been in the lagoon between 25 July and 10 August and hence were radiologically suspect. He wrote that before these ships could be considered completely clear, further monitoring would be needed, especially to ensure the safety of personnel.
scraping ships' bottoms or working on their evaporators. Arrangements were being made for radiological monitors to be available at naval shipyards and principal ports on the U.S. west coast and Pearl Harbor. Commanding officers of the ships involved were to request these monitors before having evaporators opened, having work done on other contaminated machinery, or entering drydock (Reference C.9.185, pp. 144 and 145).

After further study, the task force radsafe and safety advisors decided the precautions set forth in the letter of 19 August were inadequate to protect personnel from alpha emitters associated with the detected radiation. Moreover, considerable cleaning would be required to eliminate radioactivity, and the cleaning itself and the wastes created would pose yet another problem. After a conference with the safety advisors, the ComServPac on 29 August issued special precautions to be applied to all vessels that had spent more than 10 days in Bikini Lagoon after 25 July (Reference C.9.185, p. 21). In summary, the precautions were as follows:

1. Avoid drydocking until further notice
2. Avoid opening saltwater plumbing
3. Avoid exposing the external surface of the hull below the waterline
4. Avoid exposing personnel to fumes or dust from welding, cutting, or other work on contaminated saltwater surfaces.

He also recommended the ships be examined at San Francisco or Pearl Harbor to determine their exact radiological status and to indoctrinate crews in proper radsafe procedures (Reference C.10.5).

CJTF 1 concurred with ComServPac, but argued that ships in the western Pacific should return to Guam for radiological monitoring. He advised that CJTF 1 was organizing a monitoring group for use at San Francisco, Pearl Harbor, and other ports as required. He recommended that docking or yard work on the affected ships be avoided until they had been monitored and declared radiologically safe. Finally, he suggested that the precautions applied to the ships also be applied to the small boats they carried (Reference C.9.185, p. 22). On 28 August CNO directed compliance with these recommendations and two days later ordered all small boats found radiologically unsafe sunk in deep water (Reference C.9.185, pp. 22 and 23; Reference C.10.4, p. 1).

RADIOLOGICAL CLEARANCE OF NONTARGET SHIPS

CJTF 1 dispatched his Chief Medical Officer to head the program for giving radiological clearance to nontarget vessels. On 26 August the medical officer established his headquarters in the offices of the 12th District Medical Officer at San Francisco Naval Shipyard. He encountered immediate difficulties. Radsafe monitors were not available at San Francisco in numbers sufficient to check the many ships expected to arrive during the coming weeks. Monitors were drawn from the ranks of those who had served during CROSSROADS and from the radsafe organization at Kwajalein, but at some cost to operations there. The first graduates of the CJTF 1 radsafe school became available for duty by mid-October. Although some were assigned to Kwajalein, most were assigned to
shipyards or laboratories on the west coast or in Hawaii where they worked on problems presented by the contaminated nontarget vessels. Because no safe and effective methods had yet been developed for removing the known or suspected contamination on the nontarget ships, only a list of precautionary measures could be given to ships' captains. These measures were principally as follows (Reference C.9.185, p. 24):

1. Treat evaporators using starch and boiler compound, cold shocking, or, in the case of vapor compression stills, standard cleaning

2. Sink at sea all radiologically hazardous equipment made from wood and plant fibers, such as lines, fenders, nets, camels, and swabs

3. Prohibit burning, welding, chipping or wire-brushing of saltwater lines or exposed saltwater surfaces except under the supervision of a monitor. Scraping is permitted on surfaces provided they are kept wet at all times.

4. When dropping anchor avoid the dust raised from the outgoing chain. Keep the anchor wet. Use gloves when handling the anchor and chain, and discard the gloves after use

5. Sink small boats with readings greater than 0.1 R/24 hours

6. Scrub urinals and head troughs with abrasive cleaner or acid solution.

In an effort to determine accurately the contamination level on nontarget ships exposed at Bikini, Commander Western Sea Frontier (ComWestSeaFron) on 30 August ordered Commander 12th Naval District to drydock one of the destroyers from the joint task force at the San Francisco Naval Shipyard. USS Laffey (DD-724) was drydocked and inspected on 5 September under supervision of the JTF 1 Chief Medical Officer. The underwater portion of the hull and portions of the saltwater plumbing were monitored. Shipyard workers in protective clothing and breathing apparatus chipped off samples of rust, paint, and scale. Radiation levels detectable with hand-held instruments were found to be below the accepted tolerance level. Samples were also taken from USS Whiry-Z (AV-14), USS Henrico (APA-45), and USS Mount McKinley (AGC-7). The samples were sent to the University of California's Crocker Radiation Laboratory for further analysis, especially for the presence of alpha emitters. Encouraged by the low readings, the medical officer gave permission for overhaul work on USS Walke (DD-723), USS Barton (DD-722), USS Lowry (DD-770), and Laffey, except that work involving the exterior of the hull below the waterline or the saltwater plumbing had to await the arrival of sufficient monitors. A decontamination center was established for yard employees working on the ships (Reference C.9.185, pp. 28 and 32; Reference C.12.2, pp. 84 and 85).

In late August and early September, however, concern increased in command circles that unless a means could be found to service the underwater hulls and saltwater plumbing of the nontarget vessels, they would eventually be rendered useless.

On 9 September 1946, CJTF 1 sent a letter (Serial 079) to commanding officers of all nontarget ships suspected of being contaminated. His purpose was
to make them aware of the discussion in progress, to summarize safety precautions, and to give information on the clearance procedure under development (Reference C.9.185, pp. 125 and 145). His letter, however, did not (Reference C.9.185, pp. 25 and 26):

1. Establish adequate decontamination procedures or a plan for developing them
2. Establish the final tolerance level for alpha emitters, the alleged principal hazard
3. Assign responsibility for decontamination and final clearance.

During the next several months the Navy put considerable effort into filling these gaps.

ComWestSeaFron on 11 September recommended to CNO that highest priority be given to providing staff for the JTF 1 Medical Officer, that BuShips have the responsibility for developing decontamination methods, and that the DSM be dispatched to the west coast as BuShips' representative. On 13 September CNO advised that ComWestSeaFron and BuShips had been assigned the responsibility and that the DSM was on his way, to arrive on 17 September (Reference C.9.185, pp. 26 and 27).

Decontamination Experiments at San Francisco Naval Shipyard

Meanwhile, efforts to measure contamination continued. On 12, 13, and 19 September portions of Laffey's hull were sandblasted and particle samples collected in filter devices set up nearby. A section of contaminated saltwater pipe was burned through in a small, closed compartment and particulate samples collected in a filter device (Reference C.9.185, p. 29). The samples were taken to the University of California Crocker Radiation Laboratory for analysis.

Methods for cleaning contaminated saltwater lines were tested. On 13 and 17 September various acid solutions were pumped into sections of Laffey's saltwater plumbing and then the sections were flushed a number of times. The result was a considerable reduction in radiation levels. These experiments were judged completely successful. Also on 17 September preparations were made to test acid solutions on the saltwater plumbing of a second ship, Henrico (Reference C.9.185, pp. 30 and 32).

The DSM arrived on 17 September, and during the next few days, he conferred with officials supervising contamination measurement and decontamination experiments. He inspected the work being done on Laffey and USS Benevolence (AH-13) (Reference C.9.185, pp. 30 through 33).

On 20 September, laboratory assays of rust, evaporator and condenser scale, saltwater lines, algae from the hull, and other samples from Laffey, Kenneth Whiting, Henrico, and Mount McKinley were completed. They indicated that the amount of plutonium (an alpha emitter) associated with fission products (beta and gamma emitters) was quite constant. Thus -- the plutonium concentration -- could therefore be estimated from the fission product activity with a Geiger counter (Reference C.11.17).
Taking samples for laboratory analysis was unnecessary, since analysis of the filter samples taken while sandblasting portions of Laffey's hull showed no detectable plutonium. Using the ratio of plutonium to fission products to calculate the amount of plutonium present led to an estimate that a worker using a respirator would have to spend 100 million days of wet-sandblasting to inhale a dangerous amount of plutonium. From this came the conclusion that ships up to 100 times as contaminated as Laffey could be sandblasted without exposing shipyard personnel to a lung hazard. Filter samples collected during welding of contaminated saltwater lines also revealed no plutonium. Calculations using the plutonium-fission products ratio indicated an individual would need to work for 1,000 days to accumulate a dangerous amount of plutonium in his body (Reference C.9.185, pp. 32 and 33). The findings of the laboratory assays appeared to show that nontarget ships of JTF 1 could be decontaminated and overhauled without radiological hazard to personnel, but, as discussed below, that work did not go forward immediately because of fears among the experts that hard-to-detect dangers were still present (Reference C.9.185, pp. 32 and 33).

The Question of Clearance Standards

About 20 September, the DSM left San Francisco for Washington, D.C., to present the findings from the decontamination experiments to higher authority. In Washington he prepared a directive setting forth the decontamination procedures established up to that point. Issued on 24 September as a joint BuShips-BuMed speedletter, it included authority and direction for decontamination of evaporators, heat-transfer apparatus (except condensers*), hulls beneath the waterline, and ships' boats of all contaminated ships scheduled to remain in the active fleet. Members of each ship's crew were to clean the evaporators and heat-transfer apparatus as soon as practical. Hulls were to be cleaned below the waterline using standard wet sandblasting methods at the time of a ship's next scheduled drydock period. Debris from cleaning evaporators and heat-transfer devices and sand from sandblasting were to be kept wet until dumped at sea. Monitors were desirable but not essential for this work. Saltwater lines could be cut and welded without hazard, but sections removed were to be dumped at sea. All zinc plates used to retard electrolytic action were to be removed from main and auxiliary condensers and discarded at sea. Different rules were being developed to cover ships scheduled for disposal or deactivation (Reference C.9.187, pp. 16 and 19).

The DSM's directive was greeted with great enthusiasm by all commands concerned. The message from CJTF 1 on 9 September had led to fears that a great and indeterminant hazard to personnel was present. Now the hazard had been found to be minimal if the indicated safety precautions were taken. The methods to remove contamination were not too complicated, and regular maintenance could proceed more or less on schedule. BuShips representatives taking part in the work at San Francisco visited the 11th, 13th, and 14th Naval Districts at San Diego, Seattle, and Pearl Harbor, respectively, to brief shipyard management.

*A condenser is a low-pressure heat-transfer device for changing steam to water in a propulsion or similar closed-cycle system. It should not be confused with the evaporators used to distill freshwater.
on the decontamination procedures (Reference C.9.185, p. 36). Meanwhile, a
vigorous program of decontamination experiments went on at the San Francisco
Naval Shipyard in an effort to develop better methods.

However, considerable uncertainty persisted about whether the 0.1 R/24
hours standard, as measured with a Geiger counter or similar device, could be
used for determining when a vessel required decontamination and when it could
be considered safe and given clearance. No reliable instrument was available
for determining the presence or absence of alpha contamination in the field.
Analyses of the samples taken from Laffey, Whiting, Henrico, and Mount McKinley
had provided an approximate ratio of plutonium to fission products, but no
radsafe expert of recognized reputation was ready to declare that a Geiger
reading of 0.1 R/24 hours or less assured protection from the total alpha haz-
ard, that is, from plutonium or any other alpha emitters (Reference C.9.185,
p. 41).

Consequently, BuShips called a conference in San Francisco on 1 October to
grapple with the problem. The decision was made to study contamination of USS
Rockbridge (APA-228). At that time it was considered the most heavily contami-
nated ship to arrive in the area, and it was of a size and type judged suitable
for a detailed study of wide implications. The hope was not only to improve
the accuracy of the plutonium ratio, but particularly to determine the total
amount of plutonium on the ship. The figure could then be used as the basis
for the needed standards. Numerous samples were taken from the ship and sent
to the University of California for analysis, but the University’s facilities
for radiochemical analysis were sufficiently limited that weeks passed before
the results were available (Reference C.9.185, pp. 41, 45 and 46).

While awaiting the results of the work on Rockbridge, BuShips in Washing-
ton, D.C., on 10 October proposed a set of contamination limits. After discus-
sions between naval and civilian radsafe experts on the west coast and BuShips
and BuMed in Washington, the final clearance standard for all ships was set at
0.001 R/24 hours (gamma) from shielded sources and 0.005 R/24 hours (combined
beta and gamma) from exposed surfaces, subject to change if required by new
information. These limits required decontamination of almost all nontarget
ships that spent more than one day in the Bikini Lagoon after BAKER (Reference
C.9.185, p. 49). Twelve ships were found to be within radiological limits.
These ships were associated with CROSSROADS, but either had never entered
Bikini after Baker or had been in the lagoon following BAKER for 1 to 3 days.
They were USS Charles P. Cecil (DD-835), USS Limestone (IX-158), USS LST-871,
USS LST-989, USS Alabemarle (AV-5), USS Panamint (AGC-13), USS Appalachian
(AGC-1), USS Blue Ridge (AGC-2), USS Furse (DD-882), USS Turner (DD-834), USS
Shangri-La (CV-38), and USS Bountiful (AH-9).

Decontamination work on a large scale apparently started after 14 October,
when BuShips authorized crews of all nontarget ships, including those sched-
uled for disposal and deactivation, immediately to go forward with acid
cleaning of evaporators and of firefighting, flushing, cooling, and drainage
systems. At least 55 nontarget ships that had arrived at one of the west coast
naval districts were involved. CINCPAC and ComWestSeaFron were to see that the
work was done. The final clearance limits recently agreed upon by BuShips and
other interested parties were used, however, only as a temporary standard for
"operational, conditional, or preliminary" clearance, pending the analysis and availability of Rockbridge data (Reference C.9.185, pp. 50 through 52).

Results of the assay of fission products and plutonium on Rockbridge were available on 25 October 1946 from the University of California. At the time of the collection of the samples, radsafe monitors reported the external hull readings were 0.009 to 0.010 R/24 hours (beta plus gamma). The total activity calculated to be present on Rockbridge was 376 millicuries of fission product activity and 2.020 milligrams of plutonium. This material was distributed inside 23,207 ft$^2$ (2.16 km$^2$) of saltwater piping, inside 12,780 ft$^2$ (1.18 km$^2$) of condenser and evaporator interiors, and the entire underwater hull. The hull contamination when removed was contained in the 125 tons of sand used to sandblast the external hull. Although about two tolerance doses of plutonium were detected, these and the fission products were spread over an extremely large area and in locations that greatly reduced the potential exposure to personnel (Reference C.11.18; Reference C.9.185, p. 56).

In addition to continuing uncertainty about final clearance standards, the decontamination regulations promulgated up to that time had two gaps: (1) how to determine contamination of a ship's hull without time-consuming and expensive drydocking, and (2) how to remove contamination from condensers. At that point BuMed appointed a special medical board to advise the Navy's Surgeon General, who was Chief of BuMed, on radiological matters presented to it for study. It was chaired by the Medical Officer dispatched to San Francisco in late August by CJTF 1 and included the Radsafe Advisor to CJTF 1 and radiation experts from the University of California (Reference C.9.185, p. 54).

The medical board held its first general meeting on 4 November to consider results of analysis of Rockbridge samples. After much discussion, the members of the board suggested a set of final clearance standards, but these were not acceptable either to BuMed or BuShips. BuShips sent a representative to the west coast, and after consultation with the BuShips representative and additional study, the board proposed a new set of final radiological clearance standards as follows (Reference C.9.185, p. 56):

1. Habitually closed saltwater systems were not to have exterior readings exceeding:
   a. 0.001 R/24 hours (gamma) for 94 percent of the system
   b. 0.005 R/24 hours (gamma) for 5 percent of the system
   c. 0.01 R/24 hours (gamma) for 1 percent of the system.

2. Open systems were not to exceed an average of 0.001 R/24 hours (gamma) and 0.005 R/24 hours (gamma plus beta)

3. Underwater portions of the hull exposed by listing and trimming were not to exceed an average of 0.02 R/24 hours (gamma plus beta) wet or dry.

BuShips accepted these standards for final clearance. For operational or preliminary clearance, the bureau took the standards the board had originally set for active ships, namely (Reference C.9.185, pp. 54 and 55):
1. For shielded systems -- 0.01 R/24 hours (gamma)
2. For unshielded systems and surfaces -- 0.05 R/24 hours (gamma plus beta)
3. For underwater body -- 0.05 R/24 hours (gamma plus beta).

During the development of clearance standards, work had continued at the San Francisco Naval Shipyard on removing radioactivity from condensers and satisfactory methods had been worked out.

Clearance Standards Adopted

On 22 November, BuMed, and BuShips jointly issued a letter giving agreed-upon decontamination methods and clearance standards (Reference C.9.187, pp. 30 through 51), which superseded all previous directives (Reference C.9.185, pp. 51 and 58).

The criteria for clearance are:

1. The existence of any areas of radioactivity with readings in excess of 0.1r (gamma) or 0.5r (beta) combined will be considered as above safety tolerance for external radiation and will be immediately decontaminated or disposed of, and there will be taken such other precautions as are required to insure safety of personnel. Serious radioactive hazard, not involving external radiation, will exist in enclosed salt water systems which give a reading of 0.1r (gamma) through the metal of the system. All areas of contamination within closed saltwater systems with readings between 0.1 and 0.01 gamma on external reading will be decontaminated immediately.

2. Operational Clearance MAY be granted for urgent reasons when readings are:
   (a) Maximum, shielded, between 0.1 and 0.001r gamma
   (b) Maximum, unshielded, between 0.5 and 0.005r beta gamma combined except underwater bodies with surface readings having statistical averages between 0.5 and 0.02 beta gamma combined.

   Operational Clearance WILL be granted when readings are:
   (a) Maximum, shielded, between 0.01 and 0.001r gamma
   (b) Maximum, unshielded, between 0.05 and 0.005r gamma beta combined except hulls of external surface readings having statistical averages between 0.05 and 0.02 R beta gamma combined.

3. Final Clearance will be granted when readings are:
   (a) Maximum, shielded, not above 0.001r gamma
   (b) Maximum, unshielded, not above 0.005r gamma beta combined.
Exception (a) Underwater body, readings statistically averaged not above 0.02r beta gamma combined and with no single localized area in excess of 0.1r beta gamma combined.

Exception (b) salt water systems having external readings ninety-four (94) per cent of which are not above 0.001r gamma, five (5) per cent not above 0.005r (gamma) and, one (1) per cent not above 0.01r gamma.

The letter also stated:

All of the ships involved (target vessels not included) have low radiation intensities and small amounts of contaminating materials. They present no danger from external radiation. Any danger to personnel which may exist involves the introduction of contaminating toxic materials into the body . . . . Considering the relatively small quantities of toxic material present in any one ship and the great amount of gross material with which it is mixed (marine growth, scale, rust) and the quantities of this gross material necessary to gain access to the body in order to produce physical injury due to radioactive effects it is NOT LIKELY that personnel engaged in routine operations or maintenance of these vessels will suffer injury. It is CERTAIN they will not suffer injury if the precautions directed are followed, and the established clearance procedures complied with. The Bureau of Medicine and Surgery has established certain tolerance limits on the basis of recommendations made by an advisory board of experts in this field of toxicology. These are in conformity with nationally accepted standards for safety in regard to external radiation and to radioactive hazards within the body.

On 27 November at a conference on radiological safety convened by Buships in Washington D.C., a University of California scientist speaking to the question of dangers from scraping CROSSROADS nontarget ships took much the same position. He stated that much authoritative information indicated the insoluble form of plutonium used in nuclear weapons was not absorbed in the digestive tract or the lungs unless quantities as large as a gram were present. He argued that the health hazards from long-lived fission products, such as strontium and cesium, were far greater than from plutonium. The amount of such fission products would be on the order of 50 millicuries in many tons of scrap. This quantity of radioactive material was equivalent to the amount of radium found in ordinary rock. Therefore, he was willing to state positively that there was absolutely no possibility of physical injury from the amounts of radioactive material present on the nontarget ships (Reference C.9.187, pp. 112 and 113).

On 18 December, results from tests at the University of California indicated that decay rates of gamma emitters were much greater than had been realized. This led to some revision of the clearance instructions, and a re-estimation that all nontarget ships would receive final clearance by 15 March 1947 (Reference C.9.185, pp. 60 and 61).
Activities at Other Shipyards

In order to avoid overtaxing the facilities at San Francisco, ComServPac, CJTF 1, and CNO issued orders that established decontamination and clearance centers at San Francisco, Pearl Harbor, Guam, and other selected shipyards (Reference C.9.185, p. 22). This culminated in the ultimate dispersal of ships to the various shipyards as follows (target ships are noted with an asterisk (Reference C.13.3):

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<th>SAN FRANCISCO</th>
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<tr>
<td>USS Achomawi (ATF-148)</td>
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<td>USS Appalachia (AGC-1)</td>
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<td>USS Appleing (APA-58)</td>
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<td>USS Walke (DD-723)</td>
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<td>USS Widgeon (ASR-1)</td>
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### MARE ISLAND

- **USS Dentuda** (SS-335)
- **USS Fulton** (AS-11)
- **USS Parche** (SS-384)
- **USS Searaven** (SS-196)
- **USS Skate** (SS-305)
- **USS Skipjack** (SS-189)
- **USS Tuna** (SS-203)

### PEARL HARBOR

- **ARD-29**
- **USCG Bramble** (WAGL-392)
- **USS Chowanoc** (ATF-100)
- **USS Current** (ARS-22)
- **USS Flusser** (DD-368)
- **USS Hesperia** (AKA-13)
- **USS Ottowa** (AKA-101)
- **USS Oneota** (AN-85)
- **USS Orca** (AVP-49)
- **USS Orca** (AVP-49)
- **USS New York** (BB-34)
- **USS Nevada** (BB-36)
- **USS Shakamaxon** (AN-88)

### PUGET SOUND

- **USS Allen M. Sumner** (DD-692)
- **USS Bayfield** (APA-33)
- **USS Chikaskia** (AO-54)
- **USS Etlah** (AN-79)
- **USS Ingraham** (DD-654)
- **USS Robert K. Huntington** (DD-781)
- **USS Salt Lake City** (CA-25)
- **USS Suncock** (AN-80)
- **USS Wharton** (AP-7)
- **USS Wildcat** (AW-2)
- **USS Hughes** (DD-410)
- **USS Pensacola** (CA-24)
- **USS Pollux** (AKS-4)
- **USS Quartz** (IX-150)

### GUAM, MARIANAS

- **LCI(L)-977**
- **LCI(L)-1067**
- **LCI(L)-1091**
- **LCT-1130**
- **LCT-1155**
- **LCT-1184**
- **LCT-1341**
- **LCT-1361**
- **LCT-1377**
- **LCT-1420**
- **LCT-1461**
- **YF-990**
- **YMS-354**
- **YMS-358**
- **YMS-413**
- **YMS-463**
- **YO-132**
### SAN DIEGO

- **USS Ajax** (AR-6)
- **ATA-185**
- **USS Begor** (APD-127)
- **USS Bexar** (APA-237)
- **USS Coucai** (ASR-8)
- **USS George Clymer** (APA-27)
- **USS Mount McKinley** (AGC-7)
- **USS Newman K. Perry** (DD-883)
- **USS Rolette** (AKA-99)
- **USS Saidor** (CVE-117)
- **USS Saint Croix** (APA-231)

### LOS ANGELES

- **USS Albemarle** (AV-5)
- **USS Blue Ridge** (AGC-2)
- **USS Clamp** (ARS-33)
- **USS Coasters Harbor** (AG-74)
- **USS Creon** (ARL-11)
- **USS Cumberland Sound** (AV-17)
- **USS Dutton** (AGS-8)
- **USS Fall River** (CA-131)
- **USS Furse** (DD-882)
- **USS Gunston Hall** (LSD-5)
- **USS Haven** (AH-12)
- **USS Kenneth Whiting** (AV-14)
- **USS Mender** (ARSD-2)
- **USS Panamint** (AGC-13)
- **USS Phaon** (ARB-3)
- **USS Preserver** (ARS-8)
- **USS Presque Isle** (APB-44)
- **USS Reclaimer** (ARS-42)
- **USS Severn** (AO-61)
- **USS Sioux** (ATF-75)
- **USS Sphinx** (ARL-24)
- **USS Telamon** (ARB-8)
- **USS Tombigbee** (AOG-11)

### KWAJALEIN

- **APL-27**

### PHILIPPINES

- **PGM 32**

### NORFOLK, VIRGINIA

- **USS Burleson** (APA-67)

### NEW ORLEANS, LOUISIANA

- **PGM-25**
- **PGM-29**
Information is lacking on decontamination procedures used at shipyards other than San Francisco. San Francisco was, however, the center of research and expertise on the problem and decontamination is considered to have been standard at all naval yards. Moreover, warnings and instructions flowed at a fairly brisk rate from CJTF 1, BuMed, and BuShips. In dealing with such a new and unfamiliar problem, responsible officials at other shipyards had little to depend on except the procedures developed at San Francisco and ordered by central naval authorities.

By 1 January 1947, 80 nontarget ships had been granted final radiological clearance (Reference C.9.185, p. 59). On 28 February, the status of nontarget ship clearance was as follows (Reference C.0.1, p. 3):

- Ships with final clearance, including 12 not exposed: 128
- Ships with operational clearance and recommended for final clearance: 4
- Ships with operational clearance but requiring more work for final clearance: 3
- Ships without either clearance: 22
- Nontarget ships destroyed since BAKER: 2

Disposal of Sand and Acid Used in Decontamination

Cleaning ships' hulls using wet sandblasting and cleaning saltwater piping using various acid solution began early in the effort to decontaminate non-target CROSSROADS vessels. Until 4 December 1946, the sand and acid solution used in decontamination was segregated and disposed of at sea.

The problem of disposal was discussed at the Washington BuShips conference on 27 November. The conferees concluded that (Reference C.9.187, pp. 108 and 109):

1. Special disposal of sand used in sandblasting underwater bodies of radioactively contaminated nontarget ships is not required. Provided marine growth is removed first and disposed of.
2. Solutions used in removal of radioactivity from saltwater systems of nontarget ships may be discharged into harbors, preferably at a slow rate or after dilution, without security or health hazard.

Based on experience at the San Francisco Naval Shipyard and the discussion at the conference, CJTF 1 issued a message on 4 December stating, in part, that (Reference C.9.187, p. 53):

1. Special disposal of sand used in wet sandblasting of underwater bodies of CROSSROADS nontarget vessels is not required.
2. Marine growth and scale removed from vessels at first dry-docking shall be segregated and sunk at sea as previously prescribed.
3. Acid and other decontaminating solutions used in cleaning saltwater systems may be discharged into the harbor. Solutions should be discharged at slow rate or by providing a flow of water along with the discharge so as to dilute the solution by about one-fourth. Discharge should be made well clear of docks and shorelines during ebb tide.

4. Scales and marine growth removed manually from evaporators and saltwater systems shall be segregated and sunk at sea.

Of the approximately 54 ships decontaminated at San Francisco only 9 were decontaminated after 4 December. In a 1982 letter from the U.S. Navy to the mayor of San Francisco regarding her concern of radiation contamination of San Francisco Bay, the issue was readdressed (Reference C.13.3):

Records of the quantities of radioactive fission products which were discharged into San Francisco Bay could not be located. As a result of the Navy's current review, it is estimated that a maximum of 1 curie of fission products of the most highly contaminated ship could have been disposed of in this manner. It is concluded that the total quantity of fission products which could have been disposed of in San Francisco Bay as a result of all nine ships decontaminated after 4 December 1946, could also be discharged today from a commercial nuclear facility and meet the requirements of the Nuclear Regulatory Commission.

The procedures used in 1946 to dispose of sand and acid solutions produced no greater concentrations of radioactivity than are currently acceptable from commercial nuclear reactor operations.
CHAPTER 6
BIKINI SCIENTIFIC RESURVEY

BACKGROUND

Following the conclusion of Operation CROSSROADS, the Joint CROSSROADS Committee gave preliminary consideration to the possibility of a Bikini Scientific Resurvey. Members of the Joint Committee carried out feasibility assessments and consulted with scientists from Joint Task Force 1 on potential studies and the logistics support that would be required for the operation. A subcommittee was formed to analyze proposed operational details and make recommendations (Reference C.8.1, p. 1).

Acting in response to recommendations from the Joint CROSSROADS Committee, on 16 May 1947 the Joint Chiefs of Staff (JCS) issued a memorandum to the Secretary of the Navy requesting that the Joint CROSSROADS Committee and its successor organization, the Armed Forces Special Weapons Project, undertake technical supervision of the Bikini Scientific Resurvey. The operation was to be conducted by the Navy in cooperation with the War Department and with the participation of the U.S. Geological Survey, the Fish and Wildlife Service of the Department of Interior, and the Smithsonian Institution. A target date of 15 July 1947 was proposed (Reference C.8.1, p. 75).

The objectives of the Bikini Scientific Resurvey, as formulated by the JCS, were to (Reference C.8.1, p. 75):

- Collect biological samples
- Carry out diving operations to recover instrumentation from target ships and conduct structural examinations of these vessels
- Collect water, bottom samples, and cores
- Conduct radiological studies of the lagoon, surrounding islands, and organisms, with particular emphasis on the analysis of hazards from alpha radiation and from possibly contaminated food organisms.

Following the issuance of the JCS memorandum, the Joint CROSSROADS Committee immediately began to prepare for the operation. Building on the guidance contained in this memorandum, a number of specific scientific objectives were established (Reference C.8.1, p. 3):

- Analysis of the amount and nature of radioactivity remaining in the lagoon water and on the reef and land structure of the atoll wherever it exceeded normal background levels of radioactivity. Particular attention was to be given to the portion of the reef between Aomen and Bikini islands at a stage of tide as close as possible to that which existed 15 minutes after Test BAKER. These investigations
would include charting the exposed portion of the reef through aerial photography.

- Examination of the concentration and kinds of radioactive materials found in plants and animals in the area and assessment of the effects the radioactivity had on these organisms.

- Physiological, geological, and oceanographic studies of organisms and reef-building processes, including the drilling of cores down to 1,000 and perhaps 2,500 feet (305 and 762 meters).

- Detailed observation (including photographic recording) of target ships sunk as a result of Test BAKER, with special attention to USS Saratoga (CV-3), Nagato (captured Japanese battleship), USS Pilotfish (SS-386), USS Apogon (SS-308), and perhaps USS Arkansas (BB-33) and USS Gilliam (APA-57) if time permitted. Detailed structural inspections were to be made to determine the exact cause of sinking and to identify minor structural failures.

- Recovery of four instruments from Nagato -- one ionization gauge, two linear time-pressure recorders, and one diaphragm-type damage gauge. Since these instruments were watertight they would be in good condition and yield recordings of considerable value.

- Attempt to locate a section of LSM-60, believed to have been identified in photographs and to inspect this section for type of rupture, heat effects, and radioactivity.

**TASK GROUP 10.12**

In a directive issued on 2 June 1947, the Chief of Naval Operations (CNO) ordered that the Bikini Scientific Resurvey be carried out under the operational control of the Commander-in-Chief, Pacific Fleet (CINCPACFLT). On 3 June 1947, CNO sent a dispatch to CINCPACFLT designating three ships for participation in the operation:

- USS Chilton (APA-38) (flagship)
- USS Coucal (ASR-8)
- LCI(L)-615.

The same message ordered Chilton to depart San Diego on 1 July for Bikini Atoll via Pearl Harbor (Reference C.8.1, p. 6). On 12 June CINCPACFLT designated a commander for the task group (TG 10.12) that would conduct the Bikini Scientific Resurvey. CINCPACFLT Operation Order No. 101-47 dated 29 June 1947 (Reference C.8.1, p. 6) detailed the task group's organization.

Commander Task Group (CTG) 10.12 was a Navy captain who had a subordinate Navy officer for a technical director and a staff of 36. One Navy Medical Corps officer on the staff was assigned as Radiological Health Officer and seven officers were assigned duties involving radiological safety (Reference C.8.1,
Opp. 6 through 9). In addition, one individual from Scripps Institution of Oceanography was assigned to the radiological safety (radsafe) group as a radiological monitor and three pharmacist's mates were assigned to assist the Radiological Health Officer (Reference C.81, p. 13).

Navy Construction Battalion Detachment 1800, consisting of 1 officer and 36 enlisted personnel, was assigned to TG 10.12 to provide engineering support for the resurvey. This unit also operated one amphibian aircraft in support of the operation (Reference C.81, p. 6).

The X-Ray Division, commanded by one of the staff officers of TG 10.12, was formed to provide technical support to the resurvey scientific teams. This unit contained 183 Navy enlisted personnel (Reference C.81, p. 8).

Primarily for reporting results and findings of the investigations, a scientific group organization was set up, drawing from the military, civilian government employees, and civilian contractor personnel assigned to TG 10.12 (Reference C.81, pp. 8 through 14). This organization had ten divisions as listed below (number of personnel shown in parentheses):

- **Geology**
  - Island and Reef Geology (5)
  - Submarine Geology (2)
  - Contractor Support Team (8)

- **Radiobiology** -- (1)

- **Fisheries**
  - Reef and Lagoon Fishes (4)
  - Pelagic Fishes (6)
  - Population and Taxonomic Studies (1)

- **Biology**
  - Experimental Biology (6)
  - Ecology and Morphology (3)

- **Radiochemistry and Radiophysics**
  - Fission Products Chemistry (5)
  - Plutonium Chemistry (3)
  - Soils Chemistry (1)
  - Radiophysics (2)

- **Radiological Safety** (8 personnel -- 7 were TG 10.12 staff officers)

- **Radiological Health** (4 personnel drawn from the TG 10.12 staff)
- Diving, Underwater Photography and Television (6)
- Army Engineers (2)
- Aerology (Weather Observation) (1 person from the TG 10.12 staff).

The members of the scientific and military groups came from a large number of organizations -- the Navy (including officers taken from the TG 10.12 staff), the War Department, and (Reference C.8.1, p. 8):
- Atomic Energy Commission
- Clinton Laboratories
- Colorado School of Mines
- Columbia University
- Cornell Aeronautical Laboratory
- Department of Interior Fish and Wildlife Service
- Hanford Engineering Works
- International Pacific Fisheries Halibut Commission
- Ohio State University
- Scripps Institution of Oceanography
- Stanford University (including Stanford Research Institute and Hopkins Marine Station)
- U.S. Geological Survey
- U.S. National Museum, Smithsonian Institute
- University of Hawaii
- University of Minnesota
- University of Tennessee
- University of Washington
- Washington State Department of Game.

PREPARATIONS

Relatively little preparation time was available between the CNO order of 2 June 1947 directing that the Bikini Scientific Resurvey be undertaken and initiation of onsite operations in July 1947 (Reference C.8.1, p. 20).

Chilton, which was to serve as the task group's flagship, had been recently overhauled. The first members of the resurvey team boarded Chilton in San Diego on 17 June 1947. Construction of laboratory facilities was started immediately. Stores were loaded between 23 June 1947 and when the ship departed on 1 July 1947 (Reference C.8.1, p. 17).
Chilton arrived at Pearl Harbor on 7 July. Additional personnel and supplies were taken aboard and Chilton departed Pearl Harbor en route Bikini on 8 July (Reference C.8.1, p. 17).

Coucal departed Pearl Harbor en route Bikini on 7 July 1947. LCI(L)-615 loaded supplies at Kwajalein and arrived on station at Bikini on 17 July (Reference C.8.1, p. 17).

An operation plan was prepared while Chilton was en route from San Diego to Pearl Harbor. This plan generally restated the objectives outlined in the JCS memorandum.

Various annexes of the operation plan covered the operational, scientific, and radsafe aspects of the mission.

The plan (Reference C.8.1, pp. 23 and 24) detailed the procedures to be followed to ensure radiological safety, including the initial radiological reconnaissance of Bikini Atoll. Appendix I of Annex J of the Operation Plan (reproduced in Appendix B) contains these sections:

- Radiological hazards were defined and estimated for the Bikini area.
- Provision was made for special pre- and postoperational medical examinations.
- Provision for the issue of special clothing for personnel working in contaminated areas was made.
- Regulations covering shore operations were established. Restrictions were placed on eating foods and drinking water from the islands, swimming in the area was prohibited (these restrictions subsequently were lifted), and provision made for a radsafe officer to accompany all initial trips to onshore areas.
- Radsafe equipment was specified:
  - Type 263 Geiger tube survey meters would be used to detect beta and gamma radiation in the field
  - Portable "Zeuto" nylon window ionization chambers would be employed to detect heavy alpha radiation
  - Type 235 survey meters with ionization chambers in an extended probe would be used for gamma radiation monitoring on sunken ships
  - As dictated by circumstances, pencil-type quartz fiber dosimeters for detection of gamma radiation would be employed by divers and other personnel.
- Provisions were made for the establishment of a photographic dosimetry unit to process film badges.
- All divers and other personnel expected to encounter significant radiation would wear Type K film badges, and an individual would not be allowed to reengage in the same
activity if his total body radiation exceeded 0.1 R/24 hours the previous day.

- Plans were made for the establishment of decontamination stations and decontamination techniques were outlined.
- Rules governing the handling of radiologically active scientific specimens, the conduct of laboratory work, and disposal of laboratory waste were established.
- Procedures for reentry into Bikini Atoll and for offloading of equipment (presupposing favorable results from the initial radiological reconnaissance) were established.

Additional technical support for radsafe operations was available from the two radiochemistry laboratories and the counter room established on Chilton (Reference C.8.1, pp. 27 through 29).

Daily staff conferences were held during the trip to Bikini Atoll. During these meetings, detailed plans and procedures for the implementation of the operation plan were developed (Reference C.8.1, p. 27). A Scientific Advisory Board was established on 2 July 1947. This board provided advice to the project officer on administrative matters, particularly allocation of laboratory space and facilities and implementation of the scientific work program (Reference C.8.1, p. 33).

On the recommendation of the Scientific Advisory Board, a series of seminars was conducted. The purpose of these seminars was to provide scientific personnel with information concerning the background, objectives, and methodologies of the studies to be conducted during the Bikini Scientific Resurvey. Three of the ten seminars in the series covered topics pertaining to radiological safety (Reference C.8.1, pp. 33 through 41). The first, "Effects of Radiation on Man," summarized what was known in this field and identified potential hazards on Bikini Atoll. The remaining two seminars outlined the operation plan for radiological safety at Bikini (Reference C.8.1, pp. 39 and 40).

While Chilton was en route from Pearl Harbor to Bikini Atoll, several series of experiments bearing on radiological safety were conducted. In one group of tests, samples of seawater were analyzed for radioactive content to establish a background figure for comparison with the lagoon water at Bikini Atoll. In a separate test, a container of radium was hidden on board Chilton and monitors with Geiger counters attempted to identify its location. The monitors detected not only the radium container but also x-ray equipment in the dental office. The purpose of this test was to ensure that the Geiger counters were in good operating condition before the initial landing at Bikini Atoll (Reference C.8.1, p. 44).

During the trip to Bikini Atoll, work proceeded on the scientific laboratories. As a consequence, by 15 July 1947 all of the programmed onboard laboratories were ready for use. These facilities included (Reference C.8.1, p. 29):

- Two radiochemistry laboratories and a counting room aboard Chilton that were capable of determining beta, gamma, and alpha radiation levels in samples
• A radiobiology laboratory (aboard Chilton)
• A photography laboratory to support scientific operations, which had an associated activity devoted to photographic dosimetry, including the processing and examination of film badges aboard Chilton.

Subsequently, other laboratories were established on Bikini Island to support the scientific activities of onshore research personnel.

Medical examinations were the final preoperational component of the radsafe program. All TG 10.12 military and civilian personnel who were to be engaged in the resurvey operations were required to complete a special physical examination and detailed laboratory tests. Later, personnel who had been actively engaged in resurvey activities were reexamined following the operation. Appendix E of the operation plan detailed the medical tests and criteria employed (Reference C.8.1, p. 100).

OPERATIONS

Initial landing operations commenced on 15 July 1947. Coucal and Chilton passed through Eneu Channel at 1030. Coucal anchored in the vicinity of the sunken Saratoga; Chilton anchored off Bikini Island (Reference C.8.1, p. 47).

At 1145 a radiological monitoring team landed on Bikini Island to monitor the beach, being the first party ashore. Radsafe officers obtained beta and gamma readings along the beach and at a number of inland locations. Readings inland from the beach were uniformly at the same general levels as normal background. The lagoon side of the beach area had radioactivity concentrated in old life rafts, fenders, and similar materials. It was believed that these items might have washed ashore from target ships sunk during CROSSROADS. Samples were obtained from all areas and returned to Chilton for alpha counts (Reference C.8.1, p. 47 through 51).

All members of the initial landing party were required to wear long-sleeved shirts, full-length trousers, and heavy work shoes. On return to Chilton they were monitored to assure necessary decontamination of personnel (a change station was established for this purpose) and prevent ship contamination. All personnel wore film badges designed to record both beta and gamma radiation and monitors carried pocket dosimeters (Reference C.8.1, p. 51).

Evaluation of the pocket dosimeters and examination of developed film badges indicated that no individuals in the landing party had been exposed to tolerance levels of beta or gamma radiation (Reference C.8.1, p. 51).

Immediately after the initial landing, a second landing team went ashore on Eneman Island where monitoring operations were also carried out (Reference C.8.1, p. 51).

Evidence collected by these two landing parties indicated that landing operations could be safely conducted.
Based on the results of the initial surveys, the Radiological Health Officer reported in a memorandum dated 16 July 1947 (reproduced in Appendix B) that (Reference C.8.1, p. 119):

- The preliminary survey of Bikini Island indicated that radiation intensities were on the order of 0.004 R/24 hours and were well below the established tolerance levels.
- Reconnaissance of Bikini Island indicated that all of the low-intensity radiation encountered in the central sector of the island was confined to the sand beaches along the lagoon side of the island and to debris that had washed up on the beaches.
- The survey of the northwestern tip of the island indicated intensities of approximately 0.03 R/24 hours in algal beds and other scattered locations in that sector. In the remainder of the surveyed areas, only background counts were observed.
- Observed intensities on Eneman Island were not above background, with the exception of scattered pieces of debris that produced readings somewhat above background count.

As soon as the radiological safety of various areas on Bikini Island was assured, offloading of material from Chilton commenced. Working on a dawn-to-dark schedule between 15 July 1947 and 22 July 1947, the offloading schedule specified in Annex K of the operation plan was met (Reference C.8.1, pp. 53 and 54).

Scientific activity commenced on 16 July. On 17 July, diving operations from Coucal were initiated. The initial target was Saratoga, which had been sunk by shot BAKER almost a year before. On the same day, LCI(L)-615 arrived with additional supplies. This vessel was used to support submarine geology studies. On July 18, drilling operations commenced (Reference C.8.1, p. 54).

Radiosafe officers accompanied all scientific working parties during the initial landings on islands and reef areas and continued to accompany these groups over the period 15 July to 28 August 1947 until it had been determined that the specific areas to be visited were free from contamination by radioactive materials (Reference C.8.2, p. 94).

Victoreen Model 263 survey meters were used in all field and personnel monitoring operations. These devices were capable of detecting both gamma and beta-plus-gamma radiation through the approximate range of 0.001 to 0.6 R/24 hours. Model 356 alpha meters were also included in the equipment of the Radiological Safety Section but proved to be of no value in general terrain monitoring and of only limited value in the monitoring of underwater samples because of their comparatively low sensitivity (Reference C.8.2, p. 94).

While no major problems were encountered with the Victoreen Model 263 survey meters, these devices were a continuous repair and maintenance problem. They also proved to be too heavy and cumbersome to transport by hand over long distances. Hence, web straps were improvised. Canvas cases were also improvised.
to protect the meters from water damage during rubber boat landings (Reference C.8.2, p. 95).

Between 15 July and 28 August, two members of the Radiological Safety Section were assigned to Coucal on a full-time basis. Duties included monitoring of divers, diving dress, and associated gear immediately following return aboard the ship after a dive; preliminary monitoring of all samples brought to the surface by the divers; and periodic monitoring of the ship itself to ensure that no unnecessary accumulation of radioactive materials occurred (Reference C.8.2, p. 95).

Two types of underwater survey meters/probes were tested during deep-water diving operations conducted from Coucal (Reference C.8.2, p. 94).

The initial equipment set consisted of a brass-cased Geiger tube, approximately 120 feet (37.6 meters) of shielded extension cable, and a Victoreen Model X-325 counting rate meter. Tests conducted before the initial dive on Saratoga showed that this equipment was inadequate because the survey cable was too short to survey the bottom in the vicinity of the target ship's position. Hence, the probe could not be used throughout the target area (Reference C.8.2, p. 94).

On 28 July, an experimental underwater radiological survey meter probe was received aboard Chilton from the Naval Research Laboratory. It consisted of a brass cylinder containing seven Geiger tubes, electrical circuitry and recording meters, and 225 feet (69 meters) of shielded extension cable. This device had a sensitivity range between (approximately) 0.00005 and 0.005 R/24 hours for gamma radiation only. Limited tests of this equipment were made during the latter part of August (Reference C.8.2, pp. 94 and 95).

Both probes were of limited utility because of their high sensitivities and because they required alternating current (Reference C.8.2, p. 95).

In addition to radiological reconnaissance, one of the missions of the original landing parties was to search for signs of human activity on Bikini following the conclusion of CROSSROADS. During both the initial survey and subsequent operations, no indications of human occupation before the arrival of the resurvey team were found (Reference C.8.1, p. 59).

The operation plan prohibited the consumption of fish, fruits or other materials grown in or around Bikini Lagoon, the drinking of water from any island source, and swimming. On 19 July CTG 10.12 opened limited recreation areas on Bikini Island. Certain beach areas were opened to swimming on 21 July, and the ban on consumption of edible fruits was lifted on 24 July. The prohibition of the consumption of fish and other marine organisms remained in effect and all personnel were cautioned to avoid unnecessary contact with barges and other objects in Bikini Lagoon and with the debris found on the beaches. CTG 10.12 initiated these actions on the advice of the Radiological Health Advisory Board established by Annex J of the operation plan (Reference C.8.1, p. 59; Reference C.8.2, p. 95). This annex is reproduced in Appendix B.

After it had been determined that the general level of radiation throughout Bikini Atoll was well within the tolerance limit of 0.1 R/24 hours, all members
of the Radiological Safety Section, except the radsafe officer and the two offi-
cers assigned to Coucal, were assigned collateral duties as planning officers for
the major scientific groups of the resurvey staff. These reassigned offi-
cers continued to be primarily responsible for monitoring and for protecting
personnel from radiation. One officer served as both radsafe officer and plan-
ning officer for LCI(L)-615 throughout the period of bottom sampling and coring
operations. Another officer acted in the same capacity during shallow diving
operations conducted from an LCM (Reference C.8.2, p. 95).

Monitoring data were collected by radsafe officers accompanying scientific
teams and by independent radiological reconnaissance teams between 15 July and
28 August from all of the major islands and from representative islands in
each group except the sector at the western end of Bikini Lagoon (Bokrdolul,
Boketoktok, and Oroken islands). A complete reconnaissance of the latter
islands was regarded as unnecessary because of their distance from the anchor-
age of Chilton and their lack of significance for the resurvey operation (Ref-
ence C.8.2, p. 96).

The survey indicated that while certain isolated areas and accumulations
of waterborne debris found on the lagoon beaches continued to produce beta and
gamma radiation in excess of the established tolerance limit of 0.1 R/24 hours,
the general level of beta and gamma radiation throughout the atoll was well
below this limit. Debris along the beach that continued to produce radiation
was almost entirely material that was assumed to have been blown overboard from
target ships during CROSSROADS or thrown into the lagoon by reboarding and
damage control teams following BAKER (Reference C.8.2, p. 96).

On 25 July, CTG 10.12 forwarded two requests to CINCPACFLT, asking that
LCI(L)-615 be retained for the duration of the resurvey and that an LSM be
assigned for use in resurvey operations and for the transport of scientific
specimens to San Diego. On 30 July, Commander Service Force, Pacific, ordered
LSM-382 to report to CTG 10.12 as soon as practicable. LSM-382 reported to
Bikini Lagoon on 5 August (Reference C.8.1, pp. 59 through 61).

On 28 July USS Latona (AF-35) arrived in Bikini Lagoon. It transferred
supplies to Chilton and departed the same day (Reference C.8.1, p. 59).
Between 31 July and 2 August, three technical specialists from Cornell Aeronautical Laboratory joined the resurvey to assist in the installation and operation of underwater television equipment (Reference C.8.1, p. 59).

From 6 to 8 August, a representative from the Office of the Secretary of the Navy arrived via courier plane. He visited the sites ashore at which resurvey operations were being conducted (Reference C.8.1, pp. 61 and 62).

From 6 to 11 August, four natives of Bikini Atoll were returned by courier plane. They toured the atoll to observe changes. The only change detected was the presence of a new species of fruit-bearing plant -- the papaya. The seeds of this plant apparently reached Bikini during CROSSROADS. This group departed by aircraft (Reference C.8.1, p. 61).

One representative from Geo-Technical Corporation joined the scientific team on 15 August to assist in seismographic research (Reference C.8.1, p. 62).

A representative from the Navy Hydrographic Office reached the survey site on 20 August to participate in analyses of seawater chemistry. Two additional Navy officers joined the task group on August 25 to assist in scientific experiments (Reference C.8.1, pp. 62 and 63).

ROLLUP OPERATIONS

In a dispatch to CINCPACFLT on 13 August, CTG 10.12 recommended that operations be terminated on 30 August 1947. An affirmative response from CINCPACFLT directing that operations cease on that date was received by CTG 10.12 on 14 August (Reference C.8.1, p. 62).

Active preparations for the end of the resurvey operation began on 22 August 1947 (Reference C.8.1, p. 71). Before leaving Bikini Lagoon, all ships in TG 10.12 were instructed to dispose of all lines and other equipment exhibiting radiation in excess of the final clearance limits specified by the Bureau of Ships and the Bureau of Medicine. In the absence of specific directives covering the final clearance limits established for diving dress and associated gear, Coucal was instructed to retain all such equipment pending return to Pearl Harbor, since monitoring had indicated that the contamination present was of a low order and presented no significant radiation hazard (Reference C.8.2, p. 96).

On 25 August, the securing of shore establishments and loading of ships was begun. LSM-382 completed operations and departed for Kwajalein, Pearl Harbor, and San Francisco on 26 August. Coucal was scheduled to complete diving operations on 27 August and, after offloading some special equipment to Chilton, departed Bikini. LCI(L)-615 departed for Kwajalein on 29 August (Reference C.8.1, p. 63).

Monitoring of Chilton's hull at the waterline immediately before departure from Bikini Lagoon on 29 August resulted in readings of background and slightly above background level. Monitoring of Chilton's small boats and deck gear between 29 and 31 August failed to indicate radiation levels above background. Samples of scale taken from Chilton's No. 2 evaporator on 1 September showed a
beta plus gamma count of 1.7 times background and a gamma count of 1.25 times background in scale taken from the second stage of the evaporator, and a beta plus gamma count of 2.3 times background and a gamma count of 1.3 times background in scale taken from the first stage. External monitoring of Chilton's evaporators, condensers, and other saltwater systems produced no evidence of radiation above normal background levels (Reference C.8.2, p. 96 and 98).

Chilton was loaded and ready for sea at 1000 on 29 August. A final inspection of secured installations ashore was made and ship musters were held to ensure that all personnel were properly accounted for. The last courier plane for Kwajalein embarked passengers and loaded mail. Chilton then departed for Pearl Harbor, arriving there on 3 September 1947 (Reference C.8.1, p. 63).

TG 10.12 was dissolved at Pearl Harbor on 4 September 1947 (Reference C.8.1, p. 73).

During the concluding phase of the operation, the Medical Legal Board submitted a report to the project officer. The report began by summarizing the radiological situation. Consistent with the foregoing account, only certain isolated areas and accumulations of debris were found to produce beta and gamma radiation in excess of the tolerance limit of 0.1 R/24 hours (Reference C.8.1, p. 123).

The maximum radioactivity observed during the resurvey was found on a deposit of tar or oil residue on a ledge of rock on a sand spit extending west of Bikini Island. This area produced a beta plus gamma reading of 0.6 R/24 hours and a gamma reading of 0.18 R/24 hours (Reference C.8.1, p. 123).

Concerning the operational phase of the resurvey, the report noted that (Reference C.8.1, pp. 123 and 124):
- Radsafe and health procedures specified in the operation plan were observed throughout the operation.
- Radsafe officers accompanied all scientific work parties during initial landings and continued to accompany these parties until it had been determined that the area in question was free from any hazardous concentrations of radioactive materials.
- Each diver returning to Coucal was initially hosed down with seawater while still on the stage and before being taken aboard. Following removal of the diving suit, divers and gear were monitored with Model 263 survey meters to detect any gamma and beta radiation.
- Personnel monitoring was carried out aboard Chilton until it was determined that this procedure was no longer required.
- Personnel decontamination stations were established on both Chilton and Coucal in the event that monitoring indicated presence of excessive radiation on either individuals or clothing.
All members of the scientific teams wore individual film badges during the initial stages of the operation and until such time as it had been determined that this procedure could be modified or dispensed with entirely in areas that presented no radiological hazards.

Since deep diving and underwater inspection operations were considered to pose the greatest potential hazard, film badges and pocket dosimeters were carried by each diver throughout the course of the underwater work. Three film badges, each enclosed in a waterproof covering, were attached to the inner clothing of the diver before descent -- one at waist height, one at chest height, and one in a shoe. During the early phases of the operation, these film badges were delivered to the Photodosimetry Unit for developing and analysis at the conclusion of each dive. Later, when it had been determined that hazardous concentrations of radioactive materials were not being encountered, badges were analyzed at weekly intervals.

A total of 517 film badges were processed by the Photodosimetry Unit of the Radiological Health Section. No badge carried during the course of the operation gave evidence of exposure to beta or gamma radiation in excess of the daily specified tolerance limit of 0.1 R/24 hours.

Biological analyses conducted during the resurvey indicated the presence of varying amounts of radioactivity in marine life in Bikini Lagoon, though not in sufficient concentrations to pose an external radiation hazard. Instructions issued by the task group commander on the recommendation of the Radiological Health Advisory Board directed that no marine life would be consumed by personnel involved in the operation.

Recreational swimming at designated beaches on Bikini Island was allowed only after chemical analysis of lagoon water indicated a plutonium content of less than 10-11 grams per liter of water. A gross analysis of the fission products present in the water indicated a content of less than 10^-12 curies per liter of water.

On the basis of radiochemical analysis of edible fruits, the original ban on the consumption of such fruits was lifted on 24 July by the task group commander acting on the recommendation of the Radiological Health Advisory Board.

The Statement of Findings of the Medical Legal Board noted that (Reference C.8.1, p. 124):

In view of the data obtained and the observations made during the period 15 July 1947 through 26 August 1947, the undersigned members of the Medical Legal Board, Bikini Scientific Resurvey, attest, that to the best of their knowledge and belief, no individual assigned to, attached to, or participating
in the Bikini Scientific Resurvey during the same period of time was exposed to radiation in excess of the established standards.

PERSONNEL EXPOSURE LEVELS

The photographic dosimetric equipment that was employed consisted of (Reference C.8.2, p. 101):

- An Ansco-Sweet densitometer for reading densities of films exposed in film badges
- Type K film badges (500) obtained from the Radiation Laboratory, San Francisco Naval Shipyard
- Holders and DuPont film packets obtained from the Atomic Energy Commission at Oak Ridge, Tennessee (300 holders and 5,000 packets).

Both types of film badges were exposed to a standard radium source for calibration. Each type had an approximate sensitivity range of 0.02 to 2 R.

Project reports differ as to the number of badges used during the operation. The Report of Findings of the Medical Legal Board stated (Reference C.8.1, p. 124):

Of the total of 517 [emphasis added] film badges processed by the Photocosimetry Unit of the Radiological Health Section, no badge carried during the course of the Resurvey Operations gave evidence of exposure to beta or gamma radiation in excess of the tolerance limits referred to in Paragraph A.1., above.

On the other hand, the section entitled "Radiological Health at Bikini" presented in Volume II of the Report of the Technical Director states (Reference C.8.2, p. 101):

During the period from 15 July to 29 August 1947, a total of 572 [emphasis added] film badges were developed, and the exposures interpreted. None of these badges was found to have been exposed to sufficient radiation to acquire computable density. From film-badge data it was determined that there were no personnel exposures in excess of the daily tolerance limit of 0.1R, beta plus gamma. All developed badges were alphabetically filed, and will be permanently stored at the Radiation Laboratory, San Francisco Naval Shipyard, as a permanent exposure record for personnel connected with this Resurvey Operation.

While these two sources differ as to the number of badges examined, both reach the same conclusion regarding badge readings -- no personnel exposures in excess of specified daily tolerance limits occurred; however, neither the badges nor any listing of the readings have been located.
RESURVEY CONCLUSIONS

The Bikini resurvey concluded that the atomic detonations caused only minor, transient disturbance to the plant and animal populations in the area. Some plants and animals in the immediate area of the underwater detonation were killed and some highly radioactive plants, fish, and invertebrates of impaired vitality were found during the 3 weeks following Test BAKER. One year later, a careful search of the islands, reefs, and lagoon revealed no changes in populations, number, or composition. No physiological damage could definitely be attributed to the detonation. Some dying coral on a reef between Bikini and Aomen islands provided the closest case of damage from the test. The corals \textit{(Heliopora)} were in fine condition a few weeks before Test BAKER. At the time of the detonation, the tops of the coral clumps were about 1 foot (0.3 meter) underwater and the tide was rising. They may have been killed by the radioactive fission products that washed over the reef after raining down from the radioactive cloud. More probable causes of the corals' death were contamination from oil from the sunken ships or by heavy rain during one of the low tides. The question of what caused the death of the corals remained unsolved (Reference A.4, pp. 74 and 75).

One of the most discussed effects of the radioactivity was the possibility of producing genetic changes. At Bikini, more than 1,000 species of organisms were exposed to radioactivity, and many of them had reproduced at least once. A careful search of tens of thousands of specimens in the area failed to show definite evidence of aberrant forms. Since mutations produced by radiation almost invariably do not survive, the result was not unexpected (Reference A.4, p. 76). No scientific investigations found evidence of radiation-induced genetic effects during the 6 weeks of work in the atoll (Reference A.4, p. 77).

The Radiological Safety Section, which monitored most of the islands, found few places where beta-gamma readings exceeded the tolerance limit of 0.1 R/24 hours. The studies of sea urchins and other invertebrates led to the observation that the specimens examined in the shipboard laboratories were healthy, abundant, and reproducing normally.

Occasionally there were reports of situations in which radioactivity may have played a part in generating ecological anomalies, although other, non-radiological, factors could have been present. The Technical Director of the resurvey stated that the level of residual radioactivity was low and not dangerous (Reference A.4, p. 61). While there was no doubt that decay and dilution had reduced residual radioactivity to a low level, questions persisted (Reference A.4, p. 67).

For example, there remained the question of the unexplained turbidity of the eastern lagoon waters near Bikini Island and the target area. Before Test BAKER, the waters had been clear and transparent. However, in 1947 Chilton noted the lagoon waters were opaque. The most likely cause for the increased opacity was an increase in plankton (Reference A.4, pp. 66 and 67). Hypotheses for the increased plankton growth included seasonal effects (later rejected) and the discharge of untreated sewage by personnel at CROSSROADS in 1946. While the scientists agreed the turbidity was unique, they were unwilling to conclude that the atomic detonations had set up conditions that would encourage an increase in plankton (Reference A.4, p. 68).
Studies of radioactivity made in the vicinity of the target ships indicated that there were "large amounts of radioactive material" on the lagoon bottom, particularly in the vicinity of the target array (Reference A.4, p. 70). The radioactivity made its way into the food chain as sea cucumbers and worms ingested and excreted the mud. The plants took up some of the excreted radioactivity. The plants were eaten by small fish, which were preyed upon by larger fish. While the animals excreted most of the radioactive material, a small amount was retained, particularly by the liver, spleen, kidneys, and gonads. Furthermore, the ingestion of radioactive material resulted in a very widespread distribution of radioactivity in the lagoon. The radioactivity detected at Bikini was low, yet it was traceable in food chains. Fission products were found occurring in fish and invertebrates such as clams, snails, oysters, corals, sponges, octopods, crabs, sea urchins, sea cucumbers, spiny lobsters, and shrimp. They were also represented in the algae found in the lagoon (Reference A.4, p. 73).
CHAPTER 7
U.S. ARMY GROUND FORCES PARTICIPATION

INTRODUCTION

Approximately 3,300 Army personnel were assigned to Operation CROSSROADS (Reference C.9.206, p. III-(A)-3). Of the total number of Army personnel, approximately 350 were assigned to Task Group (TG) 1.4 (Army Ground Group) and 2,500 to TG 1.5 (Army Air Group). The forces that were to become the U.S. Air Force in 1947 were still part of the Army in 1946. A summary of Army Air Forces participation is discussed in Chapter 8. In addition to the 71 Army officers assigned to TG 1.4, another 70 Army ground officers have been identified on the Joint Task Force I (JTF I) Officer Roster. Fifty of these were assigned to the Radiological Safety Section. Approximately 380 Army ground personnel remain without positive unit identification. Some of these probably were assigned to JTF I Hq staff. Others were probably assigned to TU 1.5.5 (Air Service Unit) at Kwajalein as engineers and military police.

TASK GROUP 1.4 (ARMY GROUND GROUP)

TG 1.4 had two assigned missions: to determine damage to selected Army equipment exposed at varying distances from the point of detonation and to measure the bombs' radii of effectiveness. CTG 1.4 maintained close liaison with various agencies operating under the Director of Ship Material and was assigned the operating code designation 014B. Senior representatives of each of the technical services under TG 1.4 were at the same time in command of a task unit and also a member of the technical staff (Reference C.9.149, p. 3).

TG 1.4 was berthed aboard the support ship USS Wharton (AP-7) and consisted of a headquarters and the following six operating task units (TU):

- TU 1.4.1 (Engineer Unit)
- TU 1.4.2 (Signal Unit)
- TU 1.4.3 (Ordnance Unit)
- TU 1.4.4 (Chemical Unit)
- TU 1.4.5 (Quartermaster Unit)
- TU 1.4.6 (Air Unit).

Headquarters was composed of Command, Technical, and Administrative sections. The functions of Command and Administrative sections were the normal ones implied by their respective designations. The Technical Section was composed of representatives of six branches, i.e., Corps of Engineers, Chemical Warfare Service, etc. Its members planned, correlated, and supervised test procedures; prepared reports covering test items; and assisted the commanding officer in preparation of the test. The provisional headquarters was activated on 22 March 1946 with an operating strength of five officers and eighteen
enlisted personnel. Four officers and nine enlisted headquarters personnel have been identified, none of whom were badged.

Each operating task unit was under the command of a technical staff officer and was composed of a staff and a group of inspection teams. These teams were assigned to target ships and were responsible for loading, securing, maintaining, and inspecting test items. Teams were to reboard target ships after each detonation after the ships had been radiologically cleared and declared safe for boarding.

Task Unit 1.4.1 (Engineer Unit)

TU 1.4.1 conducted tests to determine the radii of damage to typical items of Corps of Engineers equipment and to discover weaknesses that might be corrected by improved design. Items such as construction tractors, crawlers, caterpillars, floating bridges, and firefighting and water-supply equipment were exposed aboard the target attack transports USS Gilliam (APA-57) at 800 yards (732 meters), USS Dawson (APA-79) at 1,500 yards (1.37 km), and USS Butte (APA-66) at 2,200 yards (2.01 km) for Test ABLE. During Test BAKER, water-purification units and other equipment were exposed aboard USS LST-545 4.100 yards (3.75 km), and USS LST-125 and LCM-5 5,700 yards (5.21 km) away on Bikini Island (Reference C.9.150, p. 15). TU 1.4.1 operating strength called for 12 officers, 53 enlisted personnel, and 2 civilians (Reference C.9.150, Appendix E, p. 1). Six officers, four enlisted personnel, and one civilian have been identified, but none can be positively identified as badged.

Task Unit 1.4.2 (Signal Unit)

Signal Corps participation in Tests ABLE and BAKER was to determine the effects of damage versus distance on Signal Corps equipment such as switchboards, generators, batteries, wires and installations. Equipment was exposed aboard USS Nevada (BB-36), USS Arkansas (BB-33), USS Independence (CVL-22), Prinz Eugen, USS Saratoga (CV-3), USS New York (BB-34), USS Gasconade (APA-85), and on Bikini Island for Test ABLE. For Test BAKER, items were exposed aboard Arkansas, Nevada, Saratoga, and Prinz Eugen. The unit operating strength called for nine officers and twenty-seven enlisted personnel as well as nine civilians from Signal Corps Engineer Laboratory. Seven officers, twenty-six enlisted men, and nine civilians have been identified. Two individuals can be identified as having been badged. One had a badge he carried from 30 June to 7 July 1946; it read zero. The other was badged on 19 August, and his badge read 0.130 R (gamma). He may also have had a badge showing zero exposure on 14 August.

Task Unit 1.4.3 (Ordnance Unit)

To facilitate control and preclude duplication it was agreed that the Ordnance Unit would handle all explosives and demolition materials for the Corps of Engineers. Objectives of the TU 1.4.3 tests were to determine whether changes in design of ordnance materials, ammunition, and packaging were necessary to minimize the effects of a nuclear detonation and to collect technical data that might aid in future designs. Items were placed on Arkansas, Nevada, USS Pennsylvania (BB-38), Saratoga, YOG-83, USS LST-52, USS LST-66, USS LST-220, and LST-545 for both tests; some test items were also located on Bikini Island. Operating strength called for 17 officers and 72 enlisted personnel.
Only 15 officers and 38 enlisted personnel have been identified and none were badged. It was not until 31 July that ordnance inspection teams were allowed to inspect the Army equipment after Test BAKER (Reference B.5.3; Reference C.9.155, p. 1).

Task Unit 1.4.4 (Chemical Unit)

Chemical Warfare Service personnel conducted tests to expose selected items of chemical warfare equipment and fillings to the effects of a nuclear detonation. The tests had two objectives: first, to determine the effects of heat, blast, and radiation on packaging, chemical composition, and functioning; second, to determine whether changes in design and chemical composition of these items were necessary to ensure their effective use during and after exposure. Items were displayed during Test ABLE on the following six target ships (distances from Nevada, center of target array, in parentheses): YOG-83 (1,000 yards [914 meters]), LCT-818 (1,200 yards [1.10 km]), LST-52 (1,500 yards [1.37 km]), LCT-874 (2,000 yards [1.83 km]), LST-661 (2,300 yards [2.10 km]), and LST-220 (3,200 yards [2.93 km]). The Chemical Warfare Service did not participate in Test BAKER. The operating strength of this unit called for six officers, seventeen enlisted personnel, and one civilian. Except for one enlisted man, all have been identified. Only one person was badged and he had a zero reading (Reference B.5.3; Reference C.9.151, p. 1-2, Appendix D).

Task Unit 1.4.5 (Quartermaster Unit)

The objectives for TU 1.4.5 tests were to determine the effects of a nuclear detonation on quartermaster supplies and prepare recommendations for future implementation. This unit was composed of a technical staff of four officers and five enlisted men and 11 test teams consisting of one officer and six enlisted men each. TU 1.4.5 was activated from 1 February through 10 August 1946. Test ABLE tested the effects on quartermaster supplies in open storage from an airburst, and Test BAKER tested the effects on quartermaster supplies in various stages of an amphibious invasion operation from an underwater explosion.

Test items for ABLE were displayed on the following 13 target ships: New York, Arkansas, Nevada, Pennsylvania, USS Pensacola (CA-24), Saratoga, USS Carteret (APA-70), USS Fallon (APA-81), USS Cortland (APA-75), USS Bladen (APA-63), USS Niagara (APA-87), USS Catron (APA-71), and ARDC-13. USS Rockwall (APA-230) was used as a supply ship. After each target vessel was declared radiologically safe, test teams reboarded their assigned vessels and prepared inspection reports on damage sustained by test items.

After Test ABLE, TU 1.4.5 was divided into three groups. The first group consisted of three officers, three enlisted personnel, three test teams, and a security detachment to guard supply dumps on Bikini. Each test team had one officer and fourteen enlisted personnel, and the security detachment consisted of one officer and twelve enlisted personnel. The second group was composed ofists and chemical engineers who departed for Honolulu before BAKER to compile data from ABLE. Members of the third group were relieved from further duty with TU 1.4.5 and proceeded to their normal duty stations. The latter two groups departed Bikini on 13 July aboard USS Chilton (APA-38) for Hawaii and the mainland.
Three displays were used for Test BAKER: aboard LST-545, 4,000 yards (3.66 km) from the blast, LST-125, beached on shore of Bikini, and Bikini Island beachhead. On BAKER D+6, TU 1.4.5, accompanied by radsafe monitors, inspected three displays. In all, 16 officers and 78 enlisted personnel have been identified from this unit, but only 7 were badged; the highest badge reading was 0.21 R (References B.5.3, C.9.155, and C.9.154).

Task Unit 1.4.6 (Air Unit)

The objectives of TU 1.4.6 were to test nuclear effects on representative items of Army Air Forces equipment at varying distances from Test ABLE. Navy target ships used to expose items were Nevada, Independence, and New York. After radsafe personnel declared each target ship safe, Army Air Forces inspection teams went aboard. Reboarding was as follows:

<table>
<thead>
<tr>
<th>Time</th>
<th>Date</th>
<th>Hours after Detonation</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York 0830</td>
<td>4 July</td>
<td>71</td>
</tr>
<tr>
<td>Nevada 0930</td>
<td>5 July</td>
<td>93</td>
</tr>
</tbody>
</table>

The operating strength of this unit called for seven officers and nine enlisted personnel. Reboarding teams were composed of ships' personnel and Army personnel. Seven officers and six enlisted personnel have been identified; none were badged (Reference B.5.3; Reference C.9.156, p. 218).
CHAPTER 8
U.S. ARMY AIR FORCES PARTICIPATION

About 2,500 U.S. Army personnel in the Army Air Forces* served in CROSSROADS and were assigned to Task Group (TG) 1.5, Army Air Group. The air units of TG 1.5 operated from Kwajalein and Enewetak islands. A small number of personnel (13 have been identified) were assigned to Task Unit (TU) 1.4.6 (Air Unit). This unit is discussed in Chapter 7, "U.S. Army Ground Forces Participation."

In January 1946, the 58th Bombardment Wing of the U.S. Army Fourth Air Force was designated TG 1.5 for CROSSROADS activities. Roswell Army Air Field, New Mexico, was selected as the center for preparations in the continental United States. The 509th Composite Group at Roswell formed the nucleus of the various task units needed for the tests. A large part of the headquarters staff of the 58th Wing at March Army Air Field, California, was transferred to Roswell to form Headquarters, TG 1.5. (Reference C.9.206, Part VII). Other units that furnished significant manpower included the 320th Troop Carrier Squadron, 329th Bomb Squadron, 330th Bomb Squadron, 393rd Bomb Squadron, and 1027th Air Materiel Squadron. Table 12 lists all units known to have supplied personnel to TG 1.5.

Functions performed by TG 1.5 included airdropping the shot ABLE nuclear weapon, collecting samples of nuclear debris from the radioactive clouds, weather reconnaissance and prediction, communications support, operation of the airbase at Enewetak Island, photography and air transport support for men and material. It also assisted in some effects experiments associated with measuring blast, heat, and radiation aboard aircraft.

Table 13 lists the task units in TG 1.5. The table shows number of persons in each unit, number badge, and dosimetry breakdown. The information was obtained using May 1946 task unit rosters and the Reynolds Electrical and Engineering Company's (REECo) printout of radiation exposure by name. Rosters for June and July 1946 could not be located, and there is some evidence that more personnel were assigned to the various task units during June and July. An undated chart showing task unit totals for Hq TG 1.5 and TU 1.5.1 through TU 1.5.5 was located at Brooks AFB, Texas. Totals for Hq TG 1.5, TU 1.5.1, TU 1.5.2, and TU 1.5.3 are quite close to those on the May rosters (as shown in Table 13). However, the total for TU 1.5.4 is 309 versus 55 in Table 13; and for TU 1.5.5 it is 995 versus 686 in Table 13. Since TU 1.5.4 included personnel who ferried men and equipment to the Pacific, the roster may have included only those assigned on Kwajalein. However, no such explanation is available for the difference in TU 1.5.5.

*In 1946 the Air Forces were still part of the U.S. Army.
Table 12. Participating Army Air Forces units, Operation CROSSROADS.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Home Station</th>
<th>Task Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Ordnance Squadron</td>
<td>Roswell AAF, New Mexico</td>
<td>1.5.1</td>
</tr>
<tr>
<td>6th Aircraft Repair Unit (Floating)</td>
<td>SS Brig. Gen. Alfred J. Lyon</td>
<td>Unknown</td>
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<tr>
<td>40th Bomb Group (VH)</td>
<td>Davis Montan AAF, Arizona</td>
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<td>44th Bomb Group</td>
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<td>58th Bomb Wing</td>
<td>March AAF, California</td>
<td>Hq TG 1.5</td>
</tr>
<tr>
<td>59th Weather Recon Squadron</td>
<td>Castle AAF, California</td>
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<tr>
<td>71st AACS Group</td>
<td>Hickam AAF, Hawaii</td>
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<tr>
<td>93rd Bomb Group</td>
<td>Clovis AAF, New Mexico</td>
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</tr>
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<td>107th AACS Squadron</td>
<td>Robins AAF, Georgia</td>
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<tr>
<td>110th Army Air Force Base Unit</td>
<td>Mitchel AAF, New York</td>
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</tr>
<tr>
<td>112th Army Air Force Base Unit</td>
<td>Gremier AAF, New Hampshire</td>
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<td>Seymour-Johnson AAF, North Carolina</td>
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<td>136th Army Air Force Base Unit</td>
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</tr>
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<td>139th Army Air Force Base Unit</td>
<td>Shaw AAF, South Carolina</td>
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</tr>
<tr>
<td>146th Army Air Force Base Unit</td>
<td>Selfridge AAF, Michigan</td>
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<tr>
<td>201st Army Air Force Base Unit</td>
<td>Peterson AAF, Colorado</td>
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<td>Ft. Worth AAF, Texas</td>
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<td>234th Army Air Force Base Unit</td>
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</tr>
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<td>243rd Army Air Force Base Unit</td>
<td>Great Bend AAF, Kansas</td>
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<td>245th Army Air Force Base Unit</td>
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</tr>
<tr>
<td>263rd Army Air Force Base Unit</td>
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<tr>
<td>311th Reconnaissance Wing</td>
<td>Buckley AAF, Colorado</td>
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<td>320th Troop Carrier Squadron</td>
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<td>329th Bomb Squadron</td>
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<td>330th Bomb Squadron</td>
<td>Clovis AAF, New Mexico</td>
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<tr>
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<td>Venice AAF, Florida</td>
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<td>390th Air Service Group</td>
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(continued)
Table 12. Participating Army Air Forces units, Operation CROSSROADS (continued).

<table>
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<tr>
<th>Unit</th>
<th>Home Station</th>
<th>Task Unit</th>
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<tr>
<td>393d Bomb Squadron</td>
<td>Roswell AAF, New Mexico</td>
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<td>San Francisco AAF, California</td>
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<td>Roswell AAF, New Mexico</td>
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<td>Davis-Monthan AAF, Arizona</td>
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<td>Ft. Worth AAF, Texas</td>
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<tr>
<td>462d Bomb Group</td>
<td>MacDill AAF, Florida</td>
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<td>466th Air Service Group</td>
<td>Sedalia AAF, Missouri</td>
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<td>Sedalia AAF, Missouri</td>
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<td>Salt Lake City AAF, Kearns, Utah</td>
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<td>Roswell AAF, New Mexico</td>
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<td>McCord AAF, Washington</td>
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<td>Hickam AAF, Hawaii</td>
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<td>Clovis AAF, New Mexico</td>
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<td>790th Bomb Squadron</td>
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<td>812th Army Air Force Base Unit</td>
<td>Pope AAF, North Carolina</td>
<td>1.5.5</td>
</tr>
<tr>
<td>902d Army Air Force Base Unit</td>
<td>Orlando AAF, Florida</td>
<td>1.5.2</td>
</tr>
<tr>
<td>1027th Air Materiel Squadron</td>
<td>Roswell AAF, New Mexico</td>
<td>1.5.5</td>
</tr>
<tr>
<td>1395th Military Police Squadron</td>
<td>Roswell AAF, New Mexico</td>
<td>1.5.5</td>
</tr>
<tr>
<td>1503rd Army Air Force Base Unit</td>
<td>Hamilton AAF, California</td>
<td>1.5.5</td>
</tr>
<tr>
<td>2135th Army Air Force Base Unit</td>
<td>Tyndall AAF, Florida</td>
<td>1.5.2</td>
</tr>
<tr>
<td>2140th Army Air Force Base Unit</td>
<td>Smyrna AAF, Tennessee</td>
<td>1.5.2</td>
</tr>
</tbody>
</table>

(continued)
Table 12. Participating Army Air Forces units, Operation CROSSROADS (continued).

<table>
<thead>
<tr>
<th>Unit</th>
<th>Home Station</th>
<th>Task Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2530th Army Air Force Base Unit</td>
<td>Selman AAF, Louisiana</td>
<td>1.5.2</td>
</tr>
<tr>
<td>2533rd Army Air Force Base Unit</td>
<td>Goodfellow AAF, Texas</td>
<td>1.5.2</td>
</tr>
<tr>
<td>2621st Army Air Force Base Unit</td>
<td>Barksdale AAF, Louisiana</td>
<td>1.5.2</td>
</tr>
<tr>
<td>2622nd Army Air Force Base Unit</td>
<td>Mather AAF, California</td>
<td>1.5.2</td>
</tr>
<tr>
<td>3010th Army Air Force Base Unit</td>
<td>Williams AAF, Arizona</td>
<td>1.5.2</td>
</tr>
<tr>
<td>3501st Army Air Force Base Unit</td>
<td>Boca Raton AAF, Florida</td>
<td>1.5.2</td>
</tr>
<tr>
<td>3705th Army Air Force Base Unit</td>
<td>Lowry AAF, Colorado</td>
<td>1.5.2</td>
</tr>
<tr>
<td>4000th Army Air Force Base Unit</td>
<td>Patterson AAF, Ohio</td>
<td>1.5.2</td>
</tr>
<tr>
<td>4121st Army Air Force Base Unit</td>
<td>Kelly AAF, Texas</td>
<td>1.5.2</td>
</tr>
<tr>
<td>4125th Army Air Force Base Unit</td>
<td>Hill AAF, Utah</td>
<td>1.5.2</td>
</tr>
<tr>
<td>4136th Army Air Force Base Unit</td>
<td>Tinker AAF, Oklahoma</td>
<td>1.5.2</td>
</tr>
<tr>
<td>Air Material Command</td>
<td>Wright AAF, Ohio</td>
<td>1.5.3</td>
</tr>
</tbody>
</table>

Source: Reference C.13.5.

Table 13. U.S. Army Air Forces personnel exposure, CROSSROADS.

<table>
<thead>
<tr>
<th>Element</th>
<th>No. of Persons Listed</th>
<th>No. of Persons Badged</th>
<th>Exposure Ranges (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Hq TG 1.5</td>
<td>139</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>TU 1.5.1</td>
<td>367</td>
<td>48</td>
<td>42</td>
</tr>
<tr>
<td>1.5.2</td>
<td>412</td>
<td>149</td>
<td>143</td>
</tr>
<tr>
<td>1.5.3</td>
<td>450</td>
<td>117</td>
<td>30</td>
</tr>
<tr>
<td>1.5.4</td>
<td>55</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>1.5.5</td>
<td>686</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1.5.7</td>
<td>56</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1.5.8</td>
<td>27</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>1.5.9</td>
<td>48</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>249</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Source: References C.13.4, B.5.3, and B.5.4.
Eleven personnel listed in the REECo exposure data as being on Enewetak on 25 July are not on any TG 1.5 roster. Five of these have sequential badge numbers. This strongly implies that they were an aircraft crew in TU 1.5.3. Since there were no other units on Enewetak, these 11 individuals have been counted with TU 1.5.3. It is not possible to arbitrarily group otherwise unidentified personnel on Kwajalein since numerous units were there besides Army Air Forces units.

The REECo data (taken from original source documents) shows last name only (no first name or initials) in about 60 percent of the listings, so for the more common names such as Smith, Jones, and Williams it is very difficult to match the right name. In some cases, e.g., aircraft crews, men were given sequential badge numbers and it was possible to match common names positively. In general, however, whenever there was doubt it was assumed that there was no match. In addition to name, the REECo list shows badge number, location (Enewetak, Kwajalein, ship: by name, etc.). badge dates, and badge exposure. It does not identify an individual with a particular organization, only his location. Thus the task unit rosters have to be used along with the dosimetry list.

TU 1.5.6 and TU 1.5.10 are not shown in Table 13. TU 1.5.6 was consolidated with TU 1.5.3 in June 1946. TU 1.5.3 totals reflect personnel from both units. TU 1.5.10 is synonymous with Hq TG 1.5 and the latter designation is used in Table 13.

HEADQUARTERS TASK GROUP 1.5

This group was made up primarily of personnel from Hq 58th Wing and Hq 509th Group. The listing in Table 13 includes personnel assigned to Hq TG 1.5 and Hq 509th Composite Group on Kwajalein. Why these two units are listed separately is unknown. It may be that the personnel in Hq 509th Composite Group were recent arrivals at Kwajalein and were pending assignment to one of the task units. Only 20 of 139 personnel were badged and no exposures exceeded 0.5 R. Three civilians are included in the totals.

Task Unit 1.5.1 (Tactical Operations Unit)

Personnel from the 393rd Bombardment Squadron of the 509th Group Roswell AAF, New Mexico, made up the majority of TU 1.5.1. This unit operated seven B-29 aircraft from Kwajalein including the bomb drop aircraft, two command-and-control aircraft, two pressure-gauge drop aircraft, and two spare aircraft. Of 367 personnel associated with TU 1.5.1, 48 were badged, and all exposures were less than 0.5 R. Almost all the badged personnel were aircraft crews; 27 of the 48 were officers. There were no civilians in this task unit.

Task Unit 1.5.2 (Army Air Photographic Unit)

Personnel drawn from several units in the Air Materiel Command formed this task unit. This unit was responsible for a large part of the technical photography program during CROSSROADS. It operated two C-54s and eight F-13s (modified B-29s) from Kwajalein, which were equipped with very-high-speed and normal-speed motion picture cameras and 35-mm still cameras. Table 13 provides dosimetry information for the 149 personnel out of 412 who were badged. All
but 15 of the badged personnel were aircraft crewmembers. This unit had 55 civilians assigned, several of whom were cameramen on the aircraft and were badged. The highest exposure, 0.05 R, was recorded by a civilian.

Task Unit 1.5.3 (Instrumentation and Test Requirements Unit)

Personnel drawn from several units within the Air Materiel Command made up this task unit. TU 1.5.3 was consolidated with the Drone Aircraft Unit, TU 1.5.6, and was one of two organizations based on Enewetak Island for the CROSSROADS operation. The aircrews that flew the B-17 drones came from the 329th and 330th Bomb Squadrons, Clovis AAF, New Mexico. TU 1.5.3 operated the airfield and flew and maintained the seven B-17 drone controllers and ten B-17 drone aircraft used for cloud sampling. It also operated all base support functions at Enewetak including mess facilities, post exchange, special services, rations, fuel, signal and engine support, and the message center (Reference B.5.1). There were 117 personnel badged out of a total of 450. All recorded exposures were less than 0.5 R. The vast majority of those badged were members of aircraft crews flying the B-17 controller aircraft. However, several firefighters and sheetmetal workers were also badged. The badging of firefighters is understandable since they may have had to fight a fire on contaminated aircraft. Perhaps the sheetmetal workers performed duties associated with the gaseous or particulate filter boxes on the drone B-17s, which were of sheetmetal construction.

Task Unit 1.5.4 (Air Transport Unit)

Personnel for TU 1.5.4 came primarily from the 320th Troop Carrier Squadron of the 509th Composite Group at Roswell Army Air Field, New Mexico. This unit provided airlift to and from the United States to Enewetak-Kwajalein, and performed air support missions in the Enewetak-Kwajalein-Bikini area. Although documents reflect TU 1.5.4 had 20 C-46s and 10 C-54s, there were not sufficient personnel for this many aircraft. In fact, the 20 C-46s were manned by the 439th Troop Carrier Squadron, Roswell Army Air Field, New Mexico, and were used to ferry men and materiel to and from the Pacific area. These personnel were never assigned to the joint task force. Only eight personnel were badged, four of whom were officers. None of the eight recorded any exposure.

Task Unit 1.5.5 (Air Service Unit)

Personnel for this unit came primarily from the 603rd Air Engineering Squadron, 1027th Materiel Squadron, 1395th Military Police Squadron, and the 390th Headquarters and Service Squadron. All were part of the 509th Composite Group at Roswell, New Mexico. TU 1.5.5 provided the supply and maintenance functions to Army Air Forces units on Kwajalein. In addition, it operated a mess facility, the special services office, a post exchange, rations breakdown point, fuel dump, signal and engine supply point, and a message center for the Army Air Forces needs. It also had weather forecasting personnel and military policemen assigned to it. Of 666 personnel on the roster only 2 were badged. Their exposures were less than 0.10 R.

Task Unit 1.5.6 (Army Drone Unit)

This unit was combined with TU 1.5.3 before ABLE and BAKER tests.
Task Unit 1.5.7 (Army Air Weather Reconnaissance Unit)

Personnel for this task unit came primarily from the 59th Reconnaissance Squadron at Castle Army Air Field, California. This unit operated three WB-29s from Kwajalein to monitor weather around Bikini before the tests. On days before each shot, its planes monitored the weather at long ranges. Just after midnight the morning of each shot, its planes took off and monitored the weather in the Bikini area. Records indicate that none of these personnel were badged.

Task Unit 1.5.8 (Air Orientation Unit)

Personnel and aircraft for TU 1.5.8 came from units in the Air Materiel Command. Stationed at Kwajalein, it was responsible for aiding and transporting observers, visitors, news broadcasters, and the press. It furnished facilities for broadcasting and news releases on Kwajalein and provided two B-29s and two borrowed C-54s for media representatives to view the detonations and their results. Although no roster could be located for TU 1.5.8, a Letter Order from the 40th Bomb Group provided the names of 27 personnel assigned to TU 1.5.8. More personnel were probably in this unit, but they cannot be identified. Of the 27 personnel identified, 15 were badged and only one recorded any exposure, 0.06 R.

Task Unit 1.5.9 (Air-Sea Rescue Unit)

This unit was stationed on Enewetak with TU 1.5.3, and, in fact, was part of TU 1.5.3 until June 1946. It was made a separate task unit by Change No. 4 to the JTF 1 Op Plan 1-46 dated 30 May 1946. It operated two B-17 air-sea rescue aircraft equipped to support air-sea rescue operations for downed aircraft crews. It patrolled the area between Enewetak and Bikini, which was the flight path of the B-17 drones and B-17 controllers flying out of Enewetak. Although no roster for TU 1.5.9 personnel could be located, a set of orders marked "VOCG Mid Pac, eff 6 May 46" (Verbal Order Commanding General Mid-Pacific, effective 6 May 1946) was located, assigning 40 personnel from the 4th Emergency Rescue Squadron, APO 244, to TG 1.5. The remaining eight on Table 13 were identified from a TU 1.5.3 roster made up before TU 1.5.9 broke away from TU 1.5.3. Only eight personnel were badged, all of whom were officers. Four of these eight are also listed as radsafe monitors in the Radsafe Group of the Instrumentation Division (see Chapter 3). They were badged and received exposures in August as well as on both shot days. Two other officers in TU 1.5.9 appear to have performed radsafe monitoring duties as well since they were also badged and received exposures in August and on both shot days. These latter two may have been assigned to radsafe duties after the 20 April 1946 edition of the Instrumentation Division roster was formulated.

It is unusual that six officers from this unit received exposures on 1 July and 25 July (shot days), while no one else in the unit did. Furthermore, the location for all six on both dates is shown as "Enewetak." They obviously were not members of a B-17 air-sea rescue crew since no one else was badged. They may have monitored returning drones for radiation at Enewetak on those dates and then went on to other radsafe monitoring duties in August. The highest exposure of the six was 0.77 R, recorded by an Army Air Forces captain. He was badged three times in August for a total of 0.47 R and on both shot days when
he recorded a total of 0.30 R. As mentioned above, his location on shot days was "Eniwetok;" however, his locations in August were target ships in Bikini Lagoon. His name is so unusual that it is unlikely that these were two different individuals, although it remains a possibility since the REECo exposure list shows no initials for this name.

OTHERS

Unit orders were located that identify the 6th Aircraft Repair Unit (Floating) as being aboard SS Brigadier General Alfred J. Lyon at Kwajalein during CROSSROADS. Lyon was a U.S. Army aircraft repair ship. Names of assigned personnel do not appear on other TG 1.5 rosters. None of the personnel assigned this unit has a record of being badged during CROSSROADS.
Operation CROSSROADS was popularly perceived as a Navy operation. The Deputy Task Force Commander for Aviation, an Army Air Forces officer, observed that (Reference C.9.206, pp. II-(B)-3 and II-(B)-4):

Despite all efforts to the contrary on the part of the Task Force Commander and his officers in charge of public relations, news releases and publicity in the majority of cases tended to create, in the mind of the public, the impression that the tests were primarily a naval activity rather than a joint effort in which all services were participating and in which they were equally entitled to praise or censure.

That this was the case is not surprising. From every point of view except the organizational, CROSSROADS was predominantly a U.S. Navy operation. The primary mission of the test was to determine the effects of nuclear detonations on naval vessels. Commander Joint Task Force 1 (CJTF 1) was a Navy officer, and the majority of his joint staff were Navy personnel. In all, over 37,000 Navy personnel participated in CROSSROADS, approximately 90 percent of the total combined military and civilian population of the operation. There were 45 Navy aircraft and 237 Navy ships involved as full-time participants.

The ships were in two categories: support ships and target ships. In the support group were 153 large and small ships, which provided the berthing, messing, laboratory, and office space for the task force. In the target group were 93 vessels for Test ABLE and 92 vessels for Test BAKER, ranging from battleships to small amphibious craft. Of the target ships only 12 were re-manned by their crews after the tests, 13 were sunk after ABLE or BAKER, 8 were towed to Pearl Harbor or the United States for inspection, and the remainder were sunk at Bikini or Kwajalein. The target ships that were later remanned were those with low radioactive contamination and no significant structural damage. Support ships evacuated the lagoon before each shot and took all personnel, including target ship crews, to a safe distance outside Bikini Lagoon. Tables 14 and 15 summarize the Navy vessels' participation in CROSSROADS. Ship histories, largely extracted from the ships' deck logs, which present information pertinent to potential personnel exposure, make up Appendix A to this report.

In the remainder of this chapter, the other Navy components of JTF 1 are discussed. For each unit, except small support ships, detailed information is given on the events in which they were involved during CROSSROADS. Discussed are Navy air units, diving units, and other Navy units that had some potential for radiological exposure.
Table 14. CROSSROADS target vessels and their disposition.

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Date</th>
<th>Disposition/Remarks</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Anderson (DD-411)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Jul 46</td>
<td>Sunk at Bikini, shot ABLE</td>
<td></td>
</tr>
<tr>
<td>USS Apogee (SS-509)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 Jul 46</td>
<td>Sunk at Bikini, shot BAKER</td>
<td></td>
</tr>
<tr>
<td>ARDC 13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 Aug 46</td>
<td>Sunk at Bikini, shot BAKER</td>
<td></td>
</tr>
<tr>
<td>USS Arkansas (BB-33)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 Jul 46</td>
<td>Sunk at Bikini, shot BAKER</td>
<td></td>
</tr>
<tr>
<td>USS Bracken (APA-60)</td>
<td>21 Aug 46</td>
<td>29 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>16 Feb 48</td>
<td>Scuttled off Kwajalein</td>
<td></td>
</tr>
<tr>
<td>USS Bearrow (APA-61)</td>
<td>26 Aug 46</td>
<td>27 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>11 May 48</td>
<td>Scuttled off Kwajalein</td>
<td></td>
</tr>
<tr>
<td>USS Bleden (APA-63)</td>
<td>20 Aug 46</td>
<td>21 Aug 46</td>
<td>30 Aug 46</td>
<td>Pearl Harbor</td>
<td>San Francisco</td>
<td>3 Aug 53</td>
<td>Remanned; transferred to Maritime Commission</td>
<td></td>
</tr>
<tr>
<td>USS Bracken (APA-64)</td>
<td>19 Aug 46</td>
<td>21 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>10 Mar 48</td>
<td>Scuttled off Kwajalein</td>
<td></td>
</tr>
<tr>
<td>USS Briscoe (APA-65)</td>
<td>20 Aug 46</td>
<td>27 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>6 May 48</td>
<td>Scuttled off Kwajalein</td>
<td></td>
</tr>
<tr>
<td>USS Brule (APA-66)</td>
<td>28 Aug 46</td>
<td>29 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>11 May 48</td>
<td>Scuttled off Kwajalein</td>
<td></td>
</tr>
<tr>
<td>USS Butte (APA-68)</td>
<td>20 Aug 46</td>
<td>30 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>12 May 48</td>
<td>Scuttled off Kwajalein (8047'N, 167015'E)</td>
<td></td>
</tr>
<tr>
<td>USS Carlist (APA-69)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Jul 46</td>
<td>Sunk at Bikini, shot ABLE</td>
<td></td>
</tr>
<tr>
<td>USS Carteret (APA-70)</td>
<td>25 Aug 46</td>
<td>27 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>19 Apr 48</td>
<td>Sunk by gunfire, Kwajalein (8042'N, 16705'E)</td>
<td></td>
</tr>
<tr>
<td>USS Catron (APA-71)</td>
<td>26 Aug 46</td>
<td>28 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>6 May 49</td>
<td>Sunk at Kwajalein (902'W, 167017'E)</td>
<td></td>
</tr>
<tr>
<td>USS Connor (DD-371)</td>
<td>22 Aug 46</td>
<td>23 Aug 46</td>
<td>28 Aug 46</td>
<td>Pearl Harbor</td>
<td>San Francisco</td>
<td>July 1948</td>
<td>Remanned; scuttled, southern California (31033.5'N, 118027'W)</td>
<td></td>
</tr>
<tr>
<td>USS Cortland (APA-72)</td>
<td>19 Aug 46</td>
<td>20 Aug 46</td>
<td>30 Aug 46</td>
<td>Pearl Harbor</td>
<td>San Francisco</td>
<td>31 Mar 48</td>
<td>Remanned; transferred to Maritime Commission</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

1. Target vessels that were sunk or scuttled at Kwajalein have no entry in this column.
2. Inferred from various sources.
3. Operational and final radiological clearance dates for remanned target vessels can be found in Appendix A.

(continued)
Table 14. CROSSROADS target vessels and their disposition (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USS Crittenden (APA-17)</strong></td>
<td>24 Aug 46</td>
<td>26 Aug 46</td>
<td>1 Dec 46</td>
<td>San Francisco, 1 Jan 47</td>
<td>San Francisco</td>
<td>5 Oct 48</td>
<td>Sunk off southern California (32°05'N, 115°05'E)</td>
</tr>
<tr>
<td><strong>USS Dawson (APA-19)</strong></td>
<td>19 Aug 46</td>
<td>21 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>19 Apr 48</td>
<td>Sunk by gunfire, Kwajalein (80°47'W, 16°02'E)</td>
</tr>
<tr>
<td><strong>USS Dentuda (SS-335)</strong></td>
<td>22 Aug 46</td>
<td>23 Aug 46</td>
<td>28 Aug 46</td>
<td>Pearl Harbor, San Francisco, October 1946</td>
<td>Mare Island Naval Shipyard</td>
<td>20 Jan 69</td>
<td>Remanned; sold for scrap^d</td>
</tr>
<tr>
<td><strong>USS Fallon (APA-81)</strong></td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>10 Mar 48</td>
<td>Scuttled near Kwajalein</td>
</tr>
<tr>
<td><strong>USS Fillmore (APA-83)</strong></td>
<td>22 Aug 46</td>
<td>23 Aug 46</td>
<td>28 Aug 46</td>
<td>Pearl Harbor, Norfolk January 1947</td>
<td>San Francisco</td>
<td>1 Apr 48</td>
<td>Remanned; transferred to Maritime Commission^d</td>
</tr>
<tr>
<td><strong>USS Gilliam (APA-57)</strong></td>
<td>26 Aug 46</td>
<td>28 Aug 46</td>
<td>May 47</td>
<td></td>
<td>Bremerton</td>
<td>1 Jun 46</td>
<td>Sunk at Bikini, shot ABLE</td>
</tr>
<tr>
<td><strong>USS Independence (CVL-22)</strong></td>
<td>25 Aug 46</td>
<td>27 Aug 46</td>
<td>Jun 47</td>
<td>San Francisco, 16 Jun 47</td>
<td>San Francisco</td>
<td>26 Jan 51</td>
<td>Sunk off southern California (37°20'N, 123°04'W)</td>
</tr>
<tr>
<td><strong>USS Lamson (DD-367)</strong></td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>1 Jul 46</td>
<td>Sunk at Bikini, shot ABLE</td>
</tr>
<tr>
<td><strong>LCI-327</strong></td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>30 Oct 47</td>
<td>Destroyed at Kwajalein</td>
</tr>
<tr>
<td><strong>LCI-329</strong></td>
<td>24 Aug 46</td>
<td>25 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>16 Mar 48</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td><strong>LCI-332</strong></td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>30 Sep 47</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td><strong>LCI-620</strong></td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>10 Aug 46</td>
<td>Sunk at sea off Bikini</td>
</tr>
</tbody>
</table>

Notes:
- Target vessels that were sunk or scuttled at Kwajalein have no entry in this column.
- Operational and final radiological clearance dates for remanned target vessels can be found in Appendix A.
- Inferred from various sources.
Table 14. CROSSROADS target vessels and their disposition (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Departure</th>
<th>Kwajalein Arrival</th>
<th>Destination</th>
<th>Decontamination and Arrivals</th>
<th>Decontamination Location</th>
<th>Disposition/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCT(L1)-549</td>
<td>24 Aug 45</td>
<td>25 Aug 46</td>
<td>June 1948</td>
<td>San Francisco</td>
<td>San Francisco</td>
<td>19 Aug 49</td>
<td>Remained; sold to private purchaser B</td>
</tr>
<tr>
<td>LCT(L1)-615</td>
<td>4 Sep 46</td>
<td>5 Sep 46</td>
<td>June 1948</td>
<td>San Francisco</td>
<td>San Francisco</td>
<td>19 Aug 49</td>
<td>Remained; sold to private purchaser B</td>
</tr>
<tr>
<td>LCT-412C</td>
<td>4 Sep 46</td>
<td>6 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>Sept 1947 Sunk at Kwajalein</td>
<td>After Sunk at Bikini, demolition</td>
</tr>
<tr>
<td>LCT-414</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 Jul 46</td>
<td></td>
</tr>
<tr>
<td>LCT-705</td>
<td>2 Sep 46</td>
<td>4 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>Sept 1947 Sunk at Kwajalein</td>
<td></td>
</tr>
<tr>
<td>LCT-812</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 Aug 46 Sunk at Bikini, demolition</td>
<td></td>
</tr>
<tr>
<td>LCT-816</td>
<td>Unknown</td>
<td>Unknown</td>
<td></td>
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<td>June 1947 Sunk at Kwajalein</td>
<td></td>
</tr>
<tr>
<td>LCT-818</td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
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<td>Sept 1947 Sunk at Kwajalein</td>
<td></td>
</tr>
<tr>
<td>LCT-814</td>
<td>4 Sep 46</td>
<td>6 Sep 46</td>
<td></td>
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<td>Sept 1947 Sunk at Kwajalein</td>
<td></td>
</tr>
<tr>
<td>LCT-1013</td>
<td>2 Sep 46</td>
<td>4 Sep 46</td>
<td></td>
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<td>Sept 1947 Sunk at Kwajalein</td>
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<tr>
<td>LCT-1078</td>
<td>4 Sep 46</td>
<td>6 Sep 46</td>
<td></td>
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<td>Sept 1947 Sunk at Kwajalein</td>
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<tr>
<td>LCT-1112</td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td></td>
<td></td>
<td></td>
<td>Sept 1947 Sunk at Kwajalein</td>
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</tr>
<tr>
<td>LCT-1113</td>
<td>Unknown</td>
<td>Unknown</td>
<td></td>
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<td>June 1947 Sunk at Kwajalein</td>
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</tr>
<tr>
<td>LCT-1114</td>
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<td>30 Jul 46 Sunk at Bikini, demolition</td>
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</tr>
<tr>
<td>LCT-1115</td>
<td>Unknown</td>
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<td></td>
<td></td>
<td>Sept 1941 Sunk at Kwajalein</td>
<td>After Sunk at Bikini, shot BAKER</td>
</tr>
<tr>
<td>LCT-1175</td>
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<td>29 Aug 46 Sunk at Bikini, shot BAKER</td>
<td></td>
</tr>
<tr>
<td>LCT-1187</td>
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<td></td>
<td></td>
<td>After Sunk at Bikini, shot BAKER</td>
<td></td>
</tr>
<tr>
<td>LCT-1237</td>
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<td>25 Jul 46 Sunk at Bikini, shot BAKER</td>
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<tr>
<td>LSM-60</td>
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<td></td>
<td></td>
<td>25 Jul 46 Sunk at Bikini, shot BAKER</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
4 Target vessels that were sunk or scuttled at Kwajalein have no entry in this column.
5 Operational and final radiological clearance dates for remanned target vessels can be found in Appendix A.
6 Shut BAKER target only.
Table 14. CKROSSROADS target vessels and their disposition (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Majalein DepartureA</th>
<th>Destination and ArrivalA</th>
<th>Decontamination Location</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS LST-52</td>
<td>20 Aug 46</td>
<td>27 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>Apr 1948</td>
<td>Sunk by gunfire, Kwajalein (80°47'N, 167°29'W)</td>
</tr>
<tr>
<td>USS LST-725D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11 Aug 46</td>
<td>Sunk at sea off Bikini (11°25'N, 165°25'W)</td>
</tr>
<tr>
<td>USS LST-722</td>
<td>20 Aug 46</td>
<td>30 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>11 May 48</td>
<td>Sunk at Kwajalein (80°48'N, 167°23'W)</td>
</tr>
<tr>
<td>USS LST-723</td>
<td>20 Aug 46</td>
<td>30 Aug 45</td>
<td></td>
<td></td>
<td></td>
<td>12 May 48</td>
<td>Sunk at Kwajalein (80°44'N, 167°22'W)</td>
</tr>
<tr>
<td>USS LST-745</td>
<td>20 Aug 46</td>
<td>30 Aug 44</td>
<td></td>
<td></td>
<td></td>
<td>12 May 48</td>
<td>Sunk at Kwajalein (80°46'N, 167°21'W)</td>
</tr>
<tr>
<td>USS LST-661</td>
<td>25 Aug 46</td>
<td>21 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>25 Jul 48</td>
<td>Sunk at Kwajalein (80°51'N, 167°20'W)</td>
</tr>
<tr>
<td>USS Mayrant (DE-402)</td>
<td>29 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 Apr 48</td>
<td>Sunk by gunfire, Kwajalein (80°49'N, 167°23'W)</td>
</tr>
<tr>
<td>USS Mudeford (DE-789)</td>
<td>21 Aug 46</td>
<td>21 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>27 Mar 48</td>
<td>Scuttled, Kwajalein</td>
</tr>
<tr>
<td>USS Muslin (DE-413)</td>
<td>24 Aug 46</td>
<td>30 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>28 Apr 48</td>
<td>Sunk by gunfire, Kwajalein (80°47'N, 167°11'W)</td>
</tr>
<tr>
<td>Nagato (Japanese battleship)</td>
<td>19 Aug 45</td>
<td>22 Aug 46</td>
<td>27 Aug 46</td>
<td>May 1943C</td>
<td>Pearl Harbor</td>
<td>30 Jul 46</td>
<td>Sunk at Bikini, shot BAKER</td>
</tr>
<tr>
<td>USS New York (CA-33)</td>
<td>27 Aug 46</td>
<td>24 Aug 46</td>
<td>24 Aug 46</td>
<td>March 1947F</td>
<td>Pearl Harbor</td>
<td>8 Jul 48</td>
<td>Sunk 40 nm (74 km) southwest of Pearl Harbor</td>
</tr>
<tr>
<td>USS Nevada (CA-34)</td>
<td>25 Aug 46</td>
<td>23 Aug 46</td>
<td>24 Aug 46</td>
<td>March 1947F</td>
<td>Pearl Harbor</td>
<td>8 Jul 48</td>
<td>Sunk 40 nm (74 km) southwest of Pearl Harbor</td>
</tr>
<tr>
<td>USS Pennsylvania (BB-35)</td>
<td>21 Aug 46</td>
<td>24 Aug 46</td>
<td></td>
<td></td>
<td>Pearl Harbor</td>
<td>10 Feb 46</td>
<td>Sunk at Kwajalein</td>
</tr>
</tbody>
</table>

Note:
A target vessels that were sunk or scuttled at Kwajalein have no entry in this column.
B shot BAKER target only.
C inferred from various sources.
D Operational and radiological clearance dates for remanned target vessels can be found in Appendix A.

(continued)
<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Bikini Arrival</th>
<th>Kwajalein Departure</th>
<th>Kwajalein Arrival</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Disposition/Remarks</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Peary (CA-24)</td>
<td>24 Aug 46</td>
<td>27 Aug 46</td>
<td>Apr 46</td>
<td></td>
<td>Bremerton</td>
<td></td>
<td>Bremerton</td>
<td>10 Nov 48</td>
<td>48°12'0&quot;, 127°00'W</td>
</tr>
<tr>
<td>USS Pima (SS-386)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 Jul 46</td>
<td>Sunk, shot BAKER; raised and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 Oct 46</td>
<td>Inspected; resunk at Bikini</td>
</tr>
<tr>
<td>USS Light (DD-390)</td>
<td>3 Aug 46</td>
<td>22 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22 Dec 46</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td>USS Belling (DD-104)</td>
<td>29 Aug 46</td>
<td>29 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>March 48</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td>USS Kinko (Japanese cruiser)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22 Mar 48</td>
<td>Scuttled, Kwajalein</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 Jul 46</td>
<td>31°05'N, 119°04'M</td>
</tr>
<tr>
<td>USS Saratoga (CV-31)</td>
<td>27 Aug 46</td>
<td>23 Aug 46</td>
<td>28 Aug 46</td>
<td></td>
<td>San Francisco</td>
<td>Mare Island</td>
<td>Mare Island Naval Shipyard, San Francisco</td>
<td>11 Sep 48</td>
<td>31°42.3N, 118°26.4'M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>San Francisco</td>
<td></td>
<td>1948</td>
</tr>
<tr>
<td>USS Skate (SS-355)</td>
<td>23 Aug 46</td>
<td>24 Aug 46</td>
<td>28 Aug 46</td>
<td></td>
<td>San Francisco</td>
<td>Mare Island</td>
<td>Mare Island Naval Shipyard, San Francisco</td>
<td>11 Aug 48</td>
<td>32°02'N, 118°53'M</td>
</tr>
<tr>
<td>USS Sailsuck (SS-184)</td>
<td>5 Sep 46</td>
<td>7 Sep 46</td>
<td>11 Sep 46</td>
<td></td>
<td>San Francisco</td>
<td>Mare Island</td>
<td>Mare Island Naval Shipyard, San Francisco</td>
<td>24 Apr 48</td>
<td></td>
</tr>
<tr>
<td>USS Black (DD-404)</td>
<td>19 Aug 46</td>
<td>20 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 Feb 48</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td>USS Black (DD-402)</td>
<td>22 Aug 46</td>
<td>22 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24 Sep 46</td>
<td>Remanned; sunk off southern</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>USS Luna (DD-227)</td>
<td>22 Aug 46</td>
<td>1 Aug 46</td>
<td>28 Aug 46</td>
<td></td>
<td>Pearl Harbor</td>
<td>Mare Island</td>
<td>Mare Island Naval Shipyard, San Francisco</td>
<td>5 Jul 48</td>
<td>31°40'N, 118°30'M</td>
</tr>
<tr>
<td></td>
<td>23 Aug 46</td>
<td>25 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 Jul 48</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td>USS Ward (DD-409)</td>
<td>19 Aug 46</td>
<td>21 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 Jul 48</td>
<td>Sunk at Kwajalein</td>
</tr>
<tr>
<td>USS Wilson (DD-408)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 Jul 48</td>
<td>Sunk at Kwajalein</td>
</tr>
</tbody>
</table>

Notes:
- Target vessels that were sunk or scuttled at Kwajalein have no entry in this column.
- Operational and final radiological clearance dates for remanned target vessels can be found in Appendix A.
- Interred from various sources.
<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Ashmound (AM-142)</td>
<td>29 Aug 46</td>
<td>30 Aug 46</td>
<td>1 Sep 46</td>
<td>Pearl Harbor San Francisco 4 Oct 46</td>
<td>San Francisco</td>
<td>6 Dec 46</td>
<td>13 Dec 46</td>
</tr>
<tr>
<td>USS Ajax (AR-6)</td>
<td>23 Aug 46</td>
<td>24 Aug 46</td>
<td>28 Aug 46</td>
<td>Pearl Harbor San Pedro 27 Sep 46</td>
<td>San Diego</td>
<td>By 1 Jan 47</td>
<td>Unknown</td>
</tr>
<tr>
<td>USS Althea (AV-5) d</td>
<td>25 Jul 46</td>
<td>26 Jul 46</td>
<td>30 Jul 46</td>
<td>Pearl Harbor San Pedro 12 Aug 46</td>
<td>Not required</td>
<td>By 22 Nov 46</td>
<td></td>
</tr>
<tr>
<td>USS Allen M. Sumner (DD-692)</td>
<td>10 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>Puget Sound</td>
<td>19 Nov 46</td>
<td>10 Jan 47</td>
</tr>
<tr>
<td>USS Appalachian (AGC-1)</td>
<td>29 Jul 46</td>
<td>30 Jul 46</td>
<td>30 Jul 46</td>
<td>Pearl Harbor San Francisco 16 Aug 46</td>
<td>Not required</td>
<td>2 Oct 46</td>
<td>3 Oct 46</td>
</tr>
<tr>
<td>USS Appling (APA-58)</td>
<td>8 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>San Francisco</td>
<td>By 22 Nov 46</td>
<td>13 Dec 46</td>
</tr>
<tr>
<td>ARD-29</td>
<td>25 Aug 46</td>
<td>26 Aug 46</td>
<td>16 Sep 46</td>
<td>Pearl Harbor 3 Oct 46</td>
<td>Pearl Harbor</td>
<td>18 Feb 47</td>
<td>18 Feb 47</td>
</tr>
<tr>
<td>USS Artemis (AKA-21)</td>
<td>18 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>San Francisco</td>
<td>20 Nov 46</td>
<td>27 Dec 46</td>
</tr>
</tbody>
</table>

Notes:

dShip not present at Bikini for sufficient period after BAKER test to be radiologically suspect.

bShot BAKER only

cInferred from various sources.

(continued)
<table>
<thead>
<tr>
<th>Vessel</th>
<th>Rikin Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
</tr>
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<tbody>
<tr>
<td>ATA-185</td>
<td>5 Sep 46</td>
<td>7 Sep 46</td>
<td>8 Sep 46</td>
<td>Pearl Harbor Puget Sound 25 Nov 46</td>
<td>Pearl Harbor</td>
<td>13 Dec 46</td>
<td>18 Jan 47</td>
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<tr>
<td>ATA-192</td>
<td>2 Sep 46</td>
<td>4 Sep 46</td>
<td>8 Sep 46</td>
<td>Pearl Harbor San Francisco 12 Oct 46</td>
<td>San Francisco</td>
<td>14 Nov 46</td>
<td>10 Feb 47</td>
</tr>
<tr>
<td>ATR-40</td>
<td>23 Aug 46</td>
<td>25 Aug 46</td>
<td>8 Sep 46</td>
<td>Pearl Harbor 21 Sep 46</td>
<td>San Francisco</td>
<td>17 Dec 46</td>
<td>21 Dec 46</td>
</tr>
<tr>
<td>ATR-87</td>
<td>1 Sep 46</td>
<td>3 Sep 46</td>
<td>8 Sep 46</td>
<td>Johnston Island</td>
<td>Puget Sound</td>
<td>13 Dec 46</td>
<td>By 4 Jan 47</td>
</tr>
<tr>
<td>USS Avery Island (AG-76)</td>
<td>7 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>San Francisco 21 Aug 46</td>
<td>By 4 Jan 47</td>
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</tr>
<tr>
<td>USS Barton (DD-722)</td>
<td>10 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>San Francisco 22 Aug 46</td>
<td>2 Nov 46</td>
<td>18 Dec 46</td>
</tr>
<tr>
<td>USS Bayfield (APA-33)</td>
<td>3 Aug 46</td>
<td>4 Aug 46</td>
<td>8 Aug 46</td>
<td>Pearl Harbor San Francisco 22 Aug 46</td>
<td>Puget Sound</td>
<td>7 Dec 46</td>
<td>10 Feb 47</td>
</tr>
<tr>
<td>USS Beger (APD-127)</td>
<td>3 Aug 46</td>
<td></td>
<td></td>
<td></td>
<td>Pearl Harbor 8 Aug 46</td>
<td>San Diego</td>
<td>30 Sep 46</td>
</tr>
<tr>
<td>USS Benevolence (AH-13)</td>
<td>25 Aug 46</td>
<td>26 Aug 46</td>
<td>29 Aug 46</td>
<td>Pearl Harbor San Francisco 8 Sep 46</td>
<td>San Francisco</td>
<td>24 Sep 46</td>
<td>24 Nov 46</td>
</tr>
<tr>
<td>Vessel</td>
<td>Bikini Departure</td>
<td>Kwajalein Departure</td>
<td>Kwajalein Arrival</td>
<td>Destination and Arrival</td>
<td>Decontamination Location</td>
<td>Operational Clearance</td>
<td>Final Clearance</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>-------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
<td>-----------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>USS Blue Ridge (AGC-2)(^d)</td>
<td>30 Jul 46</td>
<td></td>
<td></td>
<td>Pearl Harbor</td>
<td>Not required</td>
<td>By 22 Nov 46</td>
<td></td>
</tr>
<tr>
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<td>USS Boweitch (AGS-4)(^d)</td>
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<td>USS Berston (APA-67)</td>
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<td>USS Cebu (ARC-6)</td>
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<td>16 Dec 46</td>
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<td>USS Charles P. Cecil (DD-835)(^d)</td>
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<td>USS Chowanoc (ATF-100)</td>
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<td>USS Clamp (ARS-33)</td>
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<td>San Francisco</td>
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Notes:
\(^d\)Ship not present at Bikini for sufficient period after BAKER test to be radiologically suspect.
\(^d\)Shot BAKER only
\(^c\)Inferred from various sources.
Table 75. CROSSROADS support ships and decontamination locations (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
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<tr>
<td>USS Coasters Harbor (AG-74)</td>
<td>15 Aug 46</td>
<td>16 Aug 46</td>
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<td>13 Dec 46</td>
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<td>USS Conserver (ARS-39)</td>
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<td>7 Sep 46</td>
<td>12 Feb 47</td>
<td>Pearl Harbor</td>
<td>San Diego</td>
<td>4 May 47</td>
<td>1 May 47</td>
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<td>USS Coquel (ASR-8)</td>
<td>4 Sep 46</td>
<td>6 Sep 46</td>
<td>11 Sep 46</td>
<td>Pearl Harbor</td>
<td>San Diego</td>
<td>22 Sep 46</td>
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<td>USS General (ARL-11)</td>
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<td>23 Aug 46</td>
<td>11 Sep 46</td>
<td>Pearl Harbor</td>
<td>San Pedro</td>
<td>22 Sep 46</td>
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<td>USS Cumberland Sound (AV-17)</td>
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<td>USS Dixie (AD-14)</td>
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<td>USS Dutton (AGS-8)</td>
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<td>Puget Sound</td>
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<td>USS Fuso (AS-11)</td>
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<td>26 Aug 46</td>
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<td>Pearl Harbor</td>
<td>San Francisco</td>
<td>27 Sep 46</td>
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Notes:
^aInferred from various sources.
Table 15. CROSSROADS support ships and decontamination locations (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
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<tr>
<td>USS Furse (DD-882)</td>
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<td>29 Jul 46</td>
<td>30 Jul 46</td>
<td>Pearl Harbor San Pedro</td>
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<td>Unknown</td>
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<tr>
<td>USS George Clymer (APA-27)</td>
<td>20 Aug 46</td>
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<td>Pearl Harbor San Pedro</td>
<td>San Diego</td>
<td>By 22 Nov 46</td>
<td>7 Feb 47</td>
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<tr>
<td>USS Gunston Hall (LSD-5)</td>
<td>25 Aug 46</td>
<td>26 Aug 46</td>
<td>2 Sep 46</td>
<td>Pearl Harbor 3 Sep 46</td>
<td>Los Angeles</td>
<td>8 Jan 47</td>
<td>10 Jan 47</td>
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<tr>
<td>USS Gypsy (ARSD-1)</td>
<td>5 Sep 46</td>
<td>7 Sep 46</td>
<td>10 Sep 46</td>
<td>Pearl Harbor 16 Sep 46</td>
<td>Pearl Harbor Los Angeles</td>
<td>9 Jan 47</td>
<td>19 Jan 47</td>
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<tr>
<td>USS Haven (AM-7)</td>
<td>25 Aug 46</td>
<td>26 Aug 46</td>
<td>10 Oct 46</td>
<td>Pearl Harbor 15 Oct 46</td>
<td>Los Angeles</td>
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<td>USS Henrico (APA-45)</td>
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<td>Pearl Harbor San Francisco 27 Aug 46</td>
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<td>1 Feb 47</td>
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<td>USS Hesperia (AKS-13)</td>
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<td>24 Aug 46</td>
<td>31 Aug 46</td>
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<td>Pearl Harbor</td>
<td>28 Dec 46</td>
<td>4 Jan 47</td>
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<td>USS James M. Gilliss (AGS-13)</td>
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<td>13 Nov 46</td>
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<td>USS John Blash (AGS-10)</td>
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<td>USS Ingraham (DD-694)</td>
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<td>21 Nov 46</td>
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<td>USS Kenneth Whiting (AV-14)</td>
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<td>Pearl Harbor 19 Aug 46</td>
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<td>11 Dec 46</td>
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<td>USS Laffey (DD-724)</td>
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<td>2 Nov 46</td>
<td>18 Dec 46</td>
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<td>LCI(L)-977</td>
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Note: *Ship not present at Bikini for sufficient period after BAKER test to be radiologically suspect.*

(continued)
Table 15. CROSSROADS support ships and decontamination locations (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Departure</th>
<th>Kwajalein Arrival</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
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<td>23 Aug 46</td>
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<td>LCI(L)-1067</td>
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<td>23 Aug 46</td>
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<td>6 Nov 46</td>
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<td>USS LST-383</td>
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<td>Pearl Harbor Port Hueneme 5 Oct 46</td>
<td>San Francisco</td>
<td>21 Nov 46</td>
<td>22 Nov 46</td>
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<td>2 Sep 46</td>
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<td>USS LST-881</td>
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<td>3 Sep 46</td>
<td>Pearl Harbor 19 Sep 46a</td>
<td>Los Angeles</td>
<td>3 Jan 47</td>
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</tbody>
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Notes:
- bInterred from various sources.
- Ship not present at Bikini for sufficient period after BAKER test to be radiologically suspect.
- cFrom Eniwetok.
- dShot BAKER only.

(continued)
Table 15. CROSSROADS support ships and decontamination locations (continued).

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
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<td>22 Aug 46</td>
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<td>USS Mount McKinley (AGC-7)</td>
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<td>San Diego</td>
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<td>29 Jan 47</td>
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<td>USS Munsie (ATF-107)</td>
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<td>2 Sep 46</td>
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\(^d^\)Ship not present at Bikini for sufficient period after BAKER test to be radiologically suspect.

(continued)
<table>
<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
<th>Operational Clearance</th>
<th>Final Clearance</th>
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<td>USS Phaon (ARB-3)^a</td>
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<td>3 Sep 46</td>
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<td>4 Jan 47</td>
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<td>USS Pollux (AKS-4)</td>
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<td>20 Aug 46</td>
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<td>Puget Sound</td>
<td>29 Nov 46</td>
<td>25 Jan 47</td>
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<tr>
<td>USS Preserver (ARS-8)</td>
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<td>USS Presque Isle (APB-44)</td>
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<td>USS Quartz (IX-150)</td>
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<td>USS Robert K. Huntington (DD-781)</td>
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Notes:
^aShot BAKER only.

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<th>Vessel</th>
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<th>Decontamination Location</th>
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Notes:

- aShip not present at Bikini for sufficient period after BAKER test to be radiologically suspect.
- bShot BAKER only.
- cShot ABLE only.
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<thead>
<tr>
<th>Vessel</th>
<th>Bikini Departure</th>
<th>Kwajalein Arrival</th>
<th>Kwajalein Departure</th>
<th>Destination and Arrival</th>
<th>Decontamination Location</th>
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<td>USS Wharton (AP-7)</td>
<td>25 Aug 46</td>
<td>26 Aug 46</td>
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<td>San Francisco After 3 Sep 46</td>
<td>Puget Sound</td>
<td>10 Feb 47</td>
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<td>USS Widgeon (ASR-1)</td>
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<td>7 Sep 46</td>
<td>11 Sep 46</td>
<td>Pearl Harbor 22 Sep 46</td>
<td>San Francisco</td>
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<td>10 Jan 47</td>
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<td>Guam/Marianas</td>
<td>20 Dec 46</td>
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Sources: References A.3, A.5, C.0.23, A.13.9, C.13.10, C.13.11, C.11.27.
JOINT TASK FORCE 1 STAFF

The Joint Chiefs of Staff (JCS) directive establishing JTF 1 stated that it would be organized with adequate representation of land, sea, and air forces, and that it would include civilian scientists. Implementation of adequate representation reflected the dominant naval flavor of the operation. The JTF 1 roster of officers dated 1 July 1946 shows 501 Navy officers, 8 Marine Corps officers, 141 Army ground officers, and 21 Army Air Forces officers. Of the 501 Navy officers, 444 were assigned to various ships at Bikini. The remainder filled billets in other locations: 39 were in the JTF 1 rear echelon at Washington, D.C.; 1 each was at Pearl Harbor and Oak Ridge, Tennessee; and 16 were assigned to Kwajalein Atoll.

DISPATCH BOAT AND BOAT POOL

The Dispatch Boat and Boat Pool was designated Task Unit (TU) 1.8.3 (Dispatch Boat and Boat Pool) under Task Group (TG) 1.8 (Service Group). The mission of TU 1.8.3 was to provide dispatch and mail service, interatoll freight and passenger service, and general boat pool services, e.g., ship-to-ship and ship-to-shore. Special boat operations were also a mission, which included operating a flag pool as required for use of distinguished persons and visiting flag and general officers and providing craft for radiological safety (radsafe) work and boats for the target array.

A large number of personnel, ships, and boats were assigned to TU 1.8.3. These totals varied throughout the operation as personnel were discharged from the naval service or transferred to other task force activities, and as boats were damaged or sunk, or released for special missions. Originally 313 personnel were assigned to operate and maintain the boat pool. By 10 June this number had been reduced to 228 due to discharges and transfers. Some replacements were obtained from TG 1.7 (Surface Patrol Group) and from new personnel arrivals. However, personnel deficiencies were never made up. The loss of personnel, as enlistments from World War II lapsed, continued to be a problem throughout CROSSROADS. For the most part, replacement personnel were untrained and great difficulty was experienced in keeping boats operating. For example, a maximum number of boats assigned to TU 1.8.3, 152, was reached on 19 June. By 31 July, a time of high boat pool need, only 93 boats were in operating condition.

Units assigned to TU 1.8.3 were two dock landing ships, USS San Marcos (LSD-25) and USS Gunston Hall (LSD-5), one self-propelled barracks ship, USS Presque Isle (APB-44), and a variety of small boats. The two LSDs provided boat maintenance facilities and along with the APB quartered and messing boat pool personnel. A landing craft repair ship, USS Sphinx (ARL-24), from TG 1.8 also assisted in boat repairs. The number and types of boats assigned varied. On 19 June there were six motor gunboat patrol vessels (PGM-23, PGM-24, PGM-25, PGM-29, PGM-31, and PGM-32), used almost exclusively for by the Radiological Safety Group; four large infantry landing craft (LCI(L)-1062, LCI(L)-1067, and LCI(L)-1091 at Bikini and LCI(L)-977 at Kwajalein; 38 LCMs (mechanized landing craft); 34 LCVPs (vehicle and personnel landing craft); 44 LCP(R)s (ramped personnel landing craft); 1 LCP(L) (large personnel landing craft); 30 PPBs (24-foot boats); 3 PBs (45-foot boats); 1 LCC (control landing craft); and 1 MB (35-foot boat).
All ships and most of the boats of TU 1.8.3 cleared the lagoon for both tests. San Marcos and the six PGMs used for radiological monitoring soon after both shots were stationed about 12 nmi (22 km) from the lagoon entrance. The remainder of the task unit evacuated to Rongelap Atoll for shot BAKER (Reference C.9.206, pp. VII-(A)-77 and VII-(F)-29 through VII-(F)-31).

In order to meet pressing demands, the boat pool was augmented by boats and personnel from various ships and TU 1.3.1 (Transport Unit) and TG 1.2 (Target Vessel Group). Despite these arrangements, at no time during the course of the operation did the boat pool have sufficient operable boats to meet all requirements. The situation was very much aggravated by the damage, beaching, and sinking of 42 boats in the vicinity of Aomen Island during Queen Day (ABLE shot rehearsal) evacuation. The loss was caused by a combination of heavy weather, inadequate moorings, and an LCT breaking loose and drifting through the boat moorings (Reference C.9.206, p. VII-(A)-79).

DIVERS

Following both tests, experienced salvage and diving officers took teams of divers down to inspect wrecks and to obtain comprehensive descriptions of conditions encountered (Reference C.9.207, pp. VII-(I)-87-B and VII-(I)-75-B; Reference A.2, p. 75; Reference C.2.9). The ships sunk during the operation carried with them precisely the type of information CROSSROADS was set up to obtain, the type and degree of damage caused by a nuclear detonation. Divers communicated information to the surface and took many underwater photographs. The Technical Director requested services of divers to recover instrumentation from a number of target ships. These operations were carried out when it was radiologically safe. Diving operations included recovery of (Reference C.9.207, p. VII-(I)-83-B):

- Nine vertical stations
- Pressure-time recorders from USS Arkansas (BB-33), USS Saratoga (CV-3), and USS Pilotfish (SS-386)
- Two hydrophones
- Diaphragm gauge and 5-gallon (18.93-liter) cans attached to raft on Nagato
- Radiation intensity film on Arkansas, Nagato, Saratoga, USS Apogon (SS-308), and Pilotfish
- Underwater pressure gauges on USS Bracken (APA-64) and USS Briscoe (APA-65)
- Bottom pressure recorders and possibly gamma meters attached to a cable near the center of BAKER detonation site.

Divers from the submarine rescue vessel USS Coucal (ASR-8) reported on 2 August (eight days after shot BAKER) that it was moored over the target submarine USS Skipjack (SS-184) and ready to start diving operations as soon as radiological conditions permitted. Inspection dives in preparation to salvage Skipjack were done that day (Reference C.9.207, p. VII-(I)-75-B).
In order to alert divers to radiation exposure levels, a long watertight Geiger tube was carried by them on dives when radiological conditions were uncertain. This instrument transmitted to a counter aboard the tending diving ship. When high radiation levels were detected, the crew on board communicated to the divers to stand clear (Reference A.2, p. 75).

UNDERWATER DEMOLITION TEAM 3 (UDT-3)

In March, Los Alamos scientists decided that the analysis of a sample of water from the immediate vicinity of the nuclear detonation was essential if the tests were to be properly evaluated. After consideration of several proposals to accomplish this, it was finally decided to employ drone boats of the type used in World War II by Naval Combat Demolition Units in southern France. In April, the Drone Boat Unit was designated TU 1.1.3, composed of USS Begor (APD-127). Underwater Demolition Team Easy (later renamed UDT-3), 6 LCVP drone boats (with 2 boats in reserve), and control TBM-3Es from TG 1.6 (when assigned) stationed aboard USS Salddor (CVE-117). On 27 April, Begor reported that 7 officers and 51 enlisted men boarded for transfer from Port Hueneme to Bikini for UDT operations (Reference A.3, Begor. 27 April). It is assumed that this was the composition of UDT-3. UDT-3 personnel were responsible for operation and maintenance of the drone boats and provided airborne control officers for the TBM flights. The LCVP drones were directed to desired sample areas and, when an adequate Geiger reading was transmitted back to the controllers, a water sample was taken. Upon completion of the mission, each drone was directed back to Begor where it was washed down with hoses from Begor and boarded by a safety officer. After being declared safe, a UDT-3 boat crew took over and a radiochemist boarded to transfer the collected water samples.

Successful sample operations were carried out for both shots. On BAKER day, two LCVP drones were monitored by boarding parties and were found to be highly radioactive. Water samples were left in the drones and were recovered 2-1/2 hours later (Reference C.9.207, p. VII-(R)-30). Forty 5-gallon (18.93-liter) water samples were collected on BAKER day (Reference C.9.207, p. VII-(R)-39).

53rd NAVAL CONSTRUCTION BATTALION (53rd NCB)

An advance contingent of the 53rd NCB (Seabees) arrived at Bikini Atoll on 5 March 1946 aboard USS Saint Croix (APA-231) for an initial survey by Seabees to plan the construction of facilities for CROSSROADS. On 13 March, 550 personnel of the 53rd NCB arrived at Bikini Atoll from Guam on USS Randall (APA-224). They were later transferred to Saint Croix, where most of the Seabees were berthed throughout the operation. On 14 March, USS LST-881 delivered 175 stevedores from Pearl Harbor who were to be responsible for handling cargo, assembling moorings for the target array, assisting in the installation of instruments, and assembling sonobuoys and life rafts. During CROSSROADS, the stevedores were berthed on Saint Croix, USS Ottawa (AKA-101) and USS Rolette (AKA-99). On 19 March, USS LST-817 arrived with 15 Seabees. On 20 March, Rolette and Ottawa brought 200 more Seabees from Port Hueneme (Reference C.9.206, pp. VII-(A)-20 and VII-(A)-91). The maximum strength of the battalion from 70 March to mid-May was 1,006 (Reference C.9.206, p. VII-(A)-92(d)).
Construction on Bikini Atoll was limited to that necessary for essential test instrumentation and recreational facilities. The structures built were instrument towers, radio beacons, magazines, photo reference crosses, observa-
tion towers, seismic huts, bombing targets, and a recreational area for 7,000 personnel. All of this was to be completed by 1 May 1946 (Reference C.9.206, pp. VII-(A)-2, VII-(A)-42, and VII-(A)-43).

Early in May, 200 men were released from the 53rd NCB, and an additional 522 were released early in June when all originally planned construction was essentially complete. Twenty-one officers were released late in May. They were replaced by six ensigns. By 19 June all remaining naval reserve personnel were released and replaced by regular enlisted personnel. During July, 6 officers and 240 enlisted men remained in the battalion to maintain installations at Bikini Atoll (Reference C.9.206, pp. VII-(A)-93 and VII-(A)-94).

For shot ABLE, the Seabees evacuated part of their construction equipment by LST. The equipment that remained ashore was not damaged by Test ABLE. For shot BAKER most of the equipment was left; again, there was no damage (Reference C.9.206, pp. VII-(A)-50 through VII-(A)-52).

On 3 August, the 53rd NCB was dissolved and personnel were transferred to Construction Battalion Detachment 1156 (CBD-1156), which was activated the same date, for the rollup phase at Bikini Atoll (Reference C.9.206, p. VII-(A)-99).

The majority of the 53rd NCB had completed their construction tasks and departed Bikini before shot ABLE. Those who remained were evacuated from Bikini prior to both shots.

CONSTRUCTION BATTALION DETACHMENT 1156

CBD-1156 was activated on 3 August 1946 when the 53rd NCB was dissolved. Two hundred forty enlisted men were transferred directly from the 53rd NCB to CBD-1156. Two officers were then assigned to take command (Reference C.9.206, p. VII-(A)-99). CBD-1156 prepared Bikini Atoll for rollup operations. The fleet recreation area was closed, dynamite disposed of, and security measures taken to protect equipment left behind. A complete survey and report on the condi-
tions of Bikini Atoll was taken before its departure to Eniwetok aboard Rolette. One ensign remained at Bikini and made reports on the condition of the equipment (Reference C.11.13). On 26 August, the battalion transferred from Bikini Atoll to Eniwetok Atoll after closing off areas in the atoll. On 11 September, 30 Seabees flew to Bikini from Eniwetok to assist in the trans-
portation of usable and repairable equipment on board USS LST-388. This equip-
ment went to Pearl Harbor for further evaluations (Reference C.9.206, p. VII-(A)-99). The ensign then completed another survey and reported on the condi-
tion of the equipment left behind on 27 September (Reference C.11.13). It is unknown when CBD-1156 left Eniwetok Atoll.

TRANSIENT SHIPS

Several transient ships visited Bikini Atoll during CROSSROADS. All of them were stores ships (AF) or attack transports (APA). These ships and their dates at Bikini Atoll are listed below:

191
USS Pickaway (APA-222) -- 2 July, 21 July
USS Chilton (APA-38) -- 10-15 July
USS Graffias (AF-29) -- 15-16 July and 21-23 July
USS Hyades (AF-28) -- 19-22 August
USS Lavaca (APA-180) -- 23 August.

NAVY AIR GROUP (TASK GROUP 1.6)

Composed of ships and aircraft, TG 1.6 was involved in a variety of support missions during CROSSROADS. Elements of the task group were operated from two aircraft carriers and from two island bases, RoI and Ebeye at Kwajalein. Table 16 gives TG 1.6 composition.

Task Unit 1.6.1 (Drone Carrier Unit)

This unit was based on USS Shangri-La (CV-38). It was responsible for training personnel, preparing equipment for atomic bomb tests, conducting aircraft operations for drones engaged in collecting air and water samples in target areas on ABLE and BAKER days. It operated the carrier and plane guard destroyers as necessary to carry out air operations of embarked units (Chapter 4) (Reference C.9.206, p. VII-(E)-14).

Personnel and equipment of the Drone Carrier Unit (TU 1.6.14), the Drone Boat Control Unit (TU 1.6.15), and the Field Recovery Unit (TU 1.6.13) were transported overseas aboard Shangri-La. An extensive program of takeoffs and recoveries was initiated while en route from Hawaii to RoI Island, Kwajalein. The units arrived at Dyess Field, NAB RoI, on 5 June. Training was given en route in navigation, homing, fighter direction, general communications, and the ABLE day Air Operation Plan (Reference C.9.206, p. VII-(E)-118).

Practice for ABLE day using the drones occurred on 10, 20, and 24 June. The practices included all Navy and Army aircraft. For each of these joint rehearsals, 4 drone F6Fs, 16 control F6Fs, and 2 air-sea rescue TBMs were launched from Shangri-La near Orbit Point Tara (40 nmi [74 km] from the center of Bikini Island). Orbit points for ABLE are summarized in Table 8. During each rehearsal, the carrier drones operated as follows (Reference C.9.206, pp. VII-(E)-119 and VII-(E)-120):

- Four primary drone-control flights (Red, White, Blue, Yellow) of two F6Fs each were launched and rendezvoused over Shangri-La to await the launching of four F6F drones (Red, White, Blue, Yellow).
- As each of the four F6F drones were launched (each carrying a safety pilot for the rehearsals only), the corresponding color-coded flight of the primary drone-control aircraft assumed control of the aircraft and directed it to its station over Bikini Lagoon.
- Four secondary drone-control flights (Red, White, Blue, Yellow) of two F6Fs each then took off and proceeded to their stations opposite the point where it was expected.
Table 16. Units in Task Group 1.6, CROSSROADS.

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<th>-- Drone Carrier Unit</th>
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<td>Task Unit 1.6.21</td>
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Note:

$^a$Transferred to Saidor on 10 June.

that the drones would be directed into the atomic cloud on ABLE day by the correspondingly color-coded primary control aircraft.

- Each of the secondary drone-control flights then took control of its drone after its passage through the area of the expected cloud column and guided it approximately 175 nmi (324 km) to Roi Island, where the drones were landed by the Field Recovery Unit.
- The primary control aircraft returned to the carrier, and the secondary control aircraft landed on Roi Island.

The drone unit was not successful in carrying out all the details of the plan for the first two rehearsals, but the Queen Day rehearsal was almost perfect (Reference C.9.206, p. VII-(E)-120). The control aircraft were equipped with Geiger counters to enable the pilot to detect the presence of radiation.

SHOT ABLE. On 30 June at 1625 Shangri-La, accompanied by plane guard destroyers USS Turner (DD-834) and USS Charles P. Cecil (DD-835), departed Roi Island to take station within 15 nmi (28 km) of reference Point Tare (bearing 135°T, 40 nmi [74 km] from the center of Bikini Island) (Reference C.9.206, p VII-(E)-162). Earlier, final inspection of aircraft and special equipment had been initiated. At 1005, the drone unit in Shangri-La began a deck checkout of each drone and drone-control aircraft and bench checkouts of all identification, friend or foe (IFF) equipment on them. In addition, all special equipment on the aircraft, such as Geiger-Mueller counters, air filters, cameras, and recording devices, was given final tests. By 2130 all aircraft to be launched the next morning for ABLE were on the deck ready to be launched (Reference C.9.206, p. VII-(E)-163).

Between 0714 and 0717 on 1 July, two F6Fs from each of the four primary drone-control flights took off from Shangri-La. The eight primary control F6Fs rendezvoused over the carrier in position to intercept the drones. The Red, White, Blue and Yellow drones took off, in that order, between 0725 and 0745. The primary control flight established control over each airborne drone. By 0828 all drones were at their respective stations, bearing 312°T, 20 nmi (37 km) from target center, flying at the following altitudes: Red at 28,000 feet (8.5 km), White at 20,000 feet (6.1 km), Blue at 15,000 feet (4.6 km), and Yellow at 10,000 feet (3.0 km). Meanwhile, the four secondary drone-control flights of two F6Fs each were launched between 0747 and 0750. By 0830 all were on station, bearing 135°T, 20 nmi (37 km) from the target center at altitudes corresponding to the drones and primary drone-control flights across the center of the target axis (Reference C.9.206, p. VII-(E)-167). Two air-sea rescue TBMs (Dagger-1 and Dagger-2) were launched at 0757 from Shangri-La and stood by over the carrier until 1150 (Reference C.9.206, pp. VII-(E)-167 and VII-(E)-168).

No problems in launching the drones or in controlling them to station occurred. However, after the Red drone arrived on station, a stuck aileron caused it to go out of control and it crashed in the sea at 0850. Consequently, the Red primary and secondary drone-control flights were ordered to return to base at 0900 (Reference C.9.206, pp. VII-(E)-167 and VII-(E)-168).
All pilots in the controlling planes had adjusted their darkened goggles to shield their eyes from the blinding flash of light at the instant of detonation. Since the pilots had expected a much stronger flash than actually occurred, they were momentarily unsure whether the burst had occurred on schedule. However, no serious delay resulted. The primary control flights commenced controlling the drones toward the cloud column, entering as follows: at 0906 the Yellow drone at 10,000 feet (3.0 km), at 0909 the White drone at 20,000 feet (6.1 km), and at 0910 the Blue drone at 15,000 feet (4.6 km). As the drones passed through the cloud column, the White drone increased altitude from 20,000 feet to 26,000 feet (6.1 to 7.9 km), probably due both to the strong upward currents within the cloud and to the White drone having a slight nose-up altitude when the primary drone-control flight released it. The secondary drone-control flights successfully completed the interceptions as follows: Yellow at 0923, Blue at 0924, and White at 0953. The control aircraft recaptured the White drone over Wotho Atoll and returned it to Roi without damage. All drones landed safely at Roi between 1028 and 1046, and all control aircraft returned to the base aboard Shangri-La or to Roi between 0957 and 1056 (Reference C.9.206, pp. VII-(E)-171 and VII-(E)-172). All 16 pilots wore film badges, and 16 were readable. The average exposure was 0.02 R (gamma), with a maximum of 0.03 R (gamma).

Following completion of drone flight operations, radiological samples were removed from the F6F drones after they landed at Roi. Soon after, all other drone and drone-control aircraft from Shangri-La were flown to Roi Island where they were later checked and flight-tested. On 9 July one drone and its safety pilot were lost on a routine test flight off Roi Island when the drone, under the control of the field unit, rolled over at a very low altitude and spun into the sea (Reference C.9.206, p. VII-(E)-188).

Between 0910 and 0918 four drone boat control TBMs (Bucko-1, Bucko-2, Bucko-3, and Bucko-4) of TU 1.6.15 were launched from Saldor. Immediately after takeoff, Bucko-1 and Bucko-3 proceeded to their stations 5 nmi (9.3 km) upwind from the drone boats Factory-1 and Factory-3. Bucko-2 and Bucko-4 stood by circling the carrier as replacements. When Bucko-1 reported a hydraulic leak shortly after takeoff, Bucko-2 replaced it. At 1015 Bucko-4 replaced Bucko-3, which had developed generator trouble. The TBMs remained about 5 nmi (9.3 km) upwind from the drone boats. The TBMs controlled the drone boats' courses as they moved through the radioactive target area. The TBMs also reported on the levels of radiation in the area in which they were flying. Bucko-2 and Bucko-4 completed their missions and were out of the area by 1238 (Reference C.9.206, p. VII-(E)-172).

SHOT BAKER. The air operation plan for shot BAKER provided for the active use of only three drones with twelve control aircraft: Red drone at 14,000 feet (4.3 km) at B+6 minutes, White drone at 9,000 feet (2.7 km) at B+10 minutes, and Blue drone at 5,000 feet (1.5 km) at B+12 minutes. The Yellow control flight remained in readiness as a replacement in case any control flights developed trouble. The primary drone-control aircraft were at Orbit Point Victor, bearing 315°T, 20 nmi (37 km) from the target center. The secondary drone control aircraft were at Orbit Point Sugar, bearing 135°T, 20 nmi (37) from target center (Reference C.9.206, p. VII-(E)-213).
Some safety restrictions were relaxed since airborne radiation from the underwater shot would be less than for ABLE, and the control group was brought closer to the target area. One flight in each group was positioned to be in sight contact of the drone at all times. The amber shield over the cockpit greenhouse and the blue goggles were discarded (Reference C.9.206, p. VII-(E)-187). The White drone had been modified to include the installation of a Mitchell camera, and a K-17 type aerial camera had been installed on the Red drone.

On 13 July all drones and drone-control airplanes were transported by barge from Rol to Shangri-La, which then proceeded to Bikini to participate in the first air rehearsal on 14 July. A second air rehearsal on 19 July was cancelled because of foul weather (Reference C.9.206, p. VII-(E)-183).

At 1610 on 24 July, Shangri-La, accompanied by destroyers Turner and Cecil, left Rol Island to assume their positions 40 nmi (74 km) from the center of Bikini Island (Reference C.9.206, p. VII-(E)-208). On 25 July at 0723, launching of the three F6F drones and twelve F6F drone-control aircraft began. By 0814, the three drone groups were on station. First the two F6Fs of each primary drone-control flight were launched, followed by the drones and the secondary drone-control flights. All aircraft rendezvoused over Shangri-La before proceeding to their assigned stations. At H-hour the primary drone-control flights were orbiting with their drones at Orbit Point Victor, bearing 315°T, 20 nmi (37 km) from the target center at the following altitudes: Red at 14,000 feet (4.3 km), White at 9,000 feet (2.7 km), and Blue at 5,000 feet (1.5 km). The secondary drone-control flights took up their positions on the opposite side of the target axis at Orbit Point Sugar, bearing 135°T, 20 nmi (37 km) from the target center, at altitudes corresponding to the other elements of their respective groups (Reference C.9.206, pp. VII-(E)-212 and VII-(E)-213). Orbit point: for BAKER are summarized in Table 10 (Chapter 4).

The primary drone-control flights and the drones moved toward the target array after the detonation. The Red drone entered the cloud column at 0841 from 14,000 feet (4.3 km), the White drone at 0845 from 9,000 feet (2.7 km), and the Blue drone at 0847 from 5,000 feet (1.5 km). The secondary drone-control flight reported the drones at approximately the same altitudes as follows: Red at 0850, White at 0847, and Blue at 0849. Since the cloud of water and steam did not reach the altitude expected, the Red and White drones at the higher altitudes passed over the top of the column, and the Blue drone at 5,000 feet (1.5 km) flew through the upper portion of the column (Reference C.9.206, p. VII-(E)-216). Radioactivity was detected on the Blue drone only. Maximum reading was 7 R/24 hours (Reference C.7.6). All drones were guided to Rol Island and landed without damage between 0950 and 1006. All air filters, cameras, and other special installations operated satisfactorily except the camera installation in the Red drone (Reference C.9.206, p. VII-(E)-217). All pilots wore film badges. The 12 badges averaged 0.05 R (gamma) and the maximum was 0.08 R (gamma).

At detonation, the four drone boat control TBMs (Bucko-1, Bucko-2, Bucko-3, and Bucko-4) were standing by aboard Saldor ready for launching. All four took off between 0846 and 0849. Bucko-2 and Bucko-4 stood by in the air over the carrier as replacements while Bucko-1 and Bucko-3 proceeded to a position upwind from drone boats Factory-1 and Factory-3. Remaining approximately 5 nmi
(9.3 km) upwind of the drone boats, Bucko-1 at 2,300 feet (701 meters) and Bucko-3 at 2,600 feet (792 meters) conned the courses of Factory-1 and Factory-3 by voice radio as the boats moved through the radioactive waters near the target area (Reference C.9.206, pp. VII-(E)-217 and VII-(E)-218). Bucko-1 completed its conning assignment at 1055 and Bucko-3 at 1105. In the afternoon between 1508 and 1574, similar conning assignments were carried out by Bucko-2 and Bucko-4. Bucko-3 stood by in the air over Saidor as a replacement (Reference C.9.206, p. VII-(E)-218). The three F6F drones and half the control aircraft landed at Roi after the test and radiological samples were removed. On 26 July, two drones were returned by barge to Shangri-La. The following day the remaining F6Fs were transferred to Shangri-La.

Task Unit 1.6.2 (Photographic Carrier Unit)

TU 1.6.2 was based on Saidor. Its mission was to train crews and prepare equipment for atomic bomb tests during ABLE and BAKER and:

- Conduct photographic operations
- Operate helicopter aircraft for radiological reconnaissance, photography, and photographic utility flights
- Conduct conning of drone boats
- Operate photographic carrier and plane guard destroyers as necessary to carry out air operations of embarked units
- Provide pre- and postshot mapping and other photography.

The F6F photographic aircraft were equipped with cameras to provide stills, sonne-strip photos, and a limited amount of motion-picture coverage. Their primary duty was to obtain photographs of the target array just before the detonation. In addition, they were to make mosaics of the target area and strip photos of Bikini Beach before and after the tests (Reference C.9.206, p. VII-(E)-38). One F6F was to obtain motion pictures of the target array and cloud phenomenology after detonation.

Personnel and equipment of the F6F Photo Unit (TU 1.6.23), the TBM Photo Unit (TU 1.6.24), and the Helicopter Unit (TU 1.6.25) were transported overseas in Saidor. The Drone Boat Control Unit (TU 1.6.15) also joined the carrier on 10 June at Bikini (Reference C.9.206, p. VII-(E)-122). TU 1.6.23 had eight F6F and seven F6F-5P pilots. TU 1.6.24 had five TBM and five TBM-3E pilots (Reference C.9.206, p. VII-(G)-22).

After the photographic units arrived at Bikini, the training of the two photographic carrier units (TU 1.6.23 and TU 1.6.24) consisted primarily of three air rehearsals on 10, 20, and 24 June. In addition, they completed various preshot photographic assignments (Reference C.9.206, p. VII-(E)-123).

At Bikini, the Helicopter Unit (TU 1.6.25) observed the target array and inspected target installations. Considerable difficulty was experienced in operating the HOS-1 helicopters. One helicopter was irreparably damaged on a test landing on 30 May and another force-landed in Bikini Lagoon on 3 June (Reference C.9.206, pp. VII-(E)-123, and VII-(E)-124).
SHOT ABLE. The aircraft carrier was the first element of the group to begin moving to ABLE day stations. At 1400 on 30 June, Saidor, accompanied by destroyers USS Furse (DD-882) and USS Newman K. Perry (DE 883), left Bikini Lagoon for its position bearing 0°T, 40 nmi (74 km) from the center of Bikini Island (Point Auto) (Reference C.9.206, p. VII-(E)-162).

On 1 July between 0712 and 0715, six F6Fs (Queen flight of four and Sugar and Roger flights) were launched from Saidor to obtain still photographs of the Bikini target area immediately before detonation. The F6Fs flew directly from the carrier to positions 5 nmi (9.3 km) east of Bikini Atoll. All reported on station at 0725, but the first photographic run was delayed to allow time for the dissipation of the low stratus and cumulus clouds. After making photographic runs at 0747 and 0826, the Queen flight left the target area and landed aboard Saidor by 0840 (Reference C.9.206, p. VII-(E)-165).

Meanwhile, F6F Sugar had made a calibration run over Bikini Atoll at 0725 from 3,500 feet (1.1 km) and then returned to make three photo flights over the target array at 0742, 0750, and 0800, maintaining an altitude of 3,500 feet (1.1 km) for each run. Sugar made a final calibration run at 0810 before returning to Saidor at 0839. F6F Roger, meanwhile, had made a calibration run at 0729 and a photo run over the target array. F6F Roger then proceeded to its assigned station at Orbit Point Able, 20 nmi (37 km) from the target center and was in position at 0827 (Reference C.9.206, pp. VII-(E)-165 and VII-(E)-166).

Two TBMs, Nan and Oboe, of the photographic unit were launched from Saidor at 0734 and 0736. At 0800 they were on station, 20 nmi (37 km) from the target center. At h-hour TBM Nan was orbiting at 9,000 feet (2.7 km), and Oboe orbited at 4,000 feet (1.2 km) (Reference C.9.206, p. VII-(E)-166).

By H-hour, five photographic F6Fs had completed preshot photography of the target array and returned to Saidor (Reference C.9.206, p. VII-(E)-168). Roger was the only photography F6F still airborne at detonation, approximately 12 nmi (22 km) away and flying directly toward the target center at 10,000 feet (3.0 km). Roger took motion pictures of the burst and other photographs of the cloud column and the target ships until 0927 (Reference C.9.206, p. VII-(E)-165 and VII-(E)-166).

TBM Oboe was orbiting at 4,000 feet (1.2 km), 20 nmi (37 km) from the target center at H-hour. It moved in as close as 8 nmi (15 km) during the first 6 minutes following the burst, made oblique angle photographs of the cloud column, and at 0906 returned to its carrier base. TBM Nan was approximately 12 nmi (22 km) from target center at 0900. Immediately following the burst, it began circling the cloud column counterclockwise and took photographs of the cloud and of other aircraft in the area. Six minutes after the detonation, Nan began to fly a 270° arc at a minimum radius of 8 nmi (15 km) from the target, reversing its direction away from the area whenever necessary to avoid radioactivity. Motion picture photography had been started immediately preceding the burst and continued until 0933 when Nan left the area (Reference C.9.206, p. VII-(E)-70).

At 1013 the photographic carrier unit was directed to prepare two F6F photographic aircraft for a special oceanographic survey in Bikini Lagoon. The F6Fs, Sonar-1 and Sonar-2, were launched from Saidor at 1615 and proceeded
Immediately over the lagoon. They made their strip color photographic runs from bearings 180° and 0° between 250 and 400 feet (76 and 176 meters) altitude over the target area. The aircraft landed on Saidor by 1715 (Reference C.9.206, p. VII-(E)-175).

Although not actually employed on ABLE day, the Helicopter Unit (TU 1.6.25) was standing by for air-sea rescue and miscellaneous missions as they arose. Moreover, its employment on D-1 when a helicopter delivered repair parts to Aomen Island, ensured operation of the photographic towers there on D-day (Reference C.9.206, p. VII-(E)-175). The ABLE Air Operation Plan called for a TU 1.6.25 helicopter to recover dirt samples from Bikini Island (Reference B.0.1, p. F-II-14), but there is no evidence that this mission took place.

SHOT BAKER. The mission of the units aboard the photographic carrier Saidor remained almost unchanged for BAKER. Seven F6Fs and four TBMs carried out special photographic missions over the Bikini target area on 5 July. Four TBM drone boat control aircraft practiced their BAKER assignments with Begor on the same day. The aircraft rehearsed successfully 8 and 9 July. Two F6Fs were involved in accidents between 2 July and 24 July. Both were lost on 5 July when it spun into the sea while approaching the carrier. Another plane was badly damaged on 19 July when the tail gave way in landing (Reference C.9.206, p. VII-(E)-189).

The first elements of the Navy air group to begin movement to BAKER stations were the aircraft carrier and its plane guard destroyers. At 0930 on 24 July, Saidor, accompanied by destroyers Furse and Perry, departed Bikini Lagoon to take up position in area Paige. Six F6F photographic aircraft were launched from Saidor between 0655 and 0704. The mission of the group was primarily to obtain still photographs of the target array immediately before the detonation. All six F6Fs flew directly from the photographic carrier to positions 5 nmi (9.3 km) east of Bikini Atoll, reporting on station between 0710 and 0716. One flight made photomapping runs of the target array at 0742 and 0820 and left the target area at 0825 to return to Saidor. At 0710, F6F Sugar made a camera calibration run over Bikini Island at 500 feet (152 meters), then climbed to 3,500 feet (1.1 km). It made photography runs of the target array beginning at 0725 before returning to Saidor at 0835. F6F Roger made a pass over Bikini Island from 600 feet (183 meters) at 0750 and took up station 6 nmi (11 km) northeast of the target array while awaiting the detonation (Reference C.9.206, pp. VII-(E)-211 and VII-(E)-212).

Three TBMs (Nan-1, Nan-2, and Oboe) were launched from Saidor between 0650 and 0710. By 0745 all were on station. The Nan TBMs were 7 nmi (13 km) from the target center at 10,500 feet (3.2 km). Oboe, however, proceeded first to Nan Island at Bikini Atoll and flew counterclockwise around the target center at 4,000 feet (1.2 km) so the turret photographer could make oblique angle photographs of the target array. At 0745 Oboe was on station 1 nmi (1.9 km) southeast of the south tip of Eneu Island. At H-hour, Oboe was again circling the target center at 4,000 feet (1.2 km) (Reference C.9.206, p. VII-(E)-212).

Roger, the only photographic F6F still airborne at detonation, was orbiting at 11,000 feet (3.4 km), 10 nmi (18.5 km) northeast of the target center. It immediately approached within 5 nmi (9.3 km) of the cloud column, taking motion
pictures and other photographs of the cloud column and aircraft in the vicinity. The mission was completed by 0900 when Roger returned to the photographic carrier (Reference C.9.206, p. VII-(E)-215).

Nan-1 and Nan-2 were orbiting in loose formation 7 nmi (13 km) from the target center at H-hour. After detonation, they circled the cloud column counterclockwise at approximately 5 nmi (9.3 km) from its center and photographed the cloud and the aircraft. Oboe moved from the southeast of the south tip of Enew Island to within approximately 5 nmi (9.3 km) of the cloud column, where it took photographs of the cloud and the aircraft in the vicinity. Their missions were completed between 0905 and 0908 and the three planes returned to Saidor (Reference C.9.206, p. VII-(E)-215).

Helicopters flew to some of the islands after BAKER to recover instruments (Reference C.9.206, p. VII-(E)-222).

Task Unit 1.6.3 (Seaplane Unit)

Based at Ebeye, Kwajalein Atoll, the seaplane unit conducted (Reference C.9.206, p. VII-(E)-14):

- Photographic, radiological reconnaissance, air-sea rescue, and patrol operations
- Provided air shuttle service between Ebeye and Bikini
- Provided air facilities
- Serviced and maintained seaplanes of the Navy air group.

Carrier Aircraft Service Unit (Fleet) 34 performed maintenance on the unit.

TU 1.6.3 was composed of patrol bombers (PBM-5), converted to transport and air-sea rescue aircraft, from Patrol Seaplane Squadron 32 (VPB-32) and Air-Sea Rescue Squadron 4 (VH-4). Six VH-4 aircraft arrived at Ebeye Island from Saipan, Marianas Islands, on 10 March, and nine VPB-32 aircraft arrived between 16 and 22 March. On 20 March, elements of both squadrons reported to CTG 1.6 as TU 1.6.3 (Reference C.9.206, p. VII-(E)-25).

One PBM carried radiometric equipment to measure intensity of radiant energy as a function of time. The two PBM radiological reconnaissance aircraft carried equipment to determine the safe time for reentry into the lagoon. All aircraft carried normal communications equipment (Reference C.9.206, p. VII-(E)-39).

Two PBM radiological reconnaissance aircraft also carried equipment to record the observations made by the ship observer, photographic equipment, special gas masks, and other equipment. The PBM radiological reconnaissance aircraft also carried special transmitters for actuation of cameras, sonobuoy receivers with scope cameras, and television receivers (Reference C.9.206, p. VII-(E)-39). Two PBM photographic aircraft took high-angle oblique photographs before, during, and after the blast for documentary purposes and for possible radio phototransmission. Three PBM photographic aircraft were specially equipped to obtain motion pictures of the blast for blast analysis and to obtain still

TU 1.6.3 training was carried out at Ebeye Naval Air Base (TU 1.6.31). Since the Patrol Seaplane Squadron (TU 1.6.32) was actively engaged in flight operations, its training for ABLE was limited almost exclusively to the three rehearsals. The unit was responsible for a minimum of one roundtrip flight daily from Ebeye to Bikini. Including the three rehearsals, the nine PBMs of TU 1.6.32 flew 1,139.8 hours during the period from 16 March to 30 June, transporting 1,521 passengers, 184,104 pounds of mail, and 73,469 pounds of freight (Reference C.9.206, p. VII-(E)-125).

VH-4 (TU 1.6.33) was also actively engaged in flight operations. It was directed to maintain one PBM each on the water at Ebeye and Bikini for air-sea rescue missions from 2 hours after sunrise to 2 hours before sunset. The unit assisted the patrol seaplane unit with overflow CROSSROADS passengers and freight transportation. A total of 714.3 hours was flown by the six PBMs of TU 1.6.33 between 11 March and 30 June (Reference C.9.206, p. VII-(E)-126).

SHOT ABLE. On 30 June the last seaplane cleared Bikini Lagoon at 1534. The first group of Navy aircraft to be airborne on ABLE day were nine seaplanes from Ebeye. They took off between 0503 and 0620 and reported at their respective stations off Bikini Lagoon between 0639 and 0730 (Reference C.9.206, p. VII-(E)-163). Each plane carried a radsafe officer with a Geiger counter.

The radiometry seaplane took off at 0503. It was the first Navy aircraft to depart, and at 0710 it was on its ABLE day station 15 nmi (28 km) bearing 15° from the target center. Two radiological reconnaissance seaplanes Charlie and Dog took off at 0514 and 0515 and reported at station 0730, 30 nmi (56 km) from the target center. Three photographic seaplanes (Tare, Uncle, and William) were next off the water between 0519 and 0529. By 0658 all had reported on station, 15 nmi (28 km) from the target center at orbit points Charlie, King, and Dog (Reference C.9.206, p. VII-(E)-164).

The first air-sea rescue seaplane (Dumbo-2) of TU 1.6.33 was airborne at 0505 and at 0639 arrived at its station at Orbit Point Uncle. Dumbo-1 was off the water next at 0510 and at 0642 was on station at Orbit Point Love. Both seaplanes were stationed 30 nmi (56 km) from the target center. Dumbo-3 was the last to take off at 0620 and at 0710 reported on station at 7,000 feet (2.1 km) over Wotho Atoll, 90 nmi (167 km) from the target center (Reference C.9.206, pp. VII-(E)-164 and VII-(E)-165).

The radiometry seaplane was orbiting 15 nmi (28 km) northeast of the target center at the time of detonation. Equipped with special radiometry instruments to photograph and measure the infrared and visible electromagnetic radiation of the blast, the plane remained on station only 6 minutes making its recording of blast phenomena (Reference C.9.206, p. VII-(E)-168).

Three TU 1.6.32 seaplanes (Tare, Uncle, and William) measured the waves resulting from the burst. They were also instructed to monitor readings of the sonobuoys placed in the target array and to obtain the receiver scope photographs. These attempts were unsuccessful because of the distance away from
the target array required by the air plan. Uncle was also charged with radio-actuation of the synchronized cameras in the photography towers on Enew, Bikini, and Aomen islands as well as those in PBMs Tare and William. At 0900 all three seaplanes were on station 15 nmi (28 km) from the target center. At the instant of detonation the three seaplanes carried out the following missions:

- Tate started from Orbit Point Charlie and flew track 349°T for 4 nmi (7.4 km), and then changed track right to 379°T for 20 nmi (37 km), maintaining a ground speed of approximately 150 knots (278 km/hr).

- Uncle started from Orbit Point King and flew track 0°T for 20 nmi (37 km) maintaining a ground speed of approximately 150 knots (278 km/hr).

- William started from Orbit Point Dog and flew track 309°T for 16 nmi (30 km), maintaining a ground speed of approximately 135 knots (250 km/hr).

Photographic and television equipment was turned on either immediately before or at the instant of the flash, and pictures and recordings were made throughout the runs and until approximately 0923 (Reference C.9.206, p. VII-(E)-169).

The radiological reconnaissance seaplanes, Charlie and Dog, were on station at 2,000 feet (610 meters), 30 nmi (56 km) bearing 30° from the target center at the time of burst. Leaving their stations shortly after H-hour, Charlie and Dog moved to positions approximately 5 nmi (9.3 km) upwind from the detonation points, where they awaited voice radio instructions from the Radiological Safety Officer to begin measuring radioactivity over the target area. While Dog orbited on its new station, Charlie at 0957 approached within approximately 3 nmi (5.6 km) of the target center. It then began traversing the target area in a series of parallel sweeps, flying normal to the wind direction, and covering a rectangle roughly 6 by 5 nmi (11 by 9 km) whose center was the target area.

The path of the sweeps along the rectangle were not regular, however, since the seaplane was also instructed to reduce progressively the distance of the sweeps from the radioactive area. Also, if high levels of radioactivity were encountered, the PBM was to turn abruptly, circle upwind, and turn back from the next sweep along the rectangular course. On completion of the runs at 2,000 feet (610 meters), Charlie dropped down to 1,000 feet (305 meters) at 1045 and carried through a series of similar sweeps at the new altitude. At 1126 the altitude was lowered to 500 feet (152 meters) and the pattern of radiological sweeps again was repeated.

As soon as Charlie had completed 1 sweeps at one altitude, Dog moved in and carried through the same pattern of operation. Dog commenced its 2,000-foot (610-meter) sweeps at 1055, its 1,000-foot (305-meter) sweeps at 1140, and its 500-foot (152-meter) sweeps at 1231. On completion of these flights, both seaplanes made radiological runs over the target area. At 1310 Dog flew directly over the target area at 3,000 feet (914 meters). Additional sweeps over the target area at varying altitudes were continued until 1402 when Charlie departed for Enewey and until 1427 when Dog departed (Reference C.9.206, pp. VII-(E)-173 and VII-(E)-174).
The three Dumbo seaplanes of TU 1.6.33 continued to stand by for air-sea rescue calls. At 0806, Dumbo-3 reported its Geiger-Mueller counter was out of order. When Dumbo-4, the standby PBM at Ebeeye, was ordered as a replacement, it reported having no counter. Nonetheless, Dumbo-3 was ordered to return to Ebeeye. Dumbo-2 was shifted to the position over Wotho, and Dumbo-1 was transferred to Orbit Point Uncle. The seaplanes remained on station until 1425 at Uncle and 1455 over Wotho (Reference C.9.206, p. VII-(E)-174).

In addition to providing air transportation between Ebeeye and Bikini in the period between the two tests, TU 1.6.32 prepared six PBMs to perform assignments similar to those executed on ABLE day. It also prepared two new seaplanes for participation in shot BAKER, namely Charlie-2 (a radiological reconnaissance PBM) and Eagle Eye (a special observation PBM) (Reference C.9.206, VII-(E)-190).

TU 1.6.33 continued its air-sea rescue and transportation mission between the two tests. For BAKER its mission was altered to provide two PBM air-sea rescue standby aircraft, Dumbo-4 and Dumbo-5, in addition to the three air-sea rescue seaplanes that had participated in ABLE (Reference C.9.206, p. VII-(E)-190).


A VPB-32 radiological reconnaissance seaplane (Dog) taking off at 0501 was the first Navy aircraft to depart from Ebeeye for Bikini on 25 July for BAKER operations. It was followed at 0516 by a second radiological reconnaissance seaplane (Charlie-1). By 0655 both Dog and Charlie-1 were orbiting on their assigned stations at Orbit Point Able, bearing 45°T, 20 nmi (37 km) from the target center. Meanwhile three photographic seaplanes (Tare, Uncle, and William) were airborne between 0527 and 0542. By 0705 all had reported on station at Orbit Points Charlie, King, and Dog, respectively, each 9 nmi (17 km) from the target center. Tare and Uncle orbited in loose formation at 12,000 feet (3.7 km) bearing 180° and 215°, respectively, and William at 3,000 feet (914 meters) bearing 325°. The radiometry seaplane departed at 0505 and at 0645 was on station at Orbit Point Yoke bearing 45°T, 7 nmi (13 km) from the target center. The observation PBM (Eagle Eye) had replaced one of the Army C-54s that had performed a similar mission in shot ABLE. Eagle Eye was off the water at 0545 and at 0713 was at its station approximately 10 nmi (18.5 km) from the target center, bearing 285°T at 8,000 feet (2.4 km) (Reference C.9.206, p. VII-(E)-20).

Three air-sea rescue seaplanes also took off from the lagoon at Ebeeye during the same interval. Dumbo-1 was airborne at 0510 and at 0646 arrived at its station at Orbit Point Love, bearing 315°T, 20 nmi (37 km) from the target center at 3,000 feet (914 meters). Dumbo-2 departed at 0513 and at 0647 assumed its position at Orbit Point Able, bearing 45°T, 20 nmi (37 km) from the target center at 3,000 feet (914 meters). Dumbo-3 departed last at 0617 and at 0709 was on station at 7,000 feet (2.1 km) over Wotho Atoll, 90 nmi (167 km) from the target center (Reference C.9.206, p. VII-(E)-210).
The radiometry seaplane at 0833, from its orbit point at 9,500 feet (2.9 km), 7 nmi (13 km) from the target center, took up a course heading 335°T so that the point of detonation was within 5° of the bore-sighted axis of the radiometric equipment. Remaining at the same altitude, successful operation of the radiometric, photometric, and spectrographic equipment was accomplished before its departure from the area at 0852 (Reference C.9.206, p. VII-(E)-214).

One minute before the detonation, three seaplanes (Tare, Uncle, and William) moved from their orbit points to positions tangent to a circle approximately 8 nmi (15 km) from the target center. Tare and Uncle then flew a counterclockwise course from 12,000 feet (3.7 km), generally along the periphery of the circle. Each plane flew at approximately 135 knots (250 km/hr) taking synchronized photographs of the waves and water column thrown up by the explosion. Seaplane Tare at 0834 and 0845 also transmitted synchronized signals in order to induce simultaneous operation of the airborne and ground tower cameras. The three PBMs completed their runs by 0907 and immediately departed for Ebeye (Reference C.9.206, p. VII-(E)-214).

The observation seaplane (Eagle Eye) was on course 285°T at 7,900 feet (2.4 km), approximately 10 nmi (18.5 km) from the target center at the time of detonation. It orbited the same general position until 0908 when it returned to Ebeye (Reference C.9.206, p. VII-(E)-216).

Two radiological reconnaissance seaplanes (Charlie-1 and Dog) were orbiting at 2,000 feet (610 meters), 20 nmi (37 km) from the target center at H-hour. Immediately after the explosion, Charlie-1 proceeded to a position 5 nmi (9.3 km) upwind from the target center and then approached within approximately 3 nmi (5.6 km) at 4,000 feet (1.2 km). At 0915 it began traversing the radioactive area in a series of sweeps along parallel tracks normal to the wind direction, covering a rectangle roughly 6 by 5 nmi (11 by 9 km). The paths of the sweeps were not regular because the course was shifted each time a radioactive area was encountered. Charlie-1 made sweeps at 3,000, 2,000, 1,000, and 500 feet (914, 610, 305, and 152 meters). It then orbited the target array at 500 feet (152 meters) from 4 nmi (7.4 km) before departing for Ebeye at 1304 after being relieved by Charlie-2 (Reference C.9.206, p. VII-(E)-218).

PBM Dog in the meantime had first made sweeps over the area occupied by the JTF 1 vessels northeast of Bikini Atoll and reported on the radioactivity encountered. As Charlie-1 reported completing each sweep over the target area, Dog came in at 1008 and flew four similar flight patterns at the same altitudes. After completing its radiological sweeps at 1214, Dog orbited over the target area and photographed the damaged and sinking Saratoga between 1215 and 1319 and then departed for Ebeye. Charlie-2 relieved Charlie-1 at 1258. At 1330 and 1334 it made photographic runs over Saratoga and at 1400 began the first of two photographic runs over the target array at 1,500 feet (457 meters). After descending to 1,000 feet (305 meters), Charlie-2 made eight radiological reconnaissance surveys over the radioactive area between 1425 and 1506. It executed a sonar run 2 nmi (3.7 km) west of the target area between 1535 and 1545 at 400 feet (122 meters). From 1,000 feet (305 meters), photographs of the sinking of Saratoga were taken between 1552 and 1610. Charlie-2 departed for Ebeye at 1615 (Reference C.9.206, p. VII-(E)-219).
No rescues were necessary. The air-sea rescue seaplanes left the area as follows: Dumbo-3 at 0952, Dumbo-2 at 1120, and Dumbo-1 at 1243. Dumbo-4, which relieved Dumbo-1 at 1243, remained on station until 1619 (Reference C.9.206, p. VII-(E)-219).

Task Unit 1.6.4 (Seaplane Tender Unit, Bikini)

The mission of TU 1.6.4 was to provide tender and air transport terminal services for seaplanes at Bikini Atoll. It was based from the seaplane tender USS Orca (AVP-49).

Orca arrived at Bikini Lagoon on 7 May 1946 to assume its assigned duties. It was felt, however, that provision should be made for air-sea rescue units both at Bikini and Kwajalein in case of takeoff accidents. By 15 June an AVR air-sea rescue boat had been obtained for Bikini Lagoon. During operating hours the boat was stationed at the seaplane runway. Once in the morning and again in the late afternoon it made sweeps of the area to be sure the takeoff space was clear. About this time Commander, Marianas, requested Commander in Chief, Pacific (CINCPAC) to furnish two destroyers for air-sea rescue service at Kwajalein. One to be stationed within the lagoon and the other in the ocean near the runway. CINCPAC replied that the destroyers were not available in the Pacific Fleet. It was necessary to assign vessels from JTF 1 to patrol the entrance to Kwajalein Lagoon for air-sea rescue duty (Reference C.9.206, p. VII-(E)-26). LCI(L)-977 from TU 1.8.3 (Dispatch and Boat Pool Unit) was assigned this duty.

SHOT ABLE. On 30 June the last seaplane cleared Bikini Lagoon at 1534. At 1648 Orca moved from the lagoon to its station in area Paige near reference Point Nan, bearing 0°T, 20 nmi (37 km) from the center of Bikini Island.

SHOT BAKER. On 24 July the last seaplane from Bikini Island landed at Ebeye at 1614 (Reference C.9.206, p. VII-(E)-208).

Other Navy Air Groups

Carrier Aircraft Service Unit (Fleet) 34 (CASU[F]-34). Located on Ebeye, CASU(F)-34 performed maintenance for aircraft of the Seaplane Unit (TU 1.6.3) (Reference C.9.206, p. VII-(E)-190).

VPW-1. This unit sent at least four Navy PB4Y-2s under Commander, Kwajalein Atoll, to assist in weather reconnaissance and air-sea rescue missions (Reference C.9.206, p. VII-(E)-190). The detachment at Kwajalein was recalled to Agana, Guam, on 12 August 1946. This unit was airborne on shot days, but flew weather reconnaissance flights well away from the test area.

VPB-116. With VPW-1, VPB-116 assisted in weather reconnaissance and air-sea rescue missions using 12 PB4Y-2 aircraft under Commander, Kwajalein Atoll (Reference C.9.206, p. VII-(E)-190). This unit was not airborne on shot days.

Carrier Aircraft Service Unit 8 (CASU-8). This unit performed aircraft maintenance on the PB4Y-2s from VPW-1 and VPB-116 at NAB Kwajalein (Reference C.9.206, p. VII-(E)-190).
Approximately 580 Marines participated at Bikini and Kwajalein during Operation CROSSROADS. Participation by the U.S. Marine Corps primarily involved photographic duties and security guard duties. They provided security on Aomen, Bikini, and Eneu islands at Bikini Atoll, on Kwajalein Island, and aboard certain task force ships. Approximately 155 Marines were aboard USS Saidor (CVE-117). According to a CROSSROADS participant there were three different Marine units/groups aboard the ship (Reference C.12.5):

- A detachment of Marine Fighter Squadron (VMF-513), based out of San Diego, California. Primarily, this was an aircraft maintenance detachment that was responsible for the aircraft of a Navy photographic detachment aboard Saidor.
- Marines who were part of the ship's air department.
- Twenty-eight enlisted Marines who were listed as Marine photographic personnel and who were transported by Saidor. Some were administratively assigned to VMF-513 and some to USS Wharton (AP-7).

Saidor was part of Task Unit 1.6.2 (Photo Carrier Unit), which trained air crews for the bomb tests. This unit conducted aerial photo operations, operated helicopters for radiological reconnaissance, conducted aerial control of drone boats, and operated a photo laboratory on board (Reference C.9.206, p. VII-(E)-14; Reference C.12.5). Movie crews aboard Saidor also filmed the target array and provided documentary coverage of the fleet and the visit of Commander Joint Task Force 1 to Rongerik Atoll (Reference B.7.1).

A Marine guard detachment at Bikini Atoll was furnished by Marine Ground Forces. A total of 36 Marine guards were stationed on Bikini Island, 6 each were on Aomen and Eneu islands.

A provisional Marine detachment at Enewetak had a total of 107 Marines. This unit was a heavy antiaircraft detachment whose duties were not directly related to CROSSROADS (Reference C.11.14).

Provisional detachments and normal Marine detachments were on a number of task force ships (Table 17) (Reference C.13.8). Duties primarily involved ship security.

Badge readings have not been located for Marine Corps personnel who participated in Operation CROSSROADS.
Table 17. Provisional and U.S. Marine Corps detachments aboard CROSSROADS vessels.

<table>
<thead>
<tr>
<th>Ship</th>
<th>No. of Marines</th>
<th>Ship</th>
<th>No. of Marines</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Albemarle (AV-5) (MD)</td>
<td>28</td>
<td>USS Mt. McKinley (AGC-7) (MD)</td>
<td>47</td>
</tr>
<tr>
<td>USS Bayfield (APA-33) (TQM)</td>
<td>1</td>
<td>USS Ottawa (AKA-101) (TQM)</td>
<td>1</td>
</tr>
<tr>
<td>USS Bexar (APA-237) (TQM)</td>
<td>2</td>
<td>USS Rockbridge (APA-228) (TQM)</td>
<td>2</td>
</tr>
<tr>
<td>USS Bottineau (APA-235) (TQM)</td>
<td>2</td>
<td>USS Rockingham (APA-229) (TQM)</td>
<td>1</td>
</tr>
<tr>
<td>USS Cumberland Sound (AV-17) (MD)</td>
<td>20</td>
<td>USS Rockwall (APA-230) (TQM)</td>
<td>1</td>
</tr>
<tr>
<td>USS Fall River (CA-131) (MD)</td>
<td>48</td>
<td>USS Rolette (AKA-99) (TQM)</td>
<td>4</td>
</tr>
<tr>
<td>USS George Clymer (APA-27) (TQM)</td>
<td>2</td>
<td>USS St. Croix (APA-231) (TQM)</td>
<td>2</td>
</tr>
<tr>
<td>USS Henrico (APA-45) (TQM)</td>
<td>2</td>
<td>USS Shangri-La (CV-38) (MD)</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td></td>
<td>USS Wharton (AP-7) (MD)</td>
<td>30</td>
</tr>
</tbody>
</table>

Legend: MD -- Marine Detachment, TQM -- Transport Quartermaster
CHAPTER 11
PARTICIPATION OF OTHER GOVERNMENT AGENCIES, CONTRACTING FIRMS, AND UNIVERSITIES

Many civilians from government agencies, contracting firms, and universities assisted the military personnel in Operation CROSSROADS. Civilians had played the major role in the development of atomic weapons during the war and civilian assistance at CROSSROADS was an important element in the scientific aspects of the tests. CROSSROADS occurred during a time of massive demobilization following World War II. There was also an acute shortage of specialists, including radiological safety (radsafe) monitors, who had to be recruited from universities with promises made that they would be returned before the start of the school year. Operation CROSSROADS called upon many of the nation’s leading civilian scientists. The educational background of some of these scientists serving in the Radiological Safety Section for Test ABLE are enumerated below (Reference C.9.206, p. VII-(C)-6):

<table>
<thead>
<tr>
<th>Number</th>
<th>Area of Advanced Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Medicine</td>
</tr>
<tr>
<td>20</td>
<td>Physics</td>
</tr>
<tr>
<td>19</td>
<td>Chemistry</td>
</tr>
<tr>
<td>7</td>
<td>Biology</td>
</tr>
<tr>
<td>12</td>
<td>Engineering</td>
</tr>
<tr>
<td>3</td>
<td>Anatomy</td>
</tr>
</tbody>
</table>

Roles played by the various participating government agencies, contracting firms and universities are discussed below.

GOVERNMENT AGENCIES

U.S. Army Manhattan Engineer District. This organization was officially established on 13 August 1942, although its organization had been in process for 2 months before. The Manhattan Project developed and produced the atomic bombs used in World War II and at CROSSROADS. After the passage of the Atomic Energy Act of 1946, the Manhattan Engineer District was dissolved at the end of 1946, and its contracts, facilities and management responsibilities were transferred by the Army to the Atomic Energy Commission, which was activated 1 January 1947 (Reference C.9.208, pp. 3.10 ff; Reference C.8.1, pp. 6 through 15).

After the formal creation of Joint Task Force 1 (JTF 1), Manhattan Engineer District assisted principally through the 013E Los Alamos Group and the 013H Radioactivity Group. It also supplied the Technical Director as well as 27 observers for shot ABLE and 21 for shot BAKER. These personnel were berthed aboard USS Cumberland Sound (AV-17). Two individuals were badged and had zero readings. Three of its laboratories participated in CROSSROADS and the 1947 Bikini Scientific Resurvey; these are discussed
immediately below. All Bikini Resurvey personnel had film badges and none recorded greater than the daily tolerance limit of 0.1 R.

**Argonne National Laboratory.** This laboratory, operated by the University of Chicago, provided one scientist for the 1947 Bikini Resurvey’s Radiochemistry and Radiophysics Group to investigate the presence and dispersal of plutonium and fission products and to study the vertical distribution of radioactivity in rocks (Reference C.8.1, pp. 6 through 15; Reference B.0.18).

**Clinton Laboratories, Oak Ridge, Tennessee.** On 20 May 1946, ten scientists from Clinton Laboratories were scheduled to attend CROSSROADS as part of the Radiological Safety Section. Eight personnel were badged, with a high of 0.30 R and an average exposure of 0.10 R. Clinton Laboratories also provided a physicist for the Bikini Resurvey’s Radiochemistry and Radiophysics Group to investigate the presence and dispersal of plutonium and fission products and to study the vertical distribution of radioactivity in rocks (Reference C.8.1, pp. 6 through 15; Reference B.0.18).

**Los Alamos Laboratory.** This group was responsible for preparing timing and firing devices, assembling and delivering the bomb, measuring certain phenomena, and determining yield of weapons. It was responsible to three different groups: the Technical Director, the Director of Los Alamos Laboratory, and the Deputy Task Force Commander for Technical Direction. This group consisted of 124 personnel including civilian consultants from universities, three Army officers, and two Navy officers. They were berthed aboard Cumberland Sound and USS Albemarle (AV-5). Five senior scientists served on the Medico-Legal Board. In addition, 63 personnel were assigned to the Radiological Safety Section as of 20 May. Of this group, 38 were badged. Fifteen of these had exposures of zero, the high was 0.94 R, and the average was 0.17 R.

**U.S. Department of Interior -- Fish and Wildlife Service.** The Fish and Wildlife Service designated three scientists and three fishermen to assist in fish surveys at Bikini prior to the tests. The unit collected specimens and identified fish in the shallows of the reef and in the lagoon. The unit operated from YMS-413 (see Appendix A for details). After tests ABLE and BAKER, the unit caught live fish and recovered dead fish for studies. No one was badged. The three scientists, plus eight additional scientists, also participated in the Bikini Resurvey in 1947. All persons were badged during the resurvey (Reference C.9.208, p. 3.11; Reference C.8.1, pp. 6 through 15).

**U.S. Geological Survey (USGS).** USGS personnel worked with the Oceanography Group and investigated the physiography, geology, and ecology of Bikini Atoll. USGS provided four scientists for CROSSROADS and the 1947 Bikini Resurvey to study ecology of reef-building organisms such as algae and corals and the effects of radiation upon them. None were badged for CROSSROADS. Personnel participating in the resurvey were badged (Reference C.9.208, p. 3.11; Reference C.8.1, pp. 6 through 15).
Smithsonian Institute. Smithsonian Institute cooperated with the Oceanography Group studying biological and oceanographic phenomena at Bikini. The institute provided two scientists to make fish surveys and study littoral and land animals, reef, lagoon, fish, algae, seed plants, and plankton at Bikini Atoll. These two plus two additional scientists also participated in the Bikini Resurvey to study the possible radiological effects upon the development of invertebrates and physiology of marine and other plant life. None were badged at CROSSROADS. Personnel on the resurvey were badged (Reference C.9.208, p. 3.11; Reference C.8.1, pp. 6 through 15).

Federal Security Agency -- National Cancer Institute. An unknown number of personnel from the National Cancer Institute helped the Director of Ship Material (DSM) Medical Group by providing mice for radiation experiments (Reference C.9.208, p. 3.11; Reference C.8.1, pp. 6 through 15).

The National Institute for the U.S. Public Health Service. This organization assisted the DSM Group and provided three public health service officers to the 013 Radioactivity Group. The officers were berthed aboard USS Haven (AH-12) and served as radsafe monitors part of the time. Two were badged; one had zero reading and the other had 0.06 R (Reference C.9.208, p. 3.10 ff; Reference C.4.1).

Department of Commerce -- National Bureau of Standards (NBS). NBS personnel assisted the Remote Measurements Group in attempts to detect nuclear detonations from remote locations in Projects 11, 12, and 16 of Program VIII (see Appendix C). Individual field groups were located at Honolulu, Hawaii; Kwajalein Island; Enewetak Atoll; Wake, Guam and Midway islands; Manila, Philippines; Nome, Sitka, Juneau, and Anchorage, Alaska; Bozeman, Montana; Santa Ana, San Francisco, and San Leandro, California; Seattle, Washington; Portland, Oregon; Tucson, Arizona; Kingsville, Texas; Grand Island, Nebraska; Rapid City, South Dakota; St. Louis, Missouri; Chicago, Illinois; Australia; Peru; San Juan, Puerto Rico; Germany; and Washington, D.C. The total number of personnel involved is unknown (Reference C.9.208, p. 3.45; Reference B.2.1).

U.S. Coast & Geodetic Survey (USCGS). USCGS personnel supported the Oceanography Group by investigating tides and strong seismic disturbances. They made seismic measurements at Kwajalein, Wake, and Midway islands; Honolulu, Hawaii; Sitka, Alaska; San Juan, Puerto Rico; and Tuscon, Arizona. They also sent a party to survey the general layout of Bikini Atoll before CROSSROADS. The total number of personnel involved is unknown (Reference C.9.208, p. 3.12; Reference B.2.1).

Treasury Department -- U.S. Coast Guard. The Coast Guard furnished two vessels, USCG Bramble (WAGL-392) and USCG Red Bud (WAGL-398), and personnel. Bramble laid navigation buoys at Bikini and was to survey the effects of nuclear tests on fish and wildlife and to conduct oceanographic surveys to determine the characteristics of ocean currents inside and around the atoll. Red Bud assisted in a brief survey of western islands of Bikini Atoll before CROSSROADS. These vessels operated as part of Task Unit 1.8.5 (Survey Unit). Bramble had 49 crew members and operated at Bikini Atoll from 6 July through 24 August (Reference C.9.208, p. 3.12).
CONTRACTORS, UNIVERSITIES, AND OTHER DOMESTIC ORGANIZATIONS

In addition to military and nonmilitary Federal agencies, there were also private groups who participated in CROSSROADS. Their organizations and activities are described briefly below, along with industrial organizations that either participated directly or indirectly by supplying personnel and equipment.

American Red Cross. Three Red Cross representatives were assigned on the U.S. Army ship David C. Shanks (AP-180). None were badged (Reference B.2.1).

Bell Telephone Laboratories. Two people from this organization were attached to the Staff of the Electronics Coordinating Officer and assigned to USS Begor (APD-127). Neither was badged (Reference C.9.208, pp. 3.12; Reference B.0.18).

Carbide and Carbon Chemicals Corporation (C&C Co). Twenty-six employees of C&C Co. were selected to serve in the Radiological Safety Section at CROSSROADS. Of this group, 15 were badged. Four had recorded exposures of 0 R. The high exposure was 1.06 R, and the average for the group was 0.366 R.

Carnegie Institute. Personnel from Carnegie participated in Project VIII-9, Terrestrial Magnetism. Locations were Honolulu, Hawaii; Sitka, Alaska; Tuscon, Arizona; Cheltenham, Maryland; San Juan, Puerto Rico; Huancayo, Peru; and Watheroo, Australia. Number of personnel involved is unknown (Reference C.9.208, p. 3.45).

Columbia University. One professor from Columbia served in the Radiological Safety Section. His recorded exposure was 0 R.

Cleaver Brooks Co. This company provided a technician and an assistant to repair distillation units at Bikini. Neither was badged. (Reference C.9.206, p. VII-(A)-104).

Cornell Aeronautical Laboratory. This laboratory provided engineering services and telemetering equipment, plus electronics and four engineers for CROSSROADS and one engineer for the Bikini Resurvey's Underwater Photography and Television Group. Two were badged for CROSSROADS and had zero readings. Everyone in the Resurvey Group was badged (Reference C.8.1, pp. 6 through 15; Reference B.0.18).

Eastman Kodak Co. Three scientists from Kodak were part of the Radiological Safety Section. One member of this group also served on the Medico-Legal Board. The recorded exposures for the three personnel were 0.15 R, 0.16 R, and 0.24 R.

Fairbanks Morse & Co., Beloit, Wisconsin. This company provided spare parts and a technician to repair main power plants at Kwajalein. It is unknown if this person was badged. (Reference C.9.206, pp. VII-(A)-96 ff.).

Fairchild Camera & Instrument Co., Jamaica, New York. This company was contracted to provide steel boxes for housing batteries of cameras to be installed on photographic towers. It is unknown if personnel from this company were at Bikini. (Reference C.9.206, p. VII-(A)-96).

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Franklin Institute’s Bartol Research Foundation. One physicist from the organization was in the Bikini Resurvey’s Radiochemistry and Radiophysics Group to investigate the presence and dispersal of plutonium and fission products and to study the vertical distribution of radioactivity in rocks. He was badged (Reference C.8.1, pp. 6 through 15; Reference B.0.18).

G.E. Failing Co. Under Navy contract for drilling operations at Bikini, this company also provided eight personnel for the Bikini Resurvey in 1947. Approximately nine individuals participated at Bikini during CROSSROADS. None were badged (Reference C.9.208, pp. 3.12 and 3.13; Reference B.2.1).

Geotechnical Corp., Dallas, Texas. This corporation made seismic measurements. It is unknown if any personnel were provided at Bikini (Reference C.9.208, pp. 3.12 and 3.13; Reference B.2.1).

Lenox Hill Hospital. An expert in radiological physics was sent from Lenox Hill Hospital in New York. He served in the Radiological Safety Section. His recorded exposure was 0 R.

Massachusetts Institute of Technology (MIT). Three scientists from MIT were assigned to the Radiological Safety Section at CROSSROADS. All were badged; two had exposures of 0 R, and one had an exposure of 0.36 R. MIT also provided three research associates for the Bikini Resurvey’s Radiochemistry and Radiophysics Group to investigate the presence and dispersal of plutonium and fission products. All three were badged (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

Monsanto Corporation. One representative from Monsanto was selected to work in the Radiological Safety Section. He was not badged.

Princeton University. The university provided engineering services and telemetry equipment. Five personnel were assigned to USS Avery Island (AG-76). Two were badged. The highest reading was 0.10 R (Reference C.9.208, pp. 3.12 and 3.13; Reference B.0.18).

Raytheon Corp., Waltham, Massachusetts. Raytheon provided engineering services for sonar and radar electronic equipment. They also provided eight personnel assigned to Avery Island and attached to the Staff of the Electronics Coordinating Officer. All eight were badged. The highest reading among them was 0.35 R (Reference C.9.208, pp. 3.12 and 3.13; Reference B.0.18).

Scripps Institution of Oceanography. Scripps provided technical personnel, including one radiate monitor during CROSSROADS. Two oceanographers were provided for the Bikini Resurvey. No one was badged during CROSSROADS (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

Stanford Research Institute (SRI). One physiologist to study radiological effects on developing invertebrates and other plants came from SRI. He was not badged (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

Stanford University. Four scientists from Stanford were involved in the Bikini Resurvey to investigate population studies of reef, lagoon, and pelagic
fishes. Everyone in the resurvey was badged (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

University of Chicago. Twenty-four professors and graduate students from the University of Chicago were selected to serve in the Radiological Safety Section. Of this group, 16 were badged, with a high exposure of 0.38 R. Nine individuals had exposures of 0 R, and the average recorded exposure was 0.072 R.

University of Minnesota. The university provided a physiological chemist for the Bikini Resurvey's Radiochemistry and Radiophysics Group to investigate the presence and dispersal of plutonium and fission products and to study the vertical distribution of radioactivity in rocks. Everyone in the resurvey was badged (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

University of Notre Dame. Notre Dame provided two chemistry professors for the Bikini Resurvey's Radiochemistry Group to investigate the presence and dispersal of plutonium and fission products. Both were badged (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

University of Rochester. Twenty professors and graduate students were selected to work in the Radiological Safety Section at CROSSROADS. Many in this group were medical doctors or dosimetry experts. Of the 22, 10 were badged. Six had recorded exposures of 0 R. The remaining exposures were 0.017 R, 0.04 R, 0.05 R, and 0.72 R.

University of Tennessee. This university provided one zoology professor and one agronomy professor for the Bikini Resurvey's Radiochemistry and Experimental Biology Group. Both were badged for the resurvey (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

University of Washington, Applied Fisheries, Seattle, Washington. This organization supplied three scientists on board Haven as radsafe monitors. Only one person was badged and he recorded an exposure of 0.4 R. In addition, Applied Fisheries also provided eight more scientists for the Bikini Resurvey to study the effects of radiation in living forms in and around the atoll. They also did comparative studies of radiation in different plants and animal groups and comparative studies on distribution of radioactive material in organs and tissues plus histological studies of various fish tissues. All personnel for the resurvey were badged; (Reference C.8.1, pp. 6 through 15; Reference C.9.208, p. 3.13).

University of Wisconsin. The university provided a research associate for the Bikini Resurvey's Radiochemistry and Radiophysics Group to investigate the presence and dispersal of plutonium and fission products and to study the vertical distribution of radioactivity in rocks. He was badged (Reference C.8.1, pp. 6 through 15; Reference B.0.18).

Victoreen Corporation. Victoreen manufactured Geiger counters. Three employees of Victoreen were asked to be part of the Radiological Safety Section. Two had recorded exposures -- one was 0 R and the other was 0.21 R.
Western Electric Co. This company provided one person to the staff of the Electronics Coordinating Officer. He was assigned to Avery Island and was not badged (Reference C.9.208, pp. 3.12 and 3.13; Reference B.0.18).

Westinghouse Co. Westinghouse provided two personnel attached to the staff of the Electronics Coordinating Officer. One was assigned to Avery Island and the second is indicated as having assignment on the target ship USS Bracken (APA-64). Neither was badged (Reference C.9.208, pp. 3.12 and 3.13; Reference B.0.18).


OBERVERS

A large number of military and civilian scientists, both foreign and domestic observers, witnessed CROSSROADS. The Transport Group, Task Group 1.3, provided facilities for observers and the press. Task Unit 1.3.2 (Press Unit) consisted of USS Appalachian (AGC-1) and Spindle Eye, an Army press ship operating out of Kwajalein Island. The majority of the press were transported to Bikini aboard Appalachian and were berthed aboard. Others were berthed on USS Mount McKinley (AGC-7), USS Panamint (AGC-13) (the observers ship), USS Saidor (CVE-117) (photographic headquarters ship), and at Kwajalein Island at the Press Branch Headquarters. The following is the breakdown of press observers for tests ABLE and BAKER (Reference C.9.208, p. 3.14):

<table>
<thead>
<tr>
<th>Number at ABLE</th>
<th>Number at BAKER</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Press Representatives (radio, pictorial services, magazines, etc.)</td>
<td>114</td>
</tr>
<tr>
<td>Foreign Press</td>
<td>10</td>
</tr>
</tbody>
</table>

In November 1945 the British Admiralty Delegation requested that a small group of British scientists be permitted to participate in the planning and execution of CROSSROADS. The U.S. Joint Chiefs of Staff decided on 5 December 1945 to invite British scientists. A total of nine scientists participated in blast pressure phenomena, physiological effects, radiation measurements, and effects on electronic equipment. A total of five personnel were badged. The highest was reading 0.12 R (Reference C.9.208, p. 3.13).

Table 18 is a summary of the observers (Reference C.9.208, pp. 3.12 and 3.13; Reference B.0.18).
Table 18. CROSSROADS observers.

<table>
<thead>
<tr>
<th>Group</th>
<th>ABLE</th>
<th>BAKER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. Senate&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>U.S. House of Representatives&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>U.S. Army</td>
<td>61</td>
<td>55</td>
</tr>
<tr>
<td>U.S. Navy</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Civilian scientists</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Foreign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Membership in UN AEC (Australia, Brazil, Canada, China, France, Egypt, Great Britain, Mexico, Netherlands, Poland, and USSR)</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>British</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Canadian</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Note:
<sup>a</sup>One was badged with zero exposure.

Source: Reference C.9.208, pp. 3.16 and 3.17.
CHAPTER 12
PERSONNEL EXPOSURES

The total exposure to ionizing radiation of participating personnel during atmospheric nuclear testing was the sum of their exposures resulting from activities that required them to undertake missions in radioactive areas or to deal with radioactive materials, and of exposures resulting from increased background radiation in normally nonradioactive areas. These latter might be created by fallout or as in CROSSROADS by a buildup of radioactivity in the support ships. This buildup resulted from radioactively contaminated lagoon water passing through the ships' saltwater plumbing systems where some radioactivity was retained and by radioactive material being retained by marine growth on the ships' hulls.

FILM BADGE DOSIMETRY PROGRAM

The device used to record individual exposures, the film badge, was used exclusively for personnel involved in missions that had radiation exposure potential. The Operation Plan defined the CROSSROADS personnel who were to wear badges and under what conditions. All radsafe monitors and assistant monitors were to wear them when entering potentially radioactive areas. Crewmembers of aircraft airborne within 20 nmi (37 km) of surface zero from H-2 until H+30 were all to wear badges. The Operation Plan also stated that monitors were to provide film badges to persons entering radioactive areas (Reference B.0.1, pp. E-II-1, E-II-8, and E-IV-2). Badges were to be collected daily, developed, read, and an exposure record maintained (Reference B.0.1, pp. E-X-2 and E-X-3). CROSSROADS film badges usually were issued for 1 day, but issue periods of 2, 3, or as many as 9 days have been noted.

In practice, badging for personnel other than the monitors and certain aircrews was more complete for personnel doing tasks with an obviously high potential for exposure, such as test-day surveys, initial boarding of target vessels, recovery of test animals, and early recovery of instruments, than for those engaged in other activities. For example, 50 percent of the crewmembers of PGMs and LCPLs on lagoon patrol (Program V, Project 3) were to be badged (Reference B.0.1, p. E-II-6). During early August, before decontamination of ships at Bikini was stopped, an average of about 100 unbaged personnel worked on USS Salt Lake City (CA-25) in three 2-hour shifts. Each shift was assigned two monitors who surveyed working areas to provide information concerning the time allowed in each area before a tolerance exposure was accrued (Reference C.11.16).

All personnel not badged on these missions were, however, accompanied in the potential exposure areas by monitors equipped with radiation detection instruments. The monitor's function was to guide the work parties away from radiologically "hot" areas and determine safe stay times in work areas. His pocket dosimeter or film badge recorded a representative exposure for the group he accompanied.
A total of 18,775 badges were issued during CROSSROADS at Bikini and at Kwajalein through 31 December 1946. Almost 11 percent of the badges were issued on ABLE-day and about 7 percent on BAKER-day, or the days immediately following each shot. About 38 percent were issued during August when target vessels were being reboarded for decontamination and damage inspection.

Through July and August, 10,431 personnel badges were issued. Most of the remaining 8,344 badges were issued during September and October. Because most badges were issued for only 1 day, some individuals received more than one badge. The number of individuals receiving badges is not presently available, but the Navy Department currently estimates that up to 15 percent of the personnel received at least one badge.

Badge-Recorded Exposures After ABLE

Due to the small amount of radioactive contamination as a result of Test ABLE, 47 of the target ships had been declared clear of radiation by the evening of 2 July. The lagoon was reported as less than 0.1 R/24 hours at 1008 on 2 July. By the end of 4 July most of the target ships had been remanned by their crews. As a consequence of this rapid clearing of residual radiation, the number of persons issued badges and recorded exposures decreased rapidly in the days after the detonation, even though much work was done in recovering test data and in readying the target fleet for BAKER. Post-ABLE exposures are summarized in Table 19. From 8 until 24 July, the day before BAKER, only nine badges were issued each day (Reference C.13.6). Ninety-three percent of all film badges issued between 1 and 7 July read 0 R (gamma).

Table 19. Badge issues and exposures following Test ABLE, CROSSROADS.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Badges Issued</th>
<th>No. of Badges with Zero Exposure</th>
<th>No. of Badges Exceeding 0.1 R</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July (ABLE Day)</td>
<td>1,627</td>
<td>1,501</td>
<td>6</td>
</tr>
<tr>
<td>2 July</td>
<td>274</td>
<td>264</td>
<td>2</td>
</tr>
<tr>
<td>3 July</td>
<td>107</td>
<td>105</td>
<td>1</td>
</tr>
<tr>
<td>4 July</td>
<td>90</td>
<td>85</td>
<td>0</td>
</tr>
<tr>
<td>5 July</td>
<td>16</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>6 July</td>
<td>18</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>7 July</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>2,132</td>
<td>1,988</td>
<td>9</td>
</tr>
</tbody>
</table>

Note:

\(0.1\) R was daily tolerance dose.
Badge-Recorded Exposures after BAKER

After BAKER in late July and early August, while efforts were made to find an effective means of decontamination, task force personnel were severely restricted in reboarding target vessels by high and persistent levels of radioactivity in the lagoon water in the area of the target array and on the target vessels themselves. As a consequence, the number of badges issued was low during this period.

On 4 August the Director of Ship Material issued fairly detailed instructions for ship decontamination (Reference C.9.185, pp. 4 through 13). The decontamination effort then expanded and with it the number of men issued badges.

The number of badges issued then dropped abruptly after the decision on 10 August was made to end decontamination of the target vessels and limit activities aboard them to recovery of instruments, ship inspection, salvage work, and preparations for towing vessels from the area. However, the number of badges issued then increased as the number of personnel involved with ship inspections grew and towing activity increased. For the rest of the month, the trend of badges issued was downward as target ship and support ship crews departed Bikini. By the end of August most of the support ships had left Bikini. Table 20 summarizes the badge issues and recorded exposures during this period.

The CROSSROADS Bikini badge readings were entered into standard government ledger books, along with certain associated information. The data-recording had several shortcomings. Given names or initials were included with only about half of the last names, and therefore when several entries containing only the same last name are found, it cannot be determined whether they represent the badge reading of one person or several with the same last name. Poor penmanship and spelling on the part of the clerks making the entries further complicates identification. Although a ship's name was usually entered along with a person's name, it is not always clear whether the ship named was the one on which the man lived or the one on which he worked as he wore the badge. However, the target ships with few exceptions were not remanned, so if a target ship is named in the ledger it was the place where the exposure occurred.

Other information has been used to supplement the old dosimetry records. Ships' logs, muster rolls, and other personnel lists have been compared with the ledger records in an effort to identify all those who were badged and to accurately total each individual's recorded exposure. Use of these other sources has matched from 85 to 90 percent of the Navy badges with individuals.

Badge-Recorded Exposures at Kwajalein

During the ammunition off-loading and inspection phase of the operations at Kwajalein to the end of 1946, the recordkeeping on badge issues was improved. The ledgers were used to issue the badges to the men and to record the target vessel being worked on and the exposure, but a 5x8 card was used to cumulate the individual badge readings from the ledgers for each man. Because the recordkeepers of the time made these cumulations, the problems of handwriting interpretation and same-name confusion are not present.
Table 20. CROSSROADS badging after shot BAKER.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Badges Issued</th>
<th>No. of Badges With Zero Exposure</th>
<th>No. of Badges Exceeding 0.1 R (gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 July (BAKER day)</td>
<td>468</td>
<td>189</td>
<td>85</td>
</tr>
<tr>
<td>26 July</td>
<td>211</td>
<td>128</td>
<td>4</td>
</tr>
<tr>
<td>27 July</td>
<td>287</td>
<td>175</td>
<td>27</td>
</tr>
<tr>
<td>28 July</td>
<td>110</td>
<td>40</td>
<td>25</td>
</tr>
<tr>
<td>29 July</td>
<td>180</td>
<td>62</td>
<td>49</td>
</tr>
<tr>
<td>30 July</td>
<td>68</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>31 July</td>
<td>44</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>1 August</td>
<td>40</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>2 August</td>
<td>60</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>3 August</td>
<td>91</td>
<td>46</td>
<td>18</td>
</tr>
<tr>
<td>4 August</td>
<td>81</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>5 August</td>
<td>100</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>6 August</td>
<td>101</td>
<td>48</td>
<td>19</td>
</tr>
<tr>
<td>7 August</td>
<td>107</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>8 August</td>
<td>167</td>
<td>59</td>
<td>33</td>
</tr>
<tr>
<td>9 August</td>
<td>245</td>
<td>133</td>
<td>26</td>
</tr>
<tr>
<td>10 August</td>
<td>190</td>
<td>101</td>
<td>24</td>
</tr>
<tr>
<td>11 August</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>12 August</td>
<td>201</td>
<td>79</td>
<td>32</td>
</tr>
<tr>
<td>13 August</td>
<td>280</td>
<td>73</td>
<td>54</td>
</tr>
<tr>
<td>14 August</td>
<td>416</td>
<td>329</td>
<td>20</td>
</tr>
<tr>
<td>15 August</td>
<td>402</td>
<td>342</td>
<td>1</td>
</tr>
<tr>
<td>16 August</td>
<td>543</td>
<td>460</td>
<td>2</td>
</tr>
<tr>
<td>17 August</td>
<td>733</td>
<td>682</td>
<td>13</td>
</tr>
<tr>
<td>18 August</td>
<td>238</td>
<td>135</td>
<td>2</td>
</tr>
<tr>
<td>19 August</td>
<td>511</td>
<td>158</td>
<td>59</td>
</tr>
<tr>
<td>20 August</td>
<td>555</td>
<td>367</td>
<td>36</td>
</tr>
<tr>
<td>21 August</td>
<td>386</td>
<td>177</td>
<td>42</td>
</tr>
<tr>
<td>22 August</td>
<td>277</td>
<td>100</td>
<td>53</td>
</tr>
<tr>
<td>23 August</td>
<td>153</td>
<td>53</td>
<td>15</td>
</tr>
<tr>
<td>24 August</td>
<td>126</td>
<td>64</td>
<td>11</td>
</tr>
<tr>
<td>25 August</td>
<td>78</td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>26 August</td>
<td>179</td>
<td>151</td>
<td>2</td>
</tr>
<tr>
<td>27 August</td>
<td>215</td>
<td>157</td>
<td>1</td>
</tr>
<tr>
<td>28 August</td>
<td>54</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>29 August</td>
<td>44</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>30 August</td>
<td>59</td>
<td>36</td>
<td>1</td>
</tr>
<tr>
<td>31 August</td>
<td>27</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

Inspection of these cards on the microfilm record (Reference C.13.4) shows that 699 persons were badged at Kwajalein from 30 August to year end. Most were issued more than one badge, the highest number observed being 42, and many men had from 10 to 30 badges. Each badge, of course, represented a day's work off-loading ammunition from the contaminated targets or inspecting or mooring or otherwise servicing them.

The periods of heaviest issue were from early September until the end of October. After this time very few badges were issued. The distribution of the exposures recorded during this September through October period is as follows:

<table>
<thead>
<tr>
<th>Total Exposure Recorded (R, gamma)</th>
<th>No. of Personnel With This Exposure</th>
<th>No. in Group With at Least One Missing or Unreadable Badge</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 R (gamma)</td>
<td>121</td>
<td>7</td>
</tr>
<tr>
<td>0.0001 - 0.4999</td>
<td>498</td>
<td>133</td>
</tr>
<tr>
<td>0.5 - 0.9999</td>
<td>68</td>
<td>30</td>
</tr>
<tr>
<td>1.0 - 1.4999</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1.5 or greater</td>
<td>1 (1.52 R)</td>
<td>0</td>
</tr>
</tbody>
</table>

Seven of the men had unreadable badges.

Summary of Personnel with the Highest Badged Exposures for 1946

An examination of the personnel dosimetry records shows that radiation safety monitors, certain air unit personnel, radiological patrol boat crews, target ship crews, and JTF I initial boarding teams were groups with the highest exposures. Personnel from the scientific projects also had a high potential for exposure.

The group with the highest exposures was the radsafe monitors who accompanied all personnel into contaminated areas and were responsible for monitoring radiation intensity of the water and the target ships. This group was issued more film badges than any other single group during the Bikini phase of the operation. The monitors were badged an average of five times each (1,616 total badges). One monitor was badged 28 times (on 19 days), and forty-five were badged more than 10 times. The highest cumulative exposure recorded by a monitor was 3.72 R, the highest single day exposure was 2 R, and the mean cumulative exposure was 0.278 R per monitor.

Table 21 summarizes film badge issues and exposure for the monitors. Fifty-six percent of the 1,497 readable film badges had a zero reading. There were 213 readings, or 14 percent, that exceeded the maximum daily allowance of 0.1 R/24 hours. Except for one day, the daily average was below the maximum allowed exposure.

Air unit personnel exposures and patrol boat crew exposures are summarized in Tables 22 and 23. Summaries for target ship crew reboardings for USS New York (BB-34), USS Pennsylvania (BB-38), and USS Salt Lake City (CA-25) are shown in Tables 24, 25, and 26. JTF I initial boarding team exposures are
Table 21. Summary of film badge data for radiation safety monitors, CROSSROADS.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Badges Issued</th>
<th>No. of Badges Readable</th>
<th>No. of Badges With Zero Exposure</th>
<th>Average (R)</th>
<th>High (R)</th>
<th>No. of Badges Exceeding 0.1 R/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July</td>
<td>191</td>
<td>177</td>
<td>156</td>
<td>0.019</td>
<td>2.000</td>
<td>5</td>
</tr>
<tr>
<td>2 July</td>
<td>89</td>
<td>80</td>
<td>76</td>
<td>0.006</td>
<td>0.130</td>
<td>1</td>
</tr>
<tr>
<td>3 July</td>
<td>18</td>
<td>17</td>
<td>13</td>
<td>0.008</td>
<td>0.050</td>
<td>0</td>
</tr>
<tr>
<td>4 Julyd</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>25 July</td>
<td>132</td>
<td>130</td>
<td>69</td>
<td>0.044</td>
<td>2.000</td>
<td>24</td>
</tr>
<tr>
<td>26 July</td>
<td>77</td>
<td>76</td>
<td>51</td>
<td>0.024</td>
<td>0.300</td>
<td>4</td>
</tr>
<tr>
<td>27 July</td>
<td>68</td>
<td>66</td>
<td>41</td>
<td>0.030</td>
<td>0.120</td>
<td>5</td>
</tr>
<tr>
<td>28 July</td>
<td>39</td>
<td>39</td>
<td>18</td>
<td>0.060</td>
<td>0.370</td>
<td>8</td>
</tr>
<tr>
<td>29 July</td>
<td>36</td>
<td>34</td>
<td>16</td>
<td>0.050</td>
<td>0.300</td>
<td>8</td>
</tr>
<tr>
<td>30 July</td>
<td>28</td>
<td>25</td>
<td>20</td>
<td>0.028</td>
<td>0.120</td>
<td>3</td>
</tr>
<tr>
<td>31 July</td>
<td>30</td>
<td>29</td>
<td>16</td>
<td>0.054</td>
<td>0.240</td>
<td>3</td>
</tr>
<tr>
<td>1 August</td>
<td>30</td>
<td>29</td>
<td>11</td>
<td>0.050</td>
<td>0.250</td>
<td>4</td>
</tr>
<tr>
<td>2 August</td>
<td>24</td>
<td>23</td>
<td>13</td>
<td>0.070</td>
<td>1.800</td>
<td>6</td>
</tr>
<tr>
<td>3 August</td>
<td>38</td>
<td>37</td>
<td>17</td>
<td>0.052</td>
<td>0.350</td>
<td>5</td>
</tr>
<tr>
<td>4 August</td>
<td>42</td>
<td>42</td>
<td>9</td>
<td>0.072</td>
<td>0.220</td>
<td>14</td>
</tr>
<tr>
<td>5 August</td>
<td>43</td>
<td>42</td>
<td>9</td>
<td>0.092</td>
<td>1.300</td>
<td>9</td>
</tr>
<tr>
<td>6 August</td>
<td>33</td>
<td>33</td>
<td>7</td>
<td>0.034</td>
<td>0.860</td>
<td>8</td>
</tr>
<tr>
<td>7 August</td>
<td>52</td>
<td>50</td>
<td>10</td>
<td>0.142</td>
<td>1.400</td>
<td>16</td>
</tr>
<tr>
<td>8 August</td>
<td>48</td>
<td>46</td>
<td>15</td>
<td>0.042</td>
<td>0.240</td>
<td>13</td>
</tr>
<tr>
<td>9 August</td>
<td>53</td>
<td>42</td>
<td>19</td>
<td>0.061</td>
<td>0.360</td>
<td>11</td>
</tr>
<tr>
<td>10 August</td>
<td>43</td>
<td>40</td>
<td>12</td>
<td>0.052</td>
<td>0.160</td>
<td>7</td>
</tr>
<tr>
<td>11 August</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>12 August</td>
<td>38</td>
<td>37</td>
<td>7</td>
<td>0.073</td>
<td>0.400</td>
<td>4</td>
</tr>
<tr>
<td>13 August</td>
<td>40</td>
<td>39</td>
<td>11</td>
<td>0.083</td>
<td>0.600</td>
<td>10</td>
</tr>
<tr>
<td>14 August</td>
<td>39</td>
<td>28</td>
<td>21</td>
<td>0.018</td>
<td>0.280</td>
<td>1</td>
</tr>
<tr>
<td>15 August</td>
<td>43</td>
<td>42</td>
<td>34</td>
<td>0.008</td>
<td>0.150</td>
<td>1</td>
</tr>
<tr>
<td>16 August</td>
<td>35</td>
<td>34</td>
<td>24</td>
<td>0.020</td>
<td>0.150</td>
<td>2</td>
</tr>
<tr>
<td>17 August</td>
<td>44</td>
<td>39</td>
<td>34</td>
<td>0.083</td>
<td>2.000</td>
<td>3</td>
</tr>
<tr>
<td>18 August</td>
<td>44</td>
<td>42</td>
<td>19</td>
<td>0.091</td>
<td>0.790</td>
<td>2</td>
</tr>
<tr>
<td>19 August</td>
<td>40</td>
<td>37</td>
<td>4</td>
<td>0.045</td>
<td>0.180</td>
<td>5</td>
</tr>
<tr>
<td>20 August</td>
<td>51</td>
<td>44</td>
<td>25</td>
<td>0.048</td>
<td>0.490</td>
<td>6</td>
</tr>
<tr>
<td>21 August</td>
<td>33</td>
<td>27</td>
<td>5</td>
<td>0.068</td>
<td>0.190</td>
<td>7</td>
</tr>
<tr>
<td>22 August</td>
<td>32</td>
<td>31</td>
<td>10</td>
<td>0.063</td>
<td>0.260</td>
<td>9</td>
</tr>
<tr>
<td>23 August</td>
<td>15</td>
<td>13</td>
<td>6</td>
<td>0.062</td>
<td>0.300</td>
<td>2</td>
</tr>
<tr>
<td>24 August</td>
<td>27</td>
<td>27</td>
<td>16</td>
<td>0.025</td>
<td>0.120</td>
<td>1</td>
</tr>
<tr>
<td>25 August</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>0.033</td>
<td>0.060</td>
<td>0</td>
</tr>
<tr>
<td>26 August</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>0.021</td>
<td>0.150</td>
<td>1</td>
</tr>
<tr>
<td>27 August</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>0.036</td>
<td>0.080</td>
<td>0</td>
</tr>
<tr>
<td>28 August</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>0.032</td>
<td>0.130</td>
<td>1</td>
</tr>
<tr>
<td>29 August</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0.005</td>
<td>0.010</td>
<td>0</td>
</tr>
<tr>
<td>30 August</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0.020</td>
<td>0.040</td>
<td>0</td>
</tr>
</tbody>
</table>

Totals 1,616 1,497 836 213
(100%) (56%) (14%)

Notes:

a Nineteen multi-day badges not included.
b Some badges that were issued were not readable when processed.
c 0.1 R/day was the maximum allowable exposure for CROSSROADS.
d Less than 10 film badges were issued between 5 and 24 July.
Table 22. Film badge summaries (in roentgens) for air unit personnel, CROSSROADS.

<table>
<thead>
<tr>
<th>Unit</th>
<th>ABLE</th>
<th>BAKER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Readingsa</td>
<td>Low</td>
</tr>
<tr>
<td>F6F drone control pilots</td>
<td>15 0</td>
<td>0.020</td>
</tr>
<tr>
<td>PBM radiological patrols</td>
<td>29 0 0 0</td>
<td></td>
</tr>
<tr>
<td>B-17 drone control crews</td>
<td>40 0 0 0</td>
<td></td>
</tr>
<tr>
<td>Army F-13 photo aircraft</td>
<td>24 0 0 0</td>
<td></td>
</tr>
</tbody>
</table>

Note:
\(^a\)Some badges that were issued were not readable and have been omitted from this display.

Table 23. Film badge summary (in roentgens) of radiological patrol boat crews, CROSSROADS.

<table>
<thead>
<tr>
<th>Date</th>
<th>PGMs (6)</th>
<th>LCPLs (20)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Readingsa</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>Average</td>
</tr>
<tr>
<td>ABLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 July</td>
<td>82</td>
<td>0</td>
</tr>
<tr>
<td>2 July</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>BAKER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 July</td>
<td>53</td>
<td>0</td>
</tr>
<tr>
<td>26 July</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>27 July</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>28 July</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>29 July</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>30 July</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>31 July</td>
<td>5</td>
<td>0.090</td>
</tr>
</tbody>
</table>

Note:
\(^a\)Some badges that were issued were not readable and have been omitted from this display.
Table 24. Post-BAKER film badge summary (roentgens) for USS New York (BB-34) reboarding parties.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Badges Issued</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 August</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 August</td>
<td>1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>7 August</td>
<td>4</td>
<td>0.06</td>
<td>0.165</td>
<td>0.390</td>
</tr>
<tr>
<td>8 August</td>
<td>1</td>
<td>0</td>
<td>0.021</td>
<td>0.070</td>
</tr>
<tr>
<td>9 August</td>
<td>4</td>
<td>0.07</td>
<td>0.08</td>
<td>0.1</td>
</tr>
<tr>
<td>10 August</td>
<td>6</td>
<td>0</td>
<td>0.053</td>
<td>0.08</td>
</tr>
<tr>
<td>13 August</td>
<td>3</td>
<td>0</td>
<td>0.04</td>
<td>0.07</td>
</tr>
<tr>
<td>15 August</td>
<td>9</td>
<td>0</td>
<td>0.047</td>
<td>0.09</td>
</tr>
<tr>
<td>16 August</td>
<td>151</td>
<td>0</td>
<td>0.004</td>
<td>0.06</td>
</tr>
<tr>
<td>17 August</td>
<td>34</td>
<td>0</td>
<td>0.019</td>
<td>0.1</td>
</tr>
<tr>
<td>18 August</td>
<td>42</td>
<td>0</td>
<td>0.012</td>
<td>0.06</td>
</tr>
<tr>
<td>19 August</td>
<td>42</td>
<td>0</td>
<td>0.007</td>
<td>0.03</td>
</tr>
<tr>
<td>20 August</td>
<td>28</td>
<td>0</td>
<td>0.008</td>
<td>0.05</td>
</tr>
<tr>
<td>21 August</td>
<td>109</td>
<td>0</td>
<td>0.067</td>
<td>0.21</td>
</tr>
</tbody>
</table>


Table 25. Post-BAKER film badge summary (roentgens) for USS Pennsylvania (BB-38) reboarding parties.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Badges Issued</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 August</td>
<td>1</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>8 August</td>
<td>3</td>
<td>0.04</td>
<td>0.063</td>
<td>0.08</td>
</tr>
<tr>
<td>9 August</td>
<td>2</td>
<td>0.07</td>
<td>0.105</td>
<td>0.13</td>
</tr>
<tr>
<td>10 August</td>
<td>5</td>
<td>0.0</td>
<td>0.063</td>
<td>0.07</td>
</tr>
<tr>
<td>12 August</td>
<td>1</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>16 August</td>
<td>24</td>
<td>0.0</td>
<td>0.001</td>
<td>0.03</td>
</tr>
<tr>
<td>17 August</td>
<td>46</td>
<td>0.0</td>
<td>0.002</td>
<td>0.05</td>
</tr>
<tr>
<td>19 August</td>
<td>130</td>
<td>0.0</td>
<td>0.03</td>
<td>0.1</td>
</tr>
<tr>
<td>20 August</td>
<td>40</td>
<td>0.0</td>
<td>0.067</td>
<td>0.17</td>
</tr>
<tr>
<td>21 August</td>
<td>19</td>
<td>0.05</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>25 August</td>
<td>8</td>
<td>0.0</td>
<td>0.036</td>
<td>0.11</td>
</tr>
<tr>
<td>26 August</td>
<td>42</td>
<td>0.0</td>
<td>0.008</td>
<td>0.12</td>
</tr>
<tr>
<td>27 August</td>
<td>43</td>
<td>0.0</td>
<td>0.023</td>
<td>0.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Badges Issued</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 August</td>
<td>15</td>
<td>0</td>
<td>0.088</td>
<td>0.190</td>
</tr>
<tr>
<td>5 August</td>
<td>15</td>
<td>0</td>
<td>0.146</td>
<td>0.320</td>
</tr>
<tr>
<td>6 August</td>
<td>17</td>
<td>0.070</td>
<td>0.113</td>
<td>0.230</td>
</tr>
<tr>
<td>7 August</td>
<td>4</td>
<td>0</td>
<td>0.183</td>
<td>0.400</td>
</tr>
<tr>
<td>8 August</td>
<td>29</td>
<td>0</td>
<td>0.105</td>
<td>0.210</td>
</tr>
<tr>
<td>9 August</td>
<td>18</td>
<td>0</td>
<td>0.159</td>
<td>0.360</td>
</tr>
<tr>
<td>12 August</td>
<td>1</td>
<td>0.040</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>13 August</td>
<td>9</td>
<td>0.050</td>
<td>0.084</td>
<td>0.130</td>
</tr>
<tr>
<td>17 August&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 August</td>
<td>137</td>
<td>0</td>
<td>0.017</td>
<td>0.080</td>
</tr>
<tr>
<td>23 August&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 August&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

<sup>a</sup> Boarded by 19 men for 2.5 hours to raise anchor. No film badge data.

<sup>b</sup> Boarded briefly by 6 men to rig and derig towed gear. No film badge data located.

**Source:** Reference C.13.6.
summarized in Table 27. Badged exposures for scientific personnel have been summarized in Tables 4 and 6 (Chapter 3).

Table 27. Summary of Joint Task Force 1 initial boarding team film badge readings.

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Readings</th>
<th>No. of Zero Exposures</th>
<th>Average (R)</th>
<th>High (R)</th>
<th>No. of Readings Over 0.1 R</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July</td>
<td>9</td>
<td>9</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>2 July</td>
<td>66</td>
<td>66</td>
<td>0.001</td>
<td>0.050</td>
<td>0</td>
</tr>
<tr>
<td>25 July</td>
<td>4</td>
<td>0</td>
<td>0.055</td>
<td>0.080</td>
<td>0</td>
</tr>
<tr>
<td>26 July</td>
<td>2</td>
<td>0</td>
<td>0.160</td>
<td>0.200</td>
<td>2</td>
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<tr>
<td>27 July</td>
<td>5</td>
<td>0</td>
<td>0.075</td>
<td>0.160</td>
<td>3</td>
</tr>
<tr>
<td>28 July</td>
<td>6</td>
<td>0</td>
<td>0.108</td>
<td>0.160</td>
<td>2</td>
</tr>
<tr>
<td>29 July</td>
<td>2</td>
<td>0</td>
<td>0.130</td>
<td>0.150</td>
<td>2</td>
</tr>
<tr>
<td>30 July</td>
<td>11</td>
<td>0</td>
<td>0.106</td>
<td>0.150</td>
<td>7</td>
</tr>
<tr>
<td>31 July</td>
<td>4</td>
<td>0</td>
<td>0.247</td>
<td>0.720</td>
<td>2</td>
</tr>
<tr>
<td>1 August</td>
<td>3</td>
<td>0</td>
<td>0.193</td>
<td>0.420</td>
<td>1</td>
</tr>
<tr>
<td>2 August</td>
<td>11</td>
<td>5</td>
<td>0.071</td>
<td>0.420</td>
<td>2</td>
</tr>
<tr>
<td>3 August</td>
<td>8</td>
<td>3</td>
<td>0.052</td>
<td>0.120</td>
<td>1</td>
</tr>
<tr>
<td>4 August</td>
<td>1</td>
<td>0</td>
<td>0.110</td>
<td>0.110</td>
<td>1</td>
</tr>
<tr>
<td>5 August</td>
<td>7</td>
<td>0</td>
<td>0.125</td>
<td>0.180</td>
<td>3</td>
</tr>
<tr>
<td>6 August</td>
<td>2</td>
<td>0</td>
<td>0.110</td>
<td>0.120</td>
<td>1</td>
</tr>
<tr>
<td>7 August</td>
<td>5</td>
<td>1</td>
<td>0.090</td>
<td>0.140</td>
<td>2</td>
</tr>
<tr>
<td>8 August</td>
<td>11</td>
<td>2</td>
<td>0.103</td>
<td>0.240</td>
<td>4</td>
</tr>
<tr>
<td>9 August</td>
<td>2</td>
<td>1</td>
<td>0.020</td>
<td>0.040</td>
<td>0</td>
</tr>
<tr>
<td>10 August</td>
<td>2</td>
<td>1</td>
<td>0.020</td>
<td>0.040</td>
<td>0</td>
</tr>
<tr>
<td>12 August</td>
<td>3</td>
<td>1</td>
<td>0.063</td>
<td>0.110</td>
<td>1</td>
</tr>
<tr>
<td>13 August</td>
<td>12</td>
<td>3</td>
<td>0.066</td>
<td>0.170</td>
<td>2</td>
</tr>
<tr>
<td>14 August</td>
<td>8</td>
<td>6</td>
<td>0.023</td>
<td>0.150</td>
<td>1</td>
</tr>
<tr>
<td>15 August</td>
<td>4</td>
<td>2</td>
<td>0.015</td>
<td>0.030</td>
<td>0</td>
</tr>
<tr>
<td>16 August</td>
<td>8</td>
<td>7</td>
<td>0.005</td>
<td>0.040</td>
<td>0</td>
</tr>
<tr>
<td>17 August</td>
<td>7</td>
<td>7</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>18 August</td>
<td>5</td>
<td>2</td>
<td>0.042</td>
<td>0.100</td>
<td>0</td>
</tr>
<tr>
<td>19 August</td>
<td>7</td>
<td>2</td>
<td>0.030</td>
<td>0.100</td>
<td>0</td>
</tr>
<tr>
<td>20 August</td>
<td>5</td>
<td>3</td>
<td>0.024</td>
<td>0.080</td>
<td>0</td>
</tr>
<tr>
<td>21 August</td>
<td>5</td>
<td>1</td>
<td>0.048</td>
<td>0.080</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>227</td>
<td>122</td>
<td>37</td>
<td></td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>(54%)</td>
<td>(37%)</td>
<td>(16%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

a All badges issued 1-2 July.
b Badges issued 25-26 July.
c Badges issued 25-27 July.
d Badges issued 29-31 July.
Badge-Recorded Exposures After 1946 Related to CROSSROADS

The Bikini Resurvey personnel were badged during their 1947 activities. For the over 300 personnel involved and crewmembers of the support ships, from 517 to 572 badges were issued. "There were no personnel exposures in excess of the daily tolerance of 0.1 R beta plus gamma" (Reference C.8.2, p. 101). This is discussed in Chapter 6 in more detail.

Exposures of personnel working primarily on CROSSROADS target ships were also monitored. Table 28 presents exposures at San Francisco Naval Shipyard. Of the recorded exposures at Kwajalein, where until July 1948 the ship security detail existed, the maximum exposure, accrued during 394 hours of work over 10 months, was 0.790 R (gamma), and the average exposure was 0.070 R (gamma) (Reference C.0.30). At Puget Sound Naval Shipyard, the maximum exposure, accrued during 563 hours of work, was 1.380 R (gamma). The average exposure was 0.137 R (gamma) and 0.287 rep (beta) during 20 months of work.

Table 28. Dosimetry for military and civilian personnel at San Francisco Naval Shipyard for 1947 and 1948.

<table>
<thead>
<tr>
<th></th>
<th>High (R)</th>
<th>Low (R)</th>
<th>Average (R)</th>
<th>Maximum Hours One Person Exposed</th>
<th>Average No. Hours of Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through December 1947</td>
<td></td>
<td></td>
<td></td>
<td>1,032</td>
<td>167</td>
</tr>
<tr>
<td>(128 personnel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gamma</td>
<td>4.230b</td>
<td>0</td>
<td>0.039c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>4.920</td>
<td>0</td>
<td>0.051</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1947 through 1948</td>
<td></td>
<td></td>
<td></td>
<td>2,169</td>
<td>279</td>
</tr>
<tr>
<td>(397 personnel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gamma</td>
<td>4.060d</td>
<td>0</td>
<td>0.004e</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>4.630</td>
<td>0</td>
<td>0.006</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

a This exposure summary was compiled at the end of each year. Personnel who worked both years are included in the 1947-1948 data as well as the 1947 data. Therefore, the total number of personnel from 1947 and 1948 cannot be added to determine total personnel exposed.

b Individual averaged 0.081 rem gamma and 0.094 rem beta per day during 51.8 workdays.

c In 1947, 36 percent of the badges showed zero (gamma).

d Individual averaged 0.034 rem gamma and 0.039 rem beta per day during 119 workdays.

e In combined 1947-1948, 43 percent of the badges showed zero (gamma).

PERSONNEL EXPOSURES NOT RECORDED ON FILM BADGES

Only a small portion of the CROSSROADS Bikini participants were badged and even these personnel were badged only during missions that might expose them directly to test instrumentation or test objects that were known or expected to be heavily contaminated with radioactive material. The exposure to the higher-than-normal radioactive background went largely unrecorded. The prime source of this elevated background was the contaminated lagoon water after the BAKER test. However, many participants had little or no exposure to this background. Some lived on islands distant from the tests and thus had no contact with the contaminated lagoon and received no fallout. Others were aboard ships that did not reenter the lagoon after BAKER, or did so only briefly.

Nearly 50 percent of the personnel did not reenter the lagoon after Test BAKER until it had been declared radiologically safe (less than 0.1 R/24 hours) at 0959 on 30 July. Table 29 summarizes the number of personnel and when they entered the lagoon after BAKER.

Forty-one percent of all participants were assigned to units involved with decontamination, inspection, towing, or salvage. However, only a portion of the crew on most ships would have been actively involved. Many Navy job ratings such as cooks, yeomen, engineers, signalmen, and radiomen would normally have remained aboard the support ship. The 8,463 target ship crewmembers were the most active in the reboarding and decontamination phase. Even then, as indicated in the Independence deck log, which lists the names of all boarding teams, only 50 men reboarded from the crew of 343. The USS Briscoe (APA-65) deck log indicates the boarding teams were limited to 29 men from the 112-man crew. Table 30 compares the ship's missions with their likelihood for contact with target ships for decontamination and inspection.

DOSE RECONSTRUCTION

To produce estimated doses for all CROSSROADS participants, a scientific dose reconstruction project has been completed. In this effort, three major sources of radiation were considered:

1. Radioactivity of lagoon waters due to weapon debris and neutron-activated radionuclides, such as sodium-24
2. Target ship contamination resulting from weapon debris and neutron-induced activity
3. Contamination buildup on the exterior hulls below the waterline and in the saltwater piping of ships operating in the low-level radioactive environment of Bikini Lagoon.

Reconstruction Model

Computer models were developed to combine the various radioactive sources with the movement of each support ship. Based upon recorded lagoon water and support ship hull readings, the radiological environment was reconstructed. Exposures were calculated for each ship as it operated in this environment. An integrated dose was determined up to the time that each ship was granted radiological clearance after CROSSROADS. Doses for personnel assigned to recovery
Table 29. Number of ships\textsuperscript{a} and personnel\textsuperscript{b} reentering Bikini Lagoon after Test BAKER.

<table>
<thead>
<tr>
<th>Date</th>
<th>Ships</th>
<th>Personnel</th>
<th>Target Ship</th>
<th>Joint Task Force 1</th>
<th>Marine Corps</th>
<th>Other Units</th>
<th>Total</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 July</td>
<td>49</td>
<td>11,444</td>
<td>350</td>
<td>1,274</td>
<td>325</td>
<td>584\textsuperscript{d}</td>
<td>14,920</td>
<td>(36%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 July</td>
<td>9</td>
<td>2,709</td>
<td></td>
<td>155</td>
<td></td>
<td></td>
<td>2,864</td>
<td>(7%)</td>
</tr>
<tr>
<td>27 July</td>
<td>1</td>
<td>280</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>280</td>
<td>(&lt;1%)</td>
</tr>
<tr>
<td>28 July</td>
<td>4</td>
<td>342</td>
<td></td>
<td>242</td>
<td></td>
<td></td>
<td>584</td>
<td>(1%)</td>
</tr>
<tr>
<td>29 July</td>
<td>2</td>
<td>634</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,522</td>
<td>(9%)</td>
</tr>
<tr>
<td>30 July</td>
<td>21</td>
<td>6,528</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11,160</td>
<td>(27%)</td>
</tr>
<tr>
<td>31 July</td>
<td>18</td>
<td>1,261</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,261</td>
<td>(3%)</td>
</tr>
<tr>
<td>1 August</td>
<td>2</td>
<td>944</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>344</td>
<td>(1%)</td>
</tr>
<tr>
<td>After 1 August</td>
<td>7</td>
<td>363</td>
<td></td>
<td></td>
<td></td>
<td>363</td>
<td>(1%)</td>
<td></td>
</tr>
<tr>
<td>Never Reentered\textsuperscript{e,f}</td>
<td>6</td>
<td>3,285</td>
<td>2,300</td>
<td>107</td>
<td>904</td>
<td>6,596</td>
<td>(16%)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
\textsuperscript{a}See Appendix A for details of ship activities.
\textsuperscript{b}Total CROSSROADS personnel, 41,894
\textsuperscript{c}All Army personnel are assumed to have entered on July 25.
\textsuperscript{d}Includes 312 personnel in small units. Entry date assumed to be July 25.
\textsuperscript{e}Or on other atolls.
\textsuperscript{f}About 525 aircrew members flew in the vicinity of Bikini on 25 July.
Table 30. Ship and unit missions and involvement with target ship decontamination and inspection after Test BAKER, CROSSROADS.

<table>
<thead>
<tr>
<th>Frequent Contact</th>
<th>Not Directly Involved</th>
<th>Not at Bikini After 25 July</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Ships</td>
<td>No. of Personnel</td>
</tr>
<tr>
<td>Towing/Salvage/Repair</td>
<td>39</td>
<td>5,767</td>
</tr>
<tr>
<td>Target Ship Crews</td>
<td>92</td>
<td>8,463</td>
</tr>
<tr>
<td>Army</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>Joint Task Force Staff</td>
<td>1,274</td>
<td></td>
</tr>
<tr>
<td>Dispatch and Boat Pool</td>
<td>7</td>
<td>1,269</td>
</tr>
<tr>
<td>TOTALS</td>
<td>138</td>
<td>17,123 (41%)</td>
</tr>
</tbody>
</table>

Note:
\(^a\)High potential for radiation exposure but not involved in decontamination.
parties or decontamination working parties, which boarded target ships, can be derived from the target ship radiological readings and specific boarding times, locations, and activities. These can be added to the dose calculated by the models. An example of the methodology is presented in Appendix G.

Reconstruction Results

Among the support ships, the PGM crews generally received the highest calculated doses. These ships entered the lagoon shortly after shot BAKER and, for the next several days, helped establish the Red and Blue Lines around and within the target array. While in the radioactive water, their exterior hulls below the waterline became contaminated, which in turn raised intensity levels in the interior berthing spaces near the hull. This necessitated that crews sometimes evacuate their ships at night to sleep on other support ships that were not contaminated, although in most instances, skeleton crews remained on board the PGMs. This procedure was effected to preclude the crews from receiving doses in excess of their daily tolerance. By the morning of 29 July, the hull contamination on all of the PGMs had decreased to the point that the crews could remain on board continuously and the practice of evacuating at night was terminated.

Other ships with higher exposures were the tugs and salvage ships that worked among the target fleet. USS Barton (DD-722) crew had higher than average reconstructed doses because of that ship’s radiological surveys in the contaminated lagoon waters following BAKER shot. The ships’ movements and activities are outlined in Appendix A of this report.

Table 31 presents the dose calculated by this model for crews of support ships at CROSSROADS. Table 32 presents the same information for crews of target ships. This latter is made up of exposures while the crews were berthed on support ships and times spent aboard the target ships. The number of personnel in these tables does not coincide in all cases with the crew size indicated in Appendix A because the numbers involved change as more information becomes available. The data in Tables 31 and 32 are more recent, but are subject to change.

CONTEMPORARY EVALUATIONS OF THE RADIOLOGICAL SAFETY PROGRAM

The chairman of the Medico-Legal Board that had advised the Chief of the Safety Section entered the following comments in the records after the operations (Reference C.0.5):

[The CROSSROADS operations] were carried through without irradiation injury to any persons. I consider this conclusion well reasoned and founded on a sufficiently broad basis of measurements made by monitors sufficiently skilled and conscientious in their work .... [Because the board is scattered at the time of this writing,] the conclusion will have to stand as the opinion of the chairman.

In 1966, the former chief of the CROSSROADS Radiological Safety Section wrote a short overview of radiological safety and the operation. Depending upon recollection and records personally available to him (which subsequently have
Table 31. Reconstructed (calculated) dose for support ship crews, CROSSROADS.

<table>
<thead>
<tr>
<th>Vessel Name/Identification</th>
<th>No. of Personnel</th>
<th>Bikini Departure Date</th>
<th>Bikini Reconstructed Dose (rem gamma)</th>
<th>Clearance Date</th>
<th>Total Reconstructed Dose (rem gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Achomawi (ATF-148)</td>
<td>80</td>
<td>29 Aug 46</td>
<td>1.245</td>
<td>6 Dec 46</td>
<td>1.300</td>
</tr>
<tr>
<td>USS Ajax (AR-6)</td>
<td>753</td>
<td>23 Aug 46</td>
<td>0.191</td>
<td>1 Jan 47</td>
<td>0.220</td>
</tr>
<tr>
<td>USS Albemarle (AV-5)</td>
<td>569</td>
<td>25 Jul 46</td>
<td>0</td>
<td>22 Nov 46</td>
<td>0</td>
</tr>
<tr>
<td>USS Allen M. Sumner (DD-692)</td>
<td>278</td>
<td>10 Aug 46</td>
<td>0.467</td>
<td>19 Nov 46</td>
<td>0.580</td>
</tr>
<tr>
<td>APL 27</td>
<td>23</td>
<td>24 Aug 46</td>
<td>0.131</td>
<td>25 Feb 47</td>
<td>0.220</td>
</tr>
<tr>
<td>USS Appalachian (AGC-1)</td>
<td>614</td>
<td>29 Jul 46</td>
<td>0.010</td>
<td>2 Oct 46</td>
<td>0.010</td>
</tr>
<tr>
<td>USS Applin (APA-58)</td>
<td>226</td>
<td>8 Aug 46</td>
<td>0.116</td>
<td>22 Nov 46</td>
<td>0.180</td>
</tr>
<tr>
<td>ARO-29</td>
<td>106</td>
<td>25 Aug 46</td>
<td>0.265</td>
<td>18 Feb 47</td>
<td>0.300</td>
</tr>
<tr>
<td>USS Artemis (AKA-21)</td>
<td>160</td>
<td>18 Aug 46</td>
<td>0.216</td>
<td>20 Nov 46</td>
<td>0.250</td>
</tr>
<tr>
<td>ATA-124</td>
<td>44</td>
<td>25 Aug 46</td>
<td>0.359</td>
<td>18 Dec 46</td>
<td>0.430</td>
</tr>
<tr>
<td>ATA-180</td>
<td>45</td>
<td>1 Sep 46</td>
<td>0.547</td>
<td>24 Feb 47</td>
<td>0.630</td>
</tr>
<tr>
<td>ATA-185</td>
<td>43</td>
<td>5 Sep 46</td>
<td>0.593</td>
<td>13 Dec 46</td>
<td>0.640</td>
</tr>
<tr>
<td>ATA-187</td>
<td>33</td>
<td>24 Aug 46</td>
<td>0.347</td>
<td>6 Nov 46</td>
<td>0.410</td>
</tr>
<tr>
<td>ATA-192</td>
<td>15</td>
<td>2 Sep 46</td>
<td>0.547</td>
<td>14 Nov 46</td>
<td>0.590</td>
</tr>
<tr>
<td>ATR-40</td>
<td>68</td>
<td>23 Aug 46</td>
<td>0.903</td>
<td>17 Dec 46</td>
<td>0.990</td>
</tr>
<tr>
<td>ATR-87</td>
<td>69</td>
<td>1 Sep 46</td>
<td>0.485</td>
<td>13 Dec 46</td>
<td>0.550</td>
</tr>
<tr>
<td>USS Avery Island (AG-76)</td>
<td>483</td>
<td>7 Aug 46</td>
<td>0.147</td>
<td>3 Dec 46</td>
<td>0.260</td>
</tr>
<tr>
<td>USS Berton (DD-722)</td>
<td>260</td>
<td>10 Aug 46</td>
<td>0.519</td>
<td>2 Nov 46</td>
<td>0.630</td>
</tr>
<tr>
<td>USS Bayfield (APA-33)</td>
<td>428</td>
<td>3 Aug 46</td>
<td>0.063</td>
<td>7 Dec 46</td>
<td>0.140</td>
</tr>
<tr>
<td>USS Borealis (APD-127)</td>
<td>155</td>
<td>3 Aug 46</td>
<td>0.114</td>
<td>30 Sep 46</td>
<td>0.200</td>
</tr>
<tr>
<td>USS Benezola (AH-13)</td>
<td>673</td>
<td>25 Aug 46</td>
<td>0.236</td>
<td>24 Sep 46</td>
<td>0.250</td>
</tr>
<tr>
<td>USS Bexar (APA-237)</td>
<td>293</td>
<td>23 Aug 46</td>
<td>0.231</td>
<td>24 Jan 47</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Blue Ridge (AGC-2)</td>
<td>534</td>
<td>30 Jul 46</td>
<td>0.001</td>
<td>22 Nov 46</td>
<td>0.010</td>
</tr>
<tr>
<td>USS Bonnycastle (APA-235)</td>
<td>299</td>
<td>10 Aug 46</td>
<td>0.178</td>
<td>19 Dec 46</td>
<td>0.240</td>
</tr>
<tr>
<td>USS Bountiful (AH-9)</td>
<td>565</td>
<td>25 Jul 46</td>
<td>0</td>
<td>27 Sep 46</td>
<td>0</td>
</tr>
<tr>
<td>USS Bowditch (AGS-4)</td>
<td>296</td>
<td>27 Sep 46</td>
<td>0.143</td>
<td>20 Nov 46</td>
<td>0.160</td>
</tr>
<tr>
<td>USCG Bramble (WAGL-392)</td>
<td>49</td>
<td>24 Aug 46</td>
<td>0.307</td>
<td>22 Nov 46</td>
<td>0.350</td>
</tr>
<tr>
<td>USS Burleson (APA-67)</td>
<td>244</td>
<td>5 Aug 46</td>
<td>0.066</td>
<td>14 Oct 46</td>
<td>0.110</td>
</tr>
<tr>
<td>USS Cebu (ARG-6)</td>
<td>357</td>
<td>23 Aug 46</td>
<td>0.229</td>
<td>16 Dec 46</td>
<td>0.270</td>
</tr>
</tbody>
</table>

Notes:

a In Bikini lagoon only 4 hours after BAKFR.

b Did not enter Bikini after BAKFR.

(continued)
Table 31. Reconstructed (calculated) dose for support ship crews, CROSSROADS.

<table>
<thead>
<tr>
<th>Vessel Name/Identification</th>
<th>No. of Personnel</th>
<th>Bikini Departure Date</th>
<th>Bikini Reconstructed Dose (rem gamma)</th>
<th>Clearance Date</th>
<th>Total Reconstructed Dose (rem gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Charles P. Cecil (DD-835)</td>
<td>287</td>
<td>25 Jul 46</td>
<td>0</td>
<td>22 Nov 46</td>
<td>0</td>
</tr>
<tr>
<td>USS Chickasaw (ATF-83)</td>
<td>78</td>
<td>26 Aug 46</td>
<td>0.400</td>
<td>13 Jan 47</td>
<td>0.480</td>
</tr>
<tr>
<td>USS Chikaskia (AO-54)</td>
<td>176</td>
<td>23 Aug 46</td>
<td>0.199</td>
<td>31 Dec 46</td>
<td>0.240</td>
</tr>
<tr>
<td>USS Chownoc (ATF-100)</td>
<td>88</td>
<td>28 Aug 46</td>
<td>0.401</td>
<td>1 Feb 47</td>
<td>0.470</td>
</tr>
<tr>
<td>USS Clamp (ARS-33)</td>
<td>88</td>
<td>26 Aug 46</td>
<td>0.651</td>
<td>22 Nov 46</td>
<td>0.720</td>
</tr>
<tr>
<td>USS Coasters Harbor (AG-74)</td>
<td>195</td>
<td>15 Aug 46</td>
<td>0.195</td>
<td>7 Dec 46</td>
<td>0.240</td>
</tr>
<tr>
<td>USS Conservor (ARS-39)</td>
<td>86</td>
<td>5 Sep 46</td>
<td>0.919</td>
<td>4 May 47</td>
<td>0.985</td>
</tr>
<tr>
<td>USS Cougal (ASR-6)</td>
<td>117</td>
<td>4 Sep 46</td>
<td>0.556</td>
<td>10 Jan 47</td>
<td>0.610</td>
</tr>
<tr>
<td>USS Crepc (ARL-11)</td>
<td>144</td>
<td>21 Aug 46</td>
<td>0.284</td>
<td>23 Jan 47</td>
<td>0.360</td>
</tr>
<tr>
<td>USS Cumberland Sound (AV-17)</td>
<td>540</td>
<td>1 Aug 46</td>
<td>0.061</td>
<td>3 Dec 46</td>
<td>0.130</td>
</tr>
<tr>
<td>USS Current (ARS-22)</td>
<td>94</td>
<td>25 Aug 46</td>
<td>0.885</td>
<td>6 Feb 47</td>
<td>0.970</td>
</tr>
<tr>
<td>USS Deliver (ARS-23)</td>
<td>84</td>
<td>20 Aug 46</td>
<td>0.952</td>
<td>20 Dec 46</td>
<td>1.030</td>
</tr>
<tr>
<td>USS Dixie (AD-14)</td>
<td>835</td>
<td>25 Aug 46</td>
<td>0.214</td>
<td>2 Oct 46</td>
<td>0.230</td>
</tr>
<tr>
<td>USS Putton (AGS-0)</td>
<td>60</td>
<td>14 Sep 46</td>
<td>0.306</td>
<td>18 Dec 46</td>
<td>0.360</td>
</tr>
<tr>
<td>USS Enoree (AO-69)</td>
<td>152</td>
<td>24 Aug 46</td>
<td>0.198</td>
<td>3 Dec 46</td>
<td>0.240</td>
</tr>
<tr>
<td>USS Etiah (AN-79)</td>
<td>36</td>
<td>27 Aug 46</td>
<td>0.689</td>
<td>10 Dec 46</td>
<td>0.750</td>
</tr>
<tr>
<td>USS Fall River (CA-131)</td>
<td>817</td>
<td>4 Sep 46</td>
<td>0.204</td>
<td>23 Dec 46</td>
<td>0.220</td>
</tr>
<tr>
<td>USS Flusser (DD-368)</td>
<td>146</td>
<td>4 Sep 46</td>
<td>0.428</td>
<td>22 Nov 46</td>
<td>0.490</td>
</tr>
<tr>
<td>USS Fulton (AS-11)</td>
<td>733</td>
<td>25 Aug 46</td>
<td>0.267</td>
<td>24 Dec 46</td>
<td>0.300</td>
</tr>
<tr>
<td>USS Fuse (DD-882)</td>
<td>293</td>
<td>28 Jul 46</td>
<td>0.002</td>
<td>22 Nov 46</td>
<td>0.010</td>
</tr>
<tr>
<td>USS George Clymer (APA-27)</td>
<td>270</td>
<td>20 Aug 46</td>
<td>0.248</td>
<td>22 Nov 46</td>
<td>0.270</td>
</tr>
<tr>
<td>USS Gunston Hall (LSD-5)</td>
<td>305</td>
<td>25 Aug 46</td>
<td>0.211</td>
<td>8 Jan 47</td>
<td>0.240</td>
</tr>
<tr>
<td>USS Gypsy (ARS0-1)</td>
<td>77</td>
<td>5 Sep 46</td>
<td>0.516</td>
<td>9 Jan 47</td>
<td>0.570</td>
</tr>
<tr>
<td>USS Haven (AH-12)</td>
<td>476</td>
<td>25 Aug 46</td>
<td>0.250</td>
<td>14 Feb 47</td>
<td>0.290</td>
</tr>
<tr>
<td>USS Henrico (APA-45)</td>
<td>424</td>
<td>16 Aug 46</td>
<td>0.226</td>
<td>28 Jan 47</td>
<td>0.270</td>
</tr>
<tr>
<td>USS Hesperia (AKS-13)</td>
<td>139</td>
<td>23 Aug 46</td>
<td>0.245</td>
<td>28 Dec 46</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Ingraham (DD-694)</td>
<td>237</td>
<td>10 Aug 46</td>
<td>0.505</td>
<td>19 Nov 46</td>
<td>0.620</td>
</tr>
<tr>
<td>USS James M. Gilmore (AGS-13)</td>
<td>40</td>
<td>20 Aug 46</td>
<td>0.202</td>
<td>13 Nov 46</td>
<td>0.300</td>
</tr>
<tr>
<td>USS John Plish (AGS-10)</td>
<td>48</td>
<td>20 Aug 46</td>
<td>0.335</td>
<td>15 Oct 46</td>
<td>0.410</td>
</tr>
<tr>
<td>USS Kenneth Whiting (AV-14)</td>
<td>539</td>
<td>14 Aug 46</td>
<td>0.195</td>
<td>11 Dec 46</td>
<td>0.230</td>
</tr>
<tr>
<td>USS Leffey (DD-724)</td>
<td>251</td>
<td>10 Aug 46</td>
<td>0.332</td>
<td>2 Nov 46</td>
<td>0.440</td>
</tr>
<tr>
<td>LCI(L)-977</td>
<td>35</td>
<td>22 Aug 46</td>
<td>0.176</td>
<td>7 Mar 47</td>
<td>0.300</td>
</tr>
</tbody>
</table>

(continued)
Table 31. Reconstructed (calculated) dose for support ship crews, CROSSROADS.

<table>
<thead>
<tr>
<th>Vessel Name/Identification</th>
<th>No. of Personnel</th>
<th>Bikini Departure Date</th>
<th>Bikini Reconstructed Dose (rem gamma)</th>
<th>Clearance Date</th>
<th>Total Reconstructed Dose (rem gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC(L)-1062</td>
<td>35</td>
<td>22 Aug 46</td>
<td>0.362</td>
<td>4 Jan 47</td>
<td>0.470</td>
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<tr>
<td>LC(L)-1067</td>
<td>34</td>
<td>22 Aug 46</td>
<td>0.093</td>
<td>24 Feb 47</td>
<td>0.220</td>
</tr>
<tr>
<td>LC(L)-1091</td>
<td>35</td>
<td>25 Aug 46</td>
<td>0.380</td>
<td>11 Dec 46</td>
<td>0.480</td>
</tr>
<tr>
<td>USS LCM-285 (DD-770)</td>
<td>244</td>
<td>10 Aug 46</td>
<td>0.326</td>
<td>6 Nov 46</td>
<td>0.420</td>
</tr>
<tr>
<td>USS LST-388</td>
<td>80</td>
<td>25 Aug 46</td>
<td>0.277</td>
<td>5 Dec 46</td>
<td>0.330</td>
</tr>
<tr>
<td>USS LST-501</td>
<td>63</td>
<td>23 Aug 46</td>
<td>0.182</td>
<td>21 Nov 46</td>
<td>0.260</td>
</tr>
<tr>
<td>USS LST-831</td>
<td>80</td>
<td>24 Aug 46</td>
<td>0.326</td>
<td>6 Dec 46</td>
<td>0.380</td>
</tr>
<tr>
<td>USS LST-841</td>
<td>81</td>
<td>25 Jul 46</td>
<td>0</td>
<td>22 Nov 46</td>
<td>0</td>
</tr>
<tr>
<td>USS LST-989</td>
<td>71</td>
<td>22 Aug 46</td>
<td>0.193</td>
<td>13 Dec 46</td>
<td>0.260</td>
</tr>
<tr>
<td>USS Main (ARSD-2)</td>
<td>49</td>
<td>4 Sep 46</td>
<td>0.307</td>
<td>3 Jan 47</td>
<td>0.360</td>
</tr>
<tr>
<td>USS Moa (DD-693)</td>
<td>247</td>
<td>10 Aug 46</td>
<td>0.759</td>
<td>19 Nov 46</td>
<td>0.870</td>
</tr>
<tr>
<td>USS Mount McKinley (AGC-7)</td>
<td>824</td>
<td>10 Aug 46</td>
<td>0.193</td>
<td>20 Dec 46</td>
<td>0.250</td>
</tr>
<tr>
<td>USS Munsee (ATF-107)</td>
<td>63</td>
<td>29 Aug 46</td>
<td>0.368</td>
<td>18 Nov 46</td>
<td>0.420</td>
</tr>
<tr>
<td>USS Newman K. Perry (DD-883)</td>
<td>280</td>
<td>4 Aug 46</td>
<td>0.185</td>
<td>17 Jan 47</td>
<td>0.360</td>
</tr>
<tr>
<td>USS O'Brien (DD-725)</td>
<td>237</td>
<td>8 Aug 46</td>
<td>0.175</td>
<td>6 Nov 46</td>
<td>0.310</td>
</tr>
<tr>
<td>USS Oceola (AN-85)</td>
<td>45</td>
<td>26 Aug 46</td>
<td>0.587</td>
<td>11 Dec 46</td>
<td>0.650</td>
</tr>
<tr>
<td>USS Oce (AVP-49)</td>
<td>275</td>
<td>12 Aug 46</td>
<td>0.262</td>
<td>11 Dec 46</td>
<td>0.330</td>
</tr>
<tr>
<td>USS Ottawa (AKA-101)</td>
<td>67</td>
<td>2 Aug 46</td>
<td>0.063</td>
<td>13 Sep 46</td>
<td>0.130</td>
</tr>
<tr>
<td>USS Palmyra (ARS(T)-3)</td>
<td>299</td>
<td>5 Sep 46</td>
<td>0.378</td>
<td>22 Nov 46</td>
<td>0.420</td>
</tr>
<tr>
<td>USS Panamint (AGC-13)</td>
<td>591</td>
<td>27 Jul 46</td>
<td>0</td>
<td>22 Nov 46</td>
<td>0</td>
</tr>
<tr>
<td>PGM-23</td>
<td>39</td>
<td>25 Aug 46</td>
<td>0.935</td>
<td>16 Jan 47</td>
<td>1.120</td>
</tr>
<tr>
<td>PGM-24</td>
<td>48</td>
<td>25 Aug 46</td>
<td>1.293</td>
<td>13 Feb 47</td>
<td>1.500</td>
</tr>
<tr>
<td>PGM-25</td>
<td>53</td>
<td>10 Aug 46</td>
<td>1.061</td>
<td>28 May 47</td>
<td>1.380</td>
</tr>
<tr>
<td>PGM-29</td>
<td>48</td>
<td>10 Aug 46</td>
<td>1.087</td>
<td>28 May 47</td>
<td>1.400</td>
</tr>
<tr>
<td>PGM-31</td>
<td>55</td>
<td>10 Aug 46</td>
<td>0.812</td>
<td>17 Jan 47</td>
<td>1.100</td>
</tr>
<tr>
<td>PGM-32</td>
<td>27</td>
<td>10 Aug 46</td>
<td>1.045</td>
<td>10 Oct 46</td>
<td>1.250</td>
</tr>
<tr>
<td>USS Phoem (ARB-3)</td>
<td>160</td>
<td>23 Aug 46</td>
<td>0.331</td>
<td>26 Dec 46</td>
<td>0.390</td>
</tr>
<tr>
<td>USS Polux (AKS-4)</td>
<td>154</td>
<td>19 Aug 46</td>
<td>0.117</td>
<td>29 Nov 46</td>
<td>0.150</td>
</tr>
</tbody>
</table>

Note:

a Did not enter Bikini after BAKER.
b Not in Bikini Lagoon long enough to become contaminated.

(continued)
Table 31. Reconstructed (calculated) dose for support ship crews, CROSSROADS.

<table>
<thead>
<tr>
<th>Vessel Name/Identification</th>
<th>No. of Personnel</th>
<th>Bikini Departure Date</th>
<th>Bikini Reconstructed Dose (rem gamma)</th>
<th>Clearance Date</th>
<th>Total Reconstructed Dose (rem gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Preserver (ARS-8)</td>
<td>85</td>
<td>28 Aug 46</td>
<td>1.122</td>
<td>18 Dec 46</td>
<td>1.180</td>
</tr>
<tr>
<td>USS Presque Isle (APB-44)</td>
<td>194</td>
<td>19 Aug 46</td>
<td>0.280</td>
<td>12 Dec 46</td>
<td>0.340</td>
</tr>
<tr>
<td>USS Quartz (IX-150)</td>
<td>50</td>
<td>22 Aug 46</td>
<td>0.235</td>
<td>12 Dec 46</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Reclaimer (ARS-42)</td>
<td>73</td>
<td>1 Sep 46</td>
<td>1.679</td>
<td>24 Dec 46</td>
<td>1.740</td>
</tr>
<tr>
<td>USS Robert K. Huntington (DD-781)</td>
<td>234</td>
<td>10 Aug 46</td>
<td>0.474</td>
<td>19 Nov 46</td>
<td>0.590</td>
</tr>
<tr>
<td>USS Rockbridge (APA-228)</td>
<td>206</td>
<td>23 Aug 46</td>
<td>0.334</td>
<td>6 Dec 46</td>
<td>0.400</td>
</tr>
<tr>
<td>USS Rockingham (APA-229)</td>
<td>297</td>
<td>24 Aug 46</td>
<td>0.241</td>
<td>4 Dec 46</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Rockwall (APA-230)</td>
<td>288</td>
<td>19 Aug 46</td>
<td>0.208</td>
<td>17 Dec 46</td>
<td>0.250</td>
</tr>
<tr>
<td>USS Rolette (AKA-99)</td>
<td>151</td>
<td>26 Aug 46</td>
<td>0.241</td>
<td>28 Jan 47</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Saldor (CVE-117)</td>
<td>854</td>
<td>4 Aug 46</td>
<td>0.068</td>
<td>28 Jan 47</td>
<td>0.100</td>
</tr>
<tr>
<td>USS Saint Croix (APA-231)</td>
<td>306</td>
<td>2 Aug 46</td>
<td>0.072</td>
<td>22 Nov 46</td>
<td>0.150</td>
</tr>
<tr>
<td>USS San Marcus (LSD-25)</td>
<td>631</td>
<td>25 Aug 46</td>
<td>0.249</td>
<td>24 Oct 46</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Severn (AO-61)</td>
<td>145</td>
<td>24 Aug 46</td>
<td>0.137</td>
<td>3 Nov 46</td>
<td>0.170</td>
</tr>
<tr>
<td>USS Shakamaxon (AN-88)</td>
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<td>27 Aug 46</td>
<td>0.543</td>
<td>12 Dec 46</td>
<td>0.700</td>
</tr>
<tr>
<td>USS Shangri-La (CV-38)</td>
<td>1,935</td>
<td>25 Jul 46</td>
<td>0</td>
<td>22 Nov 46</td>
<td>0</td>
</tr>
<tr>
<td>USS Sioux (AKA-75)</td>
<td>66</td>
<td>25 Aug 46</td>
<td>0.301</td>
<td>28 Nov 46</td>
<td>0.370</td>
</tr>
<tr>
<td>USS Sphinx (ARL-24)</td>
<td>155</td>
<td>19 Aug 46</td>
<td>0.290</td>
<td>14 Feb 47</td>
<td>0.360</td>
</tr>
<tr>
<td>USS Suncock (AN-B0)</td>
<td>43</td>
<td>30 Aug 46</td>
<td>0.664</td>
<td>12 Dec 46</td>
<td>0.730</td>
</tr>
<tr>
<td>USS Sylvia (AAK-44)</td>
<td>208</td>
<td>25 Aug 46</td>
<td>0.238</td>
<td>7 Dec 46</td>
<td>0.270</td>
</tr>
<tr>
<td>USS Telamon (ARB-8)</td>
<td>158</td>
<td>15 Aug 46</td>
<td>0.267</td>
<td>12 Dec 46</td>
<td>0.350</td>
</tr>
<tr>
<td>USS Tombigbee (AOG-11)</td>
<td>86</td>
<td>21 Aug 46</td>
<td>0.273</td>
<td>31 Dec 46</td>
<td>0.340</td>
</tr>
<tr>
<td>USS Towner (DD-034)</td>
<td>313</td>
<td>25 Jul 46</td>
<td>0</td>
<td>22 Nov 46</td>
<td>0</td>
</tr>
<tr>
<td>USS Walke (DD-723)</td>
<td>242</td>
<td>8 Aug 46</td>
<td>0.210</td>
<td>23 Oct 46</td>
<td>0.330</td>
</tr>
<tr>
<td>USS Wenatchee (ATF-118)</td>
<td>99</td>
<td>18 Aug 46</td>
<td>0.301</td>
<td>13 Nov 46</td>
<td>0.380</td>
</tr>
<tr>
<td>USS Wharton (AP-7)</td>
<td>493</td>
<td>25 Aug 46</td>
<td>0.245</td>
<td>10 Feb 47</td>
<td>0.280</td>
</tr>
<tr>
<td>USS Whidoeon (ASR-1)</td>
<td>86</td>
<td>5 Sep 46</td>
<td>0.637</td>
<td>13 Dec 46</td>
<td>0.690</td>
</tr>
<tr>
<td>USS Wildcat (AW-2)</td>
<td>128</td>
<td>19 Aug 46</td>
<td>0.172</td>
<td>9 Jan 47</td>
<td>0.230</td>
</tr>
<tr>
<td>YMS-354</td>
<td>28</td>
<td>14 Sep 46</td>
<td>0.457</td>
<td>20 Dec 46</td>
<td>0.500</td>
</tr>
<tr>
<td>YMS-358</td>
<td>31</td>
<td>14 Sep 46</td>
<td>0.468</td>
<td>20 Dec 46</td>
<td>0.520</td>
</tr>
<tr>
<td>YMS-413</td>
<td>32</td>
<td>14 Sep 46</td>
<td>0.444</td>
<td>20 Dec 46</td>
<td>0.500</td>
</tr>
<tr>
<td>YMS-463</td>
<td>17</td>
<td>14 Sep 46</td>
<td>0.441</td>
<td>20 Dec 46</td>
<td>0.500</td>
</tr>
</tbody>
</table>

Note:

a Did not enter Bikini after BAKER.

234
Table 32. Reconstructed (calculated) dose for target ship crews, CROSSROADS.

<table>
<thead>
<tr>
<th>Ship</th>
<th>Crew Size</th>
<th>Support Ship Dose&lt;sup&gt;a&lt;/sup&gt; (rem gamma)</th>
<th>Post-BAKER Target Ship Boarding Dose&lt;sup&gt;b&lt;/sup&gt; (rem gamma)</th>
<th>Total Dose&lt;sup&gt;c&lt;/sup&gt; (rem gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Anderson (DD-411)</td>
<td>105</td>
<td>0.192</td>
<td>Sank at ABLE</td>
<td>f</td>
</tr>
<tr>
<td>USS Apogon (SS-308)</td>
<td>54</td>
<td>0.248</td>
<td>Sank at BAKER</td>
<td>f</td>
</tr>
<tr>
<td>AROC-13</td>
<td>4</td>
<td>Unknown</td>
<td>Sank 4 Aug 46</td>
<td>f</td>
</tr>
<tr>
<td>USS Arkansas (BB-33)</td>
<td>441</td>
<td>0.178</td>
<td>Sank at BAKER</td>
<td>f</td>
</tr>
<tr>
<td>USS Banner (APA-60)</td>
<td>104</td>
<td>0.262</td>
<td>0.297</td>
<td>0.580</td>
</tr>
<tr>
<td>USS Barrow (APA-61)</td>
<td>114</td>
<td>0.223</td>
<td>0.187</td>
<td>0.420</td>
</tr>
<tr>
<td>USS Bladen (APA-63)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>111</td>
<td>0.222</td>
<td>e</td>
<td>0.260</td>
</tr>
<tr>
<td>USS Bracken (APA-64)</td>
<td>108</td>
<td>0.263</td>
<td>0.177</td>
<td>0.440</td>
</tr>
<tr>
<td>USS Briscoe (APA-65)</td>
<td>112</td>
<td>0.202</td>
<td>0.389</td>
<td>0.650</td>
</tr>
<tr>
<td>USS Brule (APA-66)</td>
<td>111</td>
<td>0.234</td>
<td>0.635</td>
<td>0.890</td>
</tr>
<tr>
<td>USS Butte (APA-68)</td>
<td>126</td>
<td>0.231</td>
<td>0.422</td>
<td>0.670</td>
</tr>
<tr>
<td>USS Carlisle (APA-69)</td>
<td>104</td>
<td>0.005</td>
<td>Sank at ABLE</td>
<td>f</td>
</tr>
<tr>
<td>USS Carteret (APA-70)</td>
<td>119</td>
<td>0.219</td>
<td>0.932</td>
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</tr>
<tr>
<td>USS Catron (APA-71)</td>
<td>116</td>
<td>0.260</td>
<td>0.850</td>
<td>1.110</td>
</tr>
<tr>
<td>USS Conyngham (DD-371)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>109</td>
<td>0.495</td>
<td>e</td>
<td>1.000</td>
</tr>
<tr>
<td>USS Cortland (APA-75)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>89</td>
<td>0.228</td>
<td>e</td>
<td>0.260</td>
</tr>
<tr>
<td>USS Crittenden (APA-77)</td>
<td>112</td>
<td>0.258</td>
<td>1.061</td>
<td>1.350</td>
</tr>
<tr>
<td>USS Dawson (APA-79)</td>
<td>110</td>
<td>0.270</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>USS Dentuda (SS-335)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>58</td>
<td>0.693</td>
<td>e</td>
<td>0.990</td>
</tr>
<tr>
<td>USS Fallon (APA-81)</td>
<td>127</td>
<td>0.232</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>USS Fillmore (APA-83)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>109</td>
<td>0.209</td>
<td>d</td>
<td>0.250</td>
</tr>
</tbody>
</table>

Notes:

<sup>a</sup>Includes time living aboard support ships at Bikini for ABLE and BAKER.

<sup>b</sup>Includes only those periods the ship was reboarded after BAKER when the ship was not remanned.

<sup>c</sup>Includes dose accrued during time living aboard target ship if it was remanned after ABLE and BAKER. Includes also Support Ship Dose as well as dose accrued during return to the United States aboard a support ship or remanned target ship. Calculation ends with the radiological clearance of the ship on which most of the crew was located.

<sup>d</sup>Post-BAKER boarding party analysis not completed at time of printing.

<sup>e</sup>Remanned target after BAKER.

<sup>f</sup>Crew splintered to several ships. Individual doses vary.

<sup>g</sup>Only 29 crewmembers reboarded after BAKER. Individual doses have been assigned.

(continued)
Table 32. Reconstructed (calculated) dose for target ship crews, CROSSROADS (continued).

<table>
<thead>
<tr>
<th>Ship</th>
<th>Crew Size</th>
<th>Support Ship Dose&lt;sup&gt;a&lt;/sup&gt; (rem gamma)</th>
<th>Post-BAKER Target Ship Boarding Dose&lt;sup&gt;b&lt;/sup&gt; (rem gamma)</th>
<th>Total Dose&lt;sup&gt;c&lt;/sup&gt; (rem gamma)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS Gasconade (APA-85)</td>
<td>105</td>
<td>0.224</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>USS Geneva (APA-86)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>115</td>
<td>0.230</td>
<td>e</td>
<td>0.270</td>
</tr>
<tr>
<td>USS Gilliam (APA-57)</td>
<td>91</td>
<td>0.379</td>
<td>Sank at ABLE</td>
<td>f</td>
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<td>USS Hughes (DD-410)</td>
<td>81</td>
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<td>USS Independence (CVL-22)</td>
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<tr>
<td>LCI-327</td>
<td>18</td>
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<td>LCI-329&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>0.208</td>
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<td>LCI-332</td>
<td>17</td>
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<td>LCI-620 (officers)</td>
<td>2</td>
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<td>LCI-620 (crew)</td>
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<td>LCI(L)-549&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>LCI(L)-615&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>LSM-60</td>
<td>44</td>
<td>f</td>
<td>Sank at BAKER</td>
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<tr>
<td>USS LST-52</td>
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<td>USS LST-125</td>
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<td>USS LST-133</td>
<td>78</td>
<td>0.207</td>
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<td>USS LST-220</td>
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<td>0.226</td>
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<td>USS LST-545</td>
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<td>USS LST-661</td>
<td>62</td>
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<tr>
<td>USS Mayrant (DD-402)</td>
<td>109</td>
<td>0.264</td>
<td>0.416</td>
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<td>USS Mugford (DD-389)</td>
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<td>1.920</td>
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<tr>
<td>USS Mustin (DD-413)</td>
<td>112</td>
<td>0.274</td>
<td>0.280</td>
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</table>

Notes:
<sup>a</sup>Includes time living aboard support ships at Bikini for ABLE and BAKER.
<sup>b</sup>Includes only those periods the ship was reboarded after BAKER when the ship was not remanned.
<sup>c</sup>Includes dose accrued during time living aboard target ship if it was remanned after ABLE and BAKER. Includes also Support Ship Dose as well as dose accrued during return to the United States aboard a support ship or remanned target ship. Calculation ends with the radiological clearance of the ship on which most of the crew was located.
<sup>d</sup>Post-BAKER boarding party analysis not completed at time of printing.
<sup>e</sup>Remanned target after BAKER.
<sup>f</sup>Crew splintered to several ships. Individual doses vary.

(continued)
<table>
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<tr>
<th>Ship</th>
<th>Crew Size</th>
<th>Support Ship Dose&lt;sup&gt;a&lt;/sup&gt; (rem gamma)</th>
<th>Post-BAKER Target Ship Boarding Dose&lt;sup&gt;b&lt;/sup&gt; (rem gamma)</th>
<th>Total Dose&lt;sup&gt;c&lt;/sup&gt; (rem gamma)</th>
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<tr>
<td><strong>Nagato</strong></td>
<td>172</td>
<td>0.118</td>
<td>Sank 29/30 July 1946</td>
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<td>USS Nevada (BB-36)</td>
<td>403</td>
<td>0.261</td>
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<td>USS New York (BB-34)</td>
<td>536</td>
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<td>0.908</td>
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<td>USS Niagara (APA-87)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>271</td>
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<td>USS Parche (SS-384)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>61</td>
<td>1.097</td>
<td>e</td>
<td>2.660</td>
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<td>USS Pennsylvania (BB-38)</td>
<td>464</td>
<td>0.255</td>
<td>0.746</td>
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<td>USS Pensacola (CA-24)</td>
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<td>0.569</td>
<td>0.810</td>
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<td>USS Pilotfish (SS-386)</td>
<td>52</td>
<td>0.209</td>
<td>Sunk at BAKER f</td>
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<td>Prinz Eugen</td>
<td>444</td>
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<td>USS Ralph Talbot (DD-390)</td>
<td>132</td>
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<tr>
<td>USS Rhind (DD-404)</td>
<td>104</td>
<td>0.266</td>
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<td>d</td>
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<tr>
<td>Sakawa</td>
<td>143</td>
<td>0.003</td>
<td>Sank at ABLE f</td>
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<tr>
<td>USS Salt Lake City (CA-25)</td>
<td>335</td>
<td>0.330</td>
<td>1.004</td>
<td>1.350</td>
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<tr>
<td>USS Saratoga (CV-3)</td>
<td>589</td>
<td>0.072</td>
<td>Sank at BAKER f</td>
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<tr>
<td>USS Searaven (SS-196)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>58</td>
<td>0.896</td>
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<td>1.560</td>
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<tr>
<td>USS Skate (SS-305)</td>
<td>53</td>
<td>0.508</td>
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<td>d</td>
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<td>USS SkipJack (SS-184)</td>
<td>78</td>
<td>0.230</td>
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<tr>
<td>USS Stack (DD-406)</td>
<td>102</td>
<td>0.239</td>
<td>1.729</td>
<td>1.990</td>
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<td>USS Trippe (DD-403)</td>
<td>135</td>
<td>0.224</td>
<td>0.118</td>
<td>0.380</td>
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<td>USS Tuna (SS-203)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>57</td>
<td>1.489</td>
<td>e</td>
<td>2.360</td>
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<td>USS Wainwright (DD-419)</td>
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<tr>
<td>USS Wilson (DD-408)</td>
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<td>1.150</td>
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<tr>
<td>YO-160</td>
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<td>YOG-83</td>
<td>10</td>
<td>unknown</td>
<td>d</td>
<td>d</td>
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</tbody>
</table>

**Notes:**

<sup>a</sup>Includes time living aboard support ships at BAKER for ABLE and BAKER.

<sup>b</sup>Includes only those periods the ship was reboarded after BAKER when the ship was not remanned.

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<sup>d</sup>Post-BAKER boarding party analysis not completed at time of printing.

<sup>e</sup>Remanned target after BAKER.

<sup>f</sup>Crew splintered to several ships. Individual doses vary.
been retired to the University of California, Los Angeles archives), he wrote (Reference A.6):

On President Harry S. Truman's instructions to Admiral Blandy [I] was to safeguard what was eventually a 42,000-man operation from the "peculiar hazards" of the atomic bomb and was to devise a radiologic defense organization and pattern for both military and civilian operations. At the end of the JTF 1 operation, it could be said that no one had been injured by the "peculiar hazards" inherent in it.
REFERENCES

The references are organized in the following manner. Section A consists of references of general interest. Section B contains CROSSROADS planning documents. Section C is comprised of operational and postoperational documents.

In sections B and C, the number following the letter gives a general indication as the type of document. The headings for B and C are as follows:

B.0 JTF 1 documents (or no task group given)
B.2 Navy planning
B.5 Army-Army Air Force planning
B.11 Letters, memoranda
B.12 Newspapers and magazine articles
C.0 JTF 1 documents
C.1 Los Alamos Laboratory reports
C.2 Target ships
C.4 General Navy
C.6 Nontarget ships
C.7 Navy aircraft
C.8 Bikini resurvey
C.9 Reports in the CROSSROADS or XRD series
C.10 Navy messages
C.11 Memoranda, letters
C.12 Lectures, interviews, newspapers, magazines
C.13 Current interpretations of CROSSROADS.

Source documents bearing an NTIS availability code may be purchased at the following address:

National Technical Information Service
(Sales Office)
5285 Port Royal Road
Springfield, Virginia 22161
Telephone: (703) 787-4650.

When ordering by mail or phone, please include both the price code and the NTIS number. The price code appears in parentheses before the NTIS order number; e.g., (A07) AD 000 000.
Additional ordering information or assistance may be obtained by writing to the NTIS, Attention: Customer Service, or by calling (703) 487-4660.

Reference citations with no availability codes may be available at the location cited or in a library.

Source documents with an availability code of DOE CIC may be reviewed at the following address:

Department of Energy
Coordination and Information Center
(Operated by Reynolds Electrical & Engineering Co., Inc)
2753 S. Highland
P.O. Box 14100
Las Vegas, Nevada 89114
Telephone: (702) 734-3194; FTS: 598-3194.

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Advance Echelon JTF 1
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C.2.35 Report Number 11, Commanding Officer's Report on Test ABLE††
Commanding Officer USS LST-545 to Director of Ship Material
4 July 1946

C.2.36 Major Damage Report (Report Number 5, Test BAKER)††
Commanding Officer Mugford to Director of Ship Material
13 August 1946

C.2.37 Major Damage Report (Report Number 5)††
Commanding Officer Nevada to Director of Ship Material
13 August 1946

††Undergoing Declassification Review; will be available from DOE CIC.

249
C.2.38  Report of Decontamination Progress, USS New York (BB-36)††
Commanding Officer to Director of Ship Material
15 August 1946

C.2.39  Report on Decontamination††
Commanding Officer USS Niagara to Director of Ship Material
20 August 1946

C.2.40  Decontamination Work Done by Ship's Forces††
Commanding Officer USS Parche to Director of Ship Material
21 August 1946

C.2.41  Commanding Officer's Report (Report Number 11), Forwarding of††
Commanding Officer USS Pennsylvania to Director of Ship Material
12 July 1946 (ABLE)
n.d. (BAKER)

C.2.42  Major Damage, Test ABLE -- CROSSROADS Report Number 5††
Commanding Officer USS Pilotfish to Director of Ship Material
4 July 1946

C.2.43  Major Damage Report -- Report Number 5††
Commanding Officer Prinz Eugen to Director of Ship Material
5 July 1946

C.2.44  Sakawa -- Condition of and Sinking††
W.S. Maxwell to Director of Ship Material
2 July 1946

C.2.45  Report of Radiological Decontamination of the USS Salt Lake City
(CA-25)††
Commanding Officer to Director of Ship Material
19 August 1946

C.2.46  Report of Decontamination Work, Submission of††
Commanding Officer Searaven to Director of Ship Material
23 July 1946

C.2.47  Report of Decontamination Work††
Commanding Officer Searaven to Director of Ship Material
20 August 1946

C.2.48  Decontamination Work, Report of††
Commanding Officer Skate to Director of Ship Material
20 August 1946

C.2.49  Boarding Reports, 28 July -- 21 August, Skipjack (SS-184)††

C.2.50  Procedure for All Target Vessels††
Commanding Officer Stack to Director of Ship Material

††Undergoing Declassification Review; will be available from DOE CIC.
C.2.51 Tuna Boarding Reports, 27 July -- 15 August††

C.2.52 Decontamination Work Accomplished Aboard USS Tuna, Report of††
Commanding Officer to CTG 1.2
19 August 1946

C.2.53 Report of Decontamination Work††
Commanding Officer Wilson to CTG 1.2
18 August 1946

C.2.54 Radiological Decontamination Procedures, Prinz Eugen, August 4 to
August 11, 1946††
Commanding Officer to CTG 1.2
13 August 1946

C.4.1 Rosters of Officers††
CJTF 1
1 July 1946

C.6.1 Comments on Results of the Investigations on the USS Rockbridge††
H. Scoville
Technical Analysis Section
21 November 1946

C.6.2 From Rockingham, CTG 1.2, to Director of Ship Material††
U.S. Naval Communications Systems Dispatch
3 August 1946

C.7.1 VX-2 Log††
Volume 1679 aboard Shangri-La

C.7.2 VPB-32 Squadron at CROSSROADS††
Ltr from William B. Lower to Capt A.G. Nelson, USN
Serial 981 T33/1243
29 June 1979 (Privacy Act Restrictions)

C.7.3 Personal Flight Log of Durell Hyers††
VPB-32 Log (Privacy Act Restrictions)

C.7.4 VH-4 PBM Daily Flight Log††
Vol. 736

C.7.5 Smooth Log -- Submission of††
Commanding Officer U.S. Pacific Fleet, Air Forces Pacific Fleet to
Chief of Naval Personnel
20 September 1946

††Undergoing Declassification Review; will be available from DOE CIC.
C.7.6 **Danger from Alpha Contamination on Drone Aircraft in Test BAKER**
Memo from H. Scoville to S.L. Warren†
9 September 1946

C.8.1 **Bikini Scientific Resurvey, Volume I, Operations**
AFSWP
December 1947 NTIS AD A077 489*

C.8.2 **Bikini Scientific Resurvey, Volume II, Report of the Technical Director**
AFSWP
December 1947 NTIS AD A077 490*

C.8.3 **Bikini Scientific Resurvey, Annex IV, Report of the Technical Director**
(Supplement to Volume II)
AFSWP
December 1947 NTIS AD A077 491*

C.8.4 **Investigation of Gamma Radiation Hazards Incident to an Underwater Atomic Explosion**
Walmer E. Strope
BuShips
March 1948

C.9.2 **Bureau of Ships Group Final Report, Test A and B, Volume I**
December 1946 XRD-2

C.9.3 **Final Report of Test ABLE and Test BAKER, Volume II**
December 1946 XRD-3

XRD-149

XRD-150

XRD-151

XRD-153

*Available from NTIS: order number appears before the asterisk.

**Undergoing Declassification Review, will be available from NTIS.
†Available from DOE CIC.
††Undergoing Declassification Review; will be available from DOE CIC.

XRD-154


XRD-155


XRD-156


18 October 1946

XRD-157

C.9.185 Radiological Decontamination of Target and Nontarget Vessels, Volume 1 NTIS AD 473 906*

XRD-185

C.9.186 Radiological Decontamination of Target and Nontarget Vessels, Volume 2 NTIS AD 473 907*

XRD-186

C.9.187 Radiological Decontamination of Target and Nontarget Vessels, Volume 3 NTIS AD 473 908*

XRD-187

C.9.189 Historical Report -- Atomic Bomb Tests ABLE and BAKER (Operation CROSSROADS), Volume I**

January 1946

XRD-189

C.9.190 Historical Report -- Atomic Bomb Tests ABLE and BAKER (Operation CROSSROADS), Volume II**

January 1947

XRD-190

C.9.191 Historical Report -- Atomic Bomb Tests ABLE and BAKER (Operation CROSSROADS), Volume III**

January 1947

XRD-191


XRD-206


January 1947

XRD-207

*Available from NTIS: order number appears before the asterisk.

**Undergoing Declassification Review. will be available from NTIS.
W.H. Shurcliff et al.
18 November 1946 XRD-208
NTIS AD 367 496*

C.9.209 Report on Instrumentation of Technical Staff**
December 1946 XRD-209

C.9.210 Report on Instrumentation of Technical Staff**
December 1946 XRD-210

C.10.1 Naval message 030445Z††
A.M. Sumner
4 August 1946

C.10.2 Naval message 120706Z††
CTG 1.2
12 August 1946

C.10.3 Naval message 032309Z††
CJTF 1
3 August 1946

C.10.4 Naval message 302200Z††
CNO
31 August 1946

C.10.5 Naval message 240111Z††
ComServPac
25 August 1946

C.10.6 Naval message 311521Z††
CJTF 1
31 July 1946

C.10.7 Naval message 020252Z††
CJTF 1
2 August 1946

C.10.8 Naval message 091244Z†
CTG 1.2
9 August 1946

*Available from NTIS; order number appears before the asterisk.

**Available at DOE CIC.

†Available from DOE CIC.

††Undergoing Declassification Review; will be available from DOE CIC.
C.10.9 Naval message 142238Z†
CTG 1.2
16 August 1946

C.10.10 Naval message 050544Z††
CJTF 1
5 August 1946

C.10.11 Naval message 080303Z††
CJTF 1
11 August 1946

C.10.12 Naval message 102345Z††
CJTF 1
11 August 1946

C.10.13 Naval message 202354Z††
Safety Advisor
21 August 1946

C.10.14 Naval message 100648Z††
CJTF 1
11 August 1946

C.10.15 Naval message 1'J8022Z†
Radsafe Section
15 August 1946

C.10.16 Naval message 100305Z†
Los Alamos Laboratory
Kwajalein
10 August 1946

C.10.17 Naval message 292336Z†
Burleson (APA-67)
30 July 1946

C.10.18 Naval message 180134Z††
CTG 1.2 to BuPers (ammunition dispersal CROSSROADS)
18 October 1946

C.11.1 Ltr: S.L. Warren to W.G. Myers†
31 December 1946

C.11.2 Messageform Sept 46 0416492†
Washington Headquarters
4 September 1946

†Available from DOE CIC.
††Undergoing Declassification Review: will be available from DOE CIC.
C.11.3 Notebook, Bikini, August 1946 (entry for 10 August)†
S.L. Warren

C.11.4 "Command Problems of Atomic Defense Warfare" (speech)††
F.T. Winant, Jr.
September 1947

C.11.5 Ltr: Task of Ammunition Inspection and Disposal on CROSSROADS Target Vessels. Report on††
LCDR S.W. McGovern to CTU 1.2.12
JTF 1
23 October 1946

C.11.6 Message: Serial T-346††
CTG 1.2 to JTF 1
29 August 1946

C.11.7 Ltr: Radiological Safety††
OIC Ammunition Disposal Unit to Chief BuMed
11 November 1946

C.11.8 Memorandum: Comments on Letter of Officer in Charge of Ammunition Disposal Unit of 11 November 1946††
Capt. G.M. Lyon, Safety Advisor
29 November 1946

C.11.9 Ltr: Safety Regulations for Work on Target Vessels Formerly JTF 1††
Chief BuMed
31 January 1947

C.11.10 Ltr: Serial 0169P36††
CNO to Chief NavPers
15 July 1947

C.11.11 Memorandum: Conference on Radiological Safety 22 November 1946, report on††
BuShips
10 December 1946

C.11.12 Message: September 462417482†
Kelley, USEO
24 September 1946

C.11.13 Memorandum††
CB 1156 to CJTF 1
1 October 1946

†Available from DOE CIC.
††Undergoing Declassification Review; will be available from DOE CIC.
C.11.14 Memorandum: Security Guards on Amen, Bikini, Eneu Islands††
23 July 1946

C.11.15 Ltr: Ser 9E1 TD/2200†
W.H. Loeffler to S. Jones
Department of the Navy

C.11.16 Memorandum: Monitor Problems††
OIC Target Ship Monitors to Chief Radsafe Section
9 August 1946

C.11.17 Ltr: Ser X-000083††
University of California, Berkeley, to Capt. W.B. Walsh, USN
20 September 1946

C.11.18 Ltr: Ser 000096††
University of California, Berkeley, to Adm. T.A. Solberg
25 October 1946

C.11.19 Memorandum: Summary Report of Conditions of Target Ships as of 2000,
4 August 1946, Based on DSM Plot in Radiological Safety Control††
Radiological Safety Section
4 August 1946

C.11.20 Memorandum: Ammunition Disposal Unit Muster List††
Commanding Officer Geneva
22 September 1946

C.11.21 Memorandum: Ammunition Disposal Muster List††
Commanding Officer Geneva
1 October 1946

C.11.22 Ltr (Ser 040S): Radiological Safety Section, Weekly Chronological
Report of Activities of Week Beginning 24 March 1947††
CINCPAC to Chief BuMed
March 1947

C.11.23 ALNAV #122: Blood Count for All Navy CROSSROADS Personnel††
19 May 1947

C.11.24 Message: ATCOMKWAJ to BuMed (160515Z)††
17 May 1947

C.11.25 Ltr: A9-4(49921) (390)/Kh††
Commander San Francisco Shipyard
22 January 1948

†Available from DOE CIC.

††Undergoing Declassification Review; will be available from DOE CIC.
C.11.26 Ltr: A(-4/S99-(5) RAC: jll, Code 950††
Commander San Francisco Shipyard
1 December 1948

C.11.27 JTF-1 Letter to commanding officers of ships††
CJTF 1
9 September 1946

C.11.28 Letter from Wright Langham to Dr. Herbert Scoville†
5 Nov 1946

C.11.29 Telegram to CWSF from Radiological Safety Advisor AH 12 - Haven†
13 August 1946

C.11.30 Memorandum: Staff Commander JTF-1, Radiological Advisor to CTG
1.2†
13 August 1946

C.11.31 Memorandum: "Dust Samples Taken in Crew Spaces on Prinz Eugen 9 August
1946." Pill Country Lab to Col. Warren†
n.d.

C.12.1 National Geographic, "Operation CROSSROADS"
April 1947

C.12.2 Life, "After Year Ships are Radioactive"
11 August 1947

C.12.3 All Hands†
Bureau of Naval Personnel
1 July 1946

C.12.4 Lecture†
Stafford L. Warren
7 October 1947

C.12.5 Personal interview with Col. Gallenten††
11 November 1982 (Privacy Act Restrictions)

C.12.6 Washington Post, "New Blood Tests Ordered for Men Who Were at Bikini"
28 May 1947

C.13.1 History of USS Geneva (APA-86) during Operation CROSSROADS (1946)†
August 1981

††Undergoing Declassification Review; will be available from DOE CIC.
C.13.2 Ltr: Beta Radiation Film Dosimetry†
J. Brady to W.H. Loeffler
Reynolds Electrical and Engineering Co., Inc.
18 March 1983

C.13.3 Ltr: Office of the Chief of Naval Operations to the Honorable Diane Feinstein, Mayor of San Francisco (includes attachment 1 and internal NTPR CROSSROADS working papers)†

C.13.4 CROSSROADS Personnel Dosimetry Records (printed list and microfilm source records)†
Reynolds Electrical and Engineering Corp.
1946-1947 (Privacy Act Restrictions)

C.13.5 Listing of Army Air Force Units Participating in CROSSROADS†
October 1982

C.13.6 Dosimetry Matrix Report, 1946 Pacific Records†
Reynolds Electrical and Engineering Co., Inc.
7 September 1982

C.13.7 Not Used

C.13.8 Marine Corps Nuclear Test Personnel Review File C†
[1983] (Privacy Act Restrictions)

C.13.9 CROSSROADS Radiological Clearance of Various Ships††
1 August 1982

C.13.10 NNTPR Ship Histories†
Various dates

C.13.11 Memorandum: Listing of the CROSSROADS Target Ships and Their Fate†
CNO
25 May 1978

C.13.12 "Plutonium Contamination on the USS SKATE, Operation CROSSROADS"††
Memorandum: J. Goetz (Science Applications Inc.) to D. Auton (DNA)
24 March 1984

†Available from DOE CIC.
††Undergoing Declassification Review; will be available from DOE CIC.
APPENDIX A

ACTIVITIES OF PARTICIPATING NAVY VESSELS
DURING OPERATION CROSSROADS
This appendix lists the 153 support ships, 84 target ships, and other Navy craft that participated in Operation CROSSROADS. Their crew complements, the dates of their arrival at and departure from Bikini, their distances from the two shots, and their postshot dispositions are given. Crew sizes and Bikini departure dates may vary somewhat from data in Tables 31 and 32 (Chapter 12), which are based on somewhat more expanded research. Activities that are considered important to the conduct of the operation or that had radiological significance are included. Excluded was information on those days that the log entries reflected only routine operations. For example, all ships left Bikini Lagoon on July 18 and 19 for the test BAKER rehearsal, but reference to the rehearsal has been omitted in the ships' activity schedule in this appendix. The ships are listed alphabetically.

The information in this appendix has been extracted primarily from each ship's log (Reference 1)* but has been been supplemented by material from logs of other ships and other documents. Information given without citation to a reference may be assumed to be from the ship's own log. Among the other documents useful in compiling this Appendix were two specified in the CROSSROADS OpPlan for each target vessel. These were the Major Damage Report (often referred to as "Report No. 5") (Reference 2) and the Commanding Officers Report (often referred to as "Report No. 11") (Reference 3). In addition, the commanding officer of each target vessel wrote a report summarizing decontamination activities (Reference 4).

Throughout the description of the ships' movements, reference is made to the numbered berths and named lagoon-patrol sectors within Bikini Lagoon and named operating areas outside the lagoon. The berths were numbered from 1 in the northwestern portion of the anchorage area to 386 in the southeastern area. The berths were arranged in long, somewhat irregular west-to-east rows. There were in addition berths near Enue Island designated by letters or their phonetic equivalent, e.g., Able for A, Jig for J, Oboe for O, etc. Figure A.1 shows the berths and their relationship to the islands of the atoll and the target fleet area.

The lagoon-patrol sectors within the lagoon important during reentry were designated with names of various countries. The sectors were centered on the surface zero point and are shown on Figure A.2.

The operating areas outside Bikini Lagoon used by the ships during the tests were designated with the names of historic automobile manufacturers. These are also shown in Figure A.2.

*References are listed at the end of this Appendix (p. 448).
Figure A.1. Bikini anchorages and target ship area, CROSSROADS.
Figure A.2. Target area patrol sectors and ship operating areas for CROSSROADS. Target area patrol sectors shown are for ABLE. For BAKER, the Holland sector was eliminated and the England, France, and Greece sectors expanded to fill the area. The ship operating areas shown are in their nominal positions. Before each shot, the shot-time wind was predicted and the areas were rotated around Point Auto accordingly. For ABLE the areas were rotated counterclockwise 50°; for BAKER, clockwise 30°.
USS Achomawi (ATF-148)

USS Achomawi, a fleet ocean tug, served as a support ship in TG 1.2.7 (Salvage Unit) under TG 1.2 (Target Vessel Group). Its function was to tow or salvage damaged target vessels after the shots and to fight fires aboard and make ship repairs.

Task Unit and Function

Achomawi, as the only fleet ocean tug, served as a support ship in TG 1.2.7 (Salvage Unit) under TG 1.2 (Target Vessel Group). Its function was to tow or salvage damaged target vessels after the shots and to fight fires aboard and make ship repairs.

Shot ABLE (1 July, 0600) 0946-1013 Towed target vessel YO-83 to new anchorage.


Bikini Atoll Arrival: 08 June 1946

1 July 0830 0936 Underway for target submarine USS Skate (SS-305). 1020 1047 Towed Skate to Ionchebi Island for mooring. 1055 Conducted diving operations on Skate. 1050 Anchored Skate.

1106 Reentered the lagoon. 1106 Anchored in berth C. 1119 Underway for target ship USS Bladen (APA-63). 1120 Arrived in vicinity of Bladen, standing by awaiting orders. 1127 Proceeded to berth G. 1156 Anchored in berth G without conducting salvage activity.

23 July 0000-0900 Cleared lines fouled while maneuvering target ship USS Briscoe (APA-65).

29 July 0749 Underway for target submarine USS Skate (SS-305). 0831-1307 Towed Skate to Ionchebi Island for mooring.

26 July 0749 Underway for target submarine USS Skate (SS-305). 0831-1307 Towed Skate to Ionchebi Island for mooring.

2615-1530 Towed Salt Lake City to a new anchorage.

1006 Anchored in berth G without conducting salvage activity.

1515-1530 Towed Salt Lake City to a new anchorage.

1509-1530 Towed Salt Lake City to a new anchorage.

1708 Anchored in berth 76.

6 July 0800-0925 Towed target ship USS Salt Lake City (CA-25) and anchored it in berth 164.

1006 Reentered the lagoon. 1119 Anchored in berth C. 1300 Underway for target ship USS Bladen (APA-63). 1320 Arrived in vicinity of Bladen, standing by awaiting orders. 1356 Proceeded to berth G. 1515-1530 Towed Salt Lake City to a new anchorage.

1020 1047 Towed Skate to Ionchebi Island for mooring. 1055 Conducted diving operations on Skate. 1050 Anchored Skate.

1006 Anchored in berth G without conducting salvage activity.

1708 Anchored in berth 76.

7 July 0830 0950 Anchored in berth 76.

1820anchored in berth 76.

30 July 0745 Underway for target submarines USS Skate and USS Curtiss (SS-203).
1027  Washed down Skate's bow with diesel fuel oil.
1125  Began washdown of Skate's portside.
1315-1327 Underway for Tuna.
1335  Began washing down Tuna.
1351  Washed down Tuna's portside.
1340  Washed down Tuna using lye solution under pressure.
1625  Completed washdown operations.
1705  Anchored in berth G.

31 July
0745  Underway for further washdown operations.
0815-1110 Washed down Skate with saltwater using two monitors and two additional streams, and sprayed with lye and boiler compound solution.
1305-1603 Washed down Tuna with two monitors and two additional streams.
1654  Anchored in berth G.

1 August
0753-0821 Underway for Skate.
0833  Began washdown of Skate.
0953  Used four streams of seawater on Skate.
1214  Skate washdown completed.
1225  Underway to target ship USS Stack (DD-406).
1316-1400 Washed down Stack with midship monitor.
1402-1420 Hose crew boarded Stack and washed it down with lye solution.
1537-1541 Lye solution sprayed on Stack.
1621-1643 Monitored Stack amidship and washed down its portside.
1652  Underway to berth 145 near USS Wharton (AP-7).
1705  Anchored in berth 145.

2 August
0936  Underway for Stack.
1006-1009 Sprayed Stack with lye solution.
1017-1021 Two men boarded Stack.
1019-1043 Repainted Stack with lye solution.
1223-1232 Stack boarded by the captain, a civilian, and members of the boarding team.
1314-1330 Sprayed Stack with lye and boiler compound solution.
1340-1352 Sprayed Stack with lye and boiler compound solution.
1420-1438 Washed down Stack's portside with saltwater.
1441-1504 A party took readings on Stack.
1515  Underway to berth 377.
1634  Anchored in berth 377.

3 August
0731  Underway for Stack.
0840-0932 Washed down Stack with saltwater.
0957-1055 Concentrated on Stack's portside.
1207  Anchored in a berth 1.375 yards (1.3 km) south of berth 377.
19 August
0930 Underway to New York.
1050 Anchored near berth 337.

5 August
0850-1050 Underway for target ship USS New York (BB-34) with boarding team members.
1100  A civilian boarded New York.
1107-1122 Sprayed New York with lye solution.
1159-1201 Sprayed New York with lye solution.
1213-1221 Sprayed New York with lye solution.
1310-1356 Washed down New York with saltwater.
1358  A civilian boarded New York.
1405  Boarding team boarded New York.
1500  Boarding team and civilian returned to Achomawi.

1515-1530 Sprayed New York with lye solution.
1705  Anchored near berth 337.

6 August
0755  Underway to New York.
0900-0905 Sprayed New York with lye solution.
0921  Resumed spraying New York.
0936  Discontinued spraying New York; boarding team returned to Achomawi.
1020  Departed area to conduct an inspection tour.
1135  Discontinued spraying New York; the boarding team returned to Achomawi.
1137  Sprayed target ship USS Pennsylvania (BB-38) with lye solution.
1607-1625 Sprayed Pennsylvania with lye solution.
1650  Departed the area.
1716  Anchored in berth 363.

7 August
0805  Underway for Pennsylvania with boarding teams and monitors.
1119-1155 Sprayed paint remover solution on Pennsylvania's superstructure.
1319-1355 Sprayed paint remover solution on Pennsylvania's portside.
1548  Anchored in berth 76.

8 August
1040  Underway for target ship USS Trippe (DD-403).
1304-1543 Washed down Trippe with saltwater streams.
1640  Anchored in berth 76.

15 August
1020 Discontinued spraying.
1345  Sprayed Pennsylvania with lye solution.
1535-1545 Anchored in berth 76.

16 August
0745  Underway for Paint Remover solution on Pennsylvania.
1010-1038 Sprayed decontamination solution on Trippe.
1304-1543 Washed down Trippe with saltwater streams.
1640  Anchored in berth 76.

17 August
0845  Sprayed Pennsylvania with lye solution.
1705 Underway to Pennsylvania.
1725  Returned to berth 76.

19 August
1037  Underway to Pennsylvania.
1118  Anchored in berth 76.

21 August
1050  Underway for anchorage.
1125  Underway to Kwajalein Atoll.
1457  Arrived at anchorage.
1526  Underway to Kwajalein Atoll.
1701  Departed Kwajalein Atoll.

22 August
1115  Underway for Bikini Atoll.
1422  Anchored at Bikini Atoll.

267
USS Achomawi (ATF-148)

24 August
1008 Anchored New York at Kwajalein Atoll.
1425 Underway for Bikini Atoll.

25 August
0727 Arrived at Bikini Atoll.

26 August
1005 Underway with target ship USS Barrow (APA-61) in tow.

27 August
1307 Arrived at Kwajalein Atoll.
1703 Underway for Bikini Atoll.

28 August
0919 Arrived at Bikini Atoll.

29 August
Left for Kwajalein Atoll with target ship USS LST-133 in tow.

30 August
1535 Anchored LST-133.

1 September
1616 Departed for Pearl Harbor.

USS AJAX (AR-6)

Crew Size: 250
Bikini Atoll Arrival: 1 May 1946
Bikini Atoll Departure: 23 August 1946
Shot ABLE Location: 16 nmi (30 km) NNE
Shot BAKER Location: 15.5 nmi (29 km) ENE
Decontamination Location: San Diego
Operational Clearance: By 1 January 1947

USS Albemarle (AV-5)

31 July
0707 Anchored at Bikini Atoll in berth 207.

2 August
Shifted to berth 207.

7 August
Shifted to berth 207.

12 August
Personnel from target ship USS Independence (CVL-22) came aboard Ajax for messing and berthing.

14 August
Shifted to anchorage located between berths 93 and 114.

18 August
Some Independence personnel transferred to USS Artemis (AKA-21) for transport to Pearl Harbor.

23 August
1150 Departed for Kwajalein Atoll.

24 August
1136 Arrived Kwajalein Atoll.

28 August
1543 Departed Kwajalein Atoll after embarking personnel for transport to Pearl Harbor.

6 September
1035 Arrived at Pearl Harbor.

USS ALBEMARLE (AV-5)

Crew Size: 569
Bikini Atoll Arrival: 4 May 1946
Bikini Atoll Departure: 25 July 1946
Shot ABLE Location: Anchored at Kwajalein Atoll
Shot BAKER Location: >8 nmi (15 km) ESE (Area Chalmers)
Decontamination Location: Los Angeles
Final Clearance: By 22 November 1946

Task Unit and Function
The seaplane tender Albemarle served in TU 1.1.1 (Laboratory Unit). It contained laboratory facilities for the technical group. It also transported the weapons and provided assembly facilities.

Shot ABLE (1 July, 0900)

1 July
1912 Anchored in berth 270.

2 July
Shifted to berth 207.

Personnel transfers occurred for several days after shot ABLE.

Shot BAKER (25 July, 0835)

24 July
1802 Underway for station northeast of Bikini Atoll.

25 July
1831 Anchored in Rongelap Lagoon in berth 1.

30 July
1811 Underway for Bikini Atoll.

26 July
0929 Anchored at Kwajalein Atoll.

30 July
1017 Underway for San Pedro, California, via Pearl Harbor.

268
USS Allen M. Sumner (DD-692)

**USS Allen M. Sumner (DD-692)**

**Crew Size:** 278
**Bikini Atoll Arrival:** 5 June 1946
**Bikini Atoll Departure:** 10 August 1946
**Shot ABLE Location:** 19 nmi (35 km) E
**Shot BAKER Location:** 19 nmi (35 km) SE
**Decontamination Location:** Puget Sound
**Operational Clearance:** 19 November 1946
**Final Clearance:** 10 January 1947

**Task Unit and function:**
The destroyer Sumner served as a Support Ship in Destroyer Division 72 in TG 1.7 (Surface Patrol). Its function was to patrol the area around the atoll and also aid in the oceanographic and radiological task unit.

**Shot ABLE (1 July, 0600)**
1 July
- En route to conduct radiological and oceanographic operations (Palmolive Operation).
- Anchored in Bikini Atoll between berths 93 and 114.

2 July
- Underway to relieve USS Fall River (CA-131) as Harbor Entrance Control Vessel (HECV).
- Anchored in berth 386, Bikini.

3 July
- Underway in search of an LCM with personnel aboard, adrift off Enidrik Island.
- Approached O'Brien 1,000 yards (914 meters) south of Enidrik Island.
- Laying to receiving passengers from O'Brien and unmooring LMC-C29 in tow.
- Underway with LCM-C29 in tow.
- All engines stopped, line towing LCM parted. Commenced maneuvering to recover LCM-C29.
- LCM-C29 recovered and recovery crew aboard for Bikini.

4 July
- Anchored at Bikini Atoll in berth 386.

6 July
- Underway to new anchorage.
- Anchored 200 yards (182 meters) north of berth 386, Bikini.

8 July
- Underway for Point Sugar oceanographic survey.
- Maneuvering to get on station for oceanographic tests.
- Laying to and Point Sugar.
- Proceeding to regain station Point Sugar for oceanographic test.
- All engines stopped, laying to at Point Sugar for oceanographic tests.

9 July
- Laying to, conducting oceanographic training.

11 July
- Underway for Point Sugar.
- Anchored in berth 147E.

14 July
- Underway to HECV berth 386.
- Anchored in berth 386 after relieving USS Flusser (DD-386) as HECV.

18 July
- Underway, proceeding to Point Sugar.
- Returned to lee of Enidrik Island: continued steaming as before to relieve Fall River as HECV at Bikini.
- Anchored in berth 386 and relieved Fall River as HECV.

21 July
- Underway after being relieved by Laffey (DD-724) as HECV. Proceeding to berth 147E.

23 July
- Underway for Kwajalein Atoll for personnel transfers.

24 July
- Anchored in anchorage berth C, Kwajalein.
- Underway to conduct tactical maneuver exercises along route to Bikini.

25 July
- Moored portside to Enoree in berth 324, Bikini, for refueling.
- Underway to berth 147E.
- Six military and civilian personnel reported aboard in accordance with verbal orders of Radiological Safety Section JRF 1.

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**USS Allen M. Sumner (DD-692)**

**Shot BAKER (25 July, 0830)**

25 July
- Underway from berth 386 to Point Sugar.
- Stopped all engines, laying to while taking deep water samples for radiological tests outside Bikini Atoll.
- Set course and proceeded to Bikini Atoll for right monitoring.
- Anchored in Bikini Atoll, about 2 1/2 km (1.4 nautical miles) south of surface zero.
- Underway for new berth.

Set course and proceeded to resume station at Point Sugar.
- Laying to at Point Sugar.
- Proceeding to station at Point Sugar.

Proceeding to rendezvous at 11492'N, 155940'W. Conducted tactical naval operations in this area in company with USS Ingraham (DD-894) and USS Robert K. Huntington (DD-781).

Proceeded independently and stood into port.
- Moored to USS Enoree for refueling in berth 386.
- Underway for berth 147E.
- Anchored in berth 147E.

Underway en route to HECV berth 386.
- Anchored in berth 386 after relieving USS Flusser (DD-386) as HECV.

Underway after being relieved by Laffey (DD-724) as HECV. Proceeding to berth 147E.

Underway for Kwajalein Atoll for personnel transfers.

Underway to conduct tactical maneuver exercises along route to Bikini.

Moored portside to Enoree in berth 324, Bikini, for refueling.
- Underway to berth 147E.
- Six military and civilian personnel reported aboard in accordance with verbal orders of Radiological Safety Section JRF 1.
- Underway to assume HECV duty.

Anchored in berth 386, Bikini.
26 July

0127 Underway to shift berths.
0146 Anchored in new berth.
0927 Underway to shift berth.
0948 Anchored in berth 313, Bikini.
1618 Underway to take deep-water soundings at various points in the atoll.
1635 Laying to while conducting oceanographic tests in position 11°32'N; 165°30'E.
1720 Laying to while conducting oceanographic tests in position 11°32'N; 165°31'E.
1730 Laying to while conducting oceanographic tests.

1815 Completed tests, proceeding on various courses to 11°53'N, 165°32'E.
1829 Anchored at 11°53'N; 165°32'E for oceanographic tests.
1912 Underway to 11°53'N; 165°31'E.
1948 Anchored in Bikini Atoll to conduct oceanographic tests.
2012 Underway to radiological station S.
2032 Anchored at station S, Bikini Atoll, to conduct radiological tests.
2109 Completed radiological tests. Made all preparations for getting underway.
2120 Underway to berth 369, Bikini.
2135 Anchored in berth 369, Bikini.

27 July

1429 Underway to investigate oil slick about 11°56'N; 165°28.5'E.
1612 Laying to in oil slick, testing sample of water for radioactivity.
1636 Sample of water showed 80 times tolerance (8.0 r/hr 24 hours).
1639 Leaving oil slick. Underway to entrance of Bikini Atoll.
1807 Anchored in berth 360, Bikini.

28 July

1558 Underway proceeding to berth 314N.
1612 Anchored in berth 314N, Bikini.
2348 Underway to shift berths due to radioactivity in excess of tolerance and to avoid excessive exposure to radiological activity.

29 July

0115 Anchored in berth 353E, Bikini.
0559 Underway to stand out of harbor.
1451 Anchored in berth 381, Bikini.
1523 Underway to shift berths.
1541 Anchored in berth D, Bikini.
1745 Five military and civilian personnel disembarked by verbal authority of the Radiological Safety Section, CTF 1.

30 July

0840 Underway proceeding to Kwajalein Atoll.
1546 Anchored in berth K-16, Kwajalein.
1751 Underway from berth K-16, Kwajalein, to Bikini Atoll.

31 July

0811 Moored starboard side to USS Chikaskia (AD-58) in berth 250 for refueling.
0938 Underway from alongside Chikaskia proceeding to berth 347.
0956 Anchored between berth 147W and 145, Bikini.

2 August

0723 Underway to go alongside USS Dixie (AD-4).
0734 Moored starboard side to Dixie in berth 191, Bikini.
1445 Underway from alongside Dixie in berth 191, proceeding to berth C.
1515 Anchored in berth C, Bikini.

3 August

0728 Underway from berth G, Bikini, to go alongside Dixie.
0749 Moored starboard side to Dixie in berth 363, Bikini.

7 August

0747 Underway standing out of harbor to join USS Mobile (DD-693) for offset firing practice off Enew island.
1445 Anchored in berth 147E, Bikini.

9 August

0716 Underway from anchorage berth 147E to fuel ship at berth 324.
0745 Moored starboard side to Enoree in berth 324, Bikini, for refueling.
0849 Underway from Enoree to berth 147E.
0917 Anchored in berth 147E, Bikini.

10 August

0750 Underway from berth 147E, Bikini, to join Ingham, Mobile, Huntingdon, Laffey, and USS Lowry (DD-770) to conduct firing runs, en route from Bikini to Pearl Harbor.

15 August

Arrived Pearl Harbor.

USS ANDERSON (DD-411)

Crew Size: 105

Bikini Atoll Arrival: Before 30 June 1946

Crew Location for Shot ABL: USS Rockbridge (APA-33)
Crew Location for Shot BAKER: USS Algol (AP-226)

Shot ABLE Location: Berth 186, Bikini Anchorage, 750 yards (695 meters) S

Sunk 1 July 1946, Bikini Atoll

Task Unit and Function

The destroyer ANDERSON was a target vessel during CROSSROADS. Its crew was transferred before ABL to an offset target and was never returned. It served in Destroyer Division 1 in TF 112.1 (Destroyer Unit). Anderson was instrumented with microphones on its deck to pick up the sound of the explosions.

Shot ABL (1 July, 0900):

Anderson's crew was transported to the above-noted ships, which were in area Marmon (21.5 mi) [34 km] east of ABLE shot site. Shot ABL sank Anderson. Diving operations were conducted later to examine the ship.
### APL-27

**Task Unit and Function**

APL-27, a non-self-propelled barracks ship, was a member of TU 1.2.12 (Kwajalein Maintenance Unit). It was used as a decontamination station at Kwajalein and was not at Bikini for either shot.

**July-August 1946**

#### 9 August
Taken in tow by USS Sioux (ATF-75) to Bikini.

#### 10-27 August
Moored alongside target vessel USS Geneva (APA-86).

#### 24 August
Taken in tow by ATR-87 for Kwajalein.

#### 25 August
Anchored in Kwajalein, berth 27.

APL-27 remained at Kwajalein until July 1947.

**USS APOGON (SS-308)**

**Crew Size:** 54

**Bikini Atoll Arrival:** Before 30 June 1946

**Crew Location for Shot ABLE:**
- USS Bottineau (APA-235)
- USS Geneva (APA-86)

**Shot ABLE Location:**
- 1,000 yards (914 meters) SSE
- 850 yards (777 meters) SSE

**Sum:**
- 25 July 1946, Bikini Atoll

**Task Unit and Function**

The submarine Apogon served in Submarine Division 112 of TU 1.2.4 (Submarine Unit) as a target vessel during CROSSROADS. Apogon carried special test torpedoes for studies of atomic blast effects on them.

**Shot ABLE (1 July, 0900)**

#### 1 July
- Anchored in assigned berth in target array (1,000 yards [914 meters] SSE of surface zero) in Bikini Lagoon. Crew evacuated to Bottineau 20 nautical miles (37 km) from shot site.

#### 2 July
- Reboarding teams A and B left Bottineau en route to USS Haven (AH-12).
- Picked up radiological monitor from Haven.
- Apogon boarded.
- Topside reported radiologically safe.
- Commenced reentry of boat through after engine room hatch. Began testing for hydrogen gas and other explosive mixtures. Hydrogen gas was the only gas found.
- Below deck spaces testing completed: normal power and lighting restored.
- Engaged in maneuvering watch.

#### 4 July
- Party came aboard to inspect radioactivity.
- Pressure gauge party left.
- Party came aboard to inspect food and medical supplies.
- Electronics party came aboard and medical party left.
- Electronics party left the boat.
- Party came aboard to read foil gauges.

#### 6 July
- Party came aboard for electronics inspection.
- Party came aboard to remove orientometers.

#### 8 July
- Los Alamos Instrumentation Party aboard to check instruments.
- Party aboard to photograph blast gauges.

#### 9 July
- Bureau of Ships Instrumentation Party aboard to install impulse velocity gauges.
- USS Kenneth Whiting (AV-14) instrumentation group came aboard to remove electronic instruments from forward bridge deck.
- Moored portside to target submarine USS Parrot (SS-364), alongside USS Fulton (AS-11), in berth 231.
- Target submarine USS Skipjack (SS-184) came alongside to port.

#### 10 July
- Party came aboard to check torpedoes.
- Skipjack got underway.
- Anchored in berth 251, Bikini.
- Working party came aboard to check fire-control gear.

#### 11 July
- Technician aboard.
- Party aboard to check torpedo data computer.
- Party aboard to remove instruments.

#### 12 July
- Moored starboard side to portside of Fulton.
- Transferred torpedoes from Fulton to Apogon.
- Anchored in 29 fathoms (53 meters) of water in target array.

#### 13 July
- Damage inspection; group came aboard from USS Whiting (AP-7).
- Sonar inspection party came aboard.
- Photographic party came aboard to take pictures of the topside.

#### 14 July
- Party came aboard to deliver safety film.
- Party came aboard to inspect salvage fittings.

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**USS Apogon (SS-308)**

1105-1130 Party came aboard to inspect radioactivity.

1130 Pressure gauge party left.

1500 Party came aboard to inspect food and medical supplies.

1505 Electronics party came aboard and medical party left.

1545 Electronics party left the boat.

1650-1655 Party came aboard to read foil gauges.
21 July 0645 Shovel first evacuation party off in preparation for test BAKER.
0805 Installed work of suspending special weights for test BAKER.
0858 Surfaccd.
1010-1052 Party came aboard to take motion pictures of top of engine room.
1050-1115 Party aboard to check instruments.
1250-1305 Party aboard to work on blast gauges.
1305-1345 Party aboard to work on torpedo room gauges.
22 July 0504 Begun rigging procedure to install deflection gauges in starboard.
0645 Commenced rigging procedure to work on suspecting special weights for test BAKER.
0856 Gypsy moved to starboard side to install set of weights.
1045-1052 Party aboard to work on blast gauges.
1445-1540 Party aboard to work on instrument.
1545-1600 Party from Appalachian came aboard to install instruments.
23 July 0505 Begun rigging procedure to install deflection gauges in starboard.
0645 Commenced rigging procedure to work on special weights for test BAKER.
0856 Gypsy moved to starboard side to install set of weights.
1225 Gypsy completed installation of weights and cleared starboard side.
1445-1540 Party aboard to check instrument.
1545-1600 Party from Appalachian came aboard to install instruments.
24 July 0645 Shovel first evacuation party off in preparation for test BAKER.
0805 Installed work of suspending special weights for test BAKER.
0858 Surfaccd.
1010-1052 Party came aboard to take motion pictures of top of engine room.
1050-1115 Party aboard to check instruments.
1250-1305 Party aboard to work on blast gauges.
1305-1345 Party aboard to work on torpedo room gauges.
25 July 0645 Shovel first evacuation party off in preparation for test BAKER.
0805 Installed work of suspending special weights for test BAKER.
0858 Surfaccd.
1010-1052 Party came aboard to take motion pictures of top of engine room.
1050-1115 Party aboard to check instruments.
1250-1305 Party aboard to work on blast gauges.
1305-1345 Party aboard to work on torpedo room gauges.
26 July 0645 Shovel first evacuation party off in preparation for test BAKER.
0805 Installed work of suspending special weights for test BAKER.
0858 Surfaccd.
1010-1052 Party came aboard to take motion pictures of top of engine room.
1050-1115 Party aboard to check instruments.
1250-1305 Party aboard to work on blast gauges.
1305-1345 Party aboard to work on torpedo room gauges.
27 July 0645 Shovel first evacuation party off in preparation for test BAKER.
0805 Installed work of suspending special weights for test BAKER.
0858 Surfaccd.
1010-1052 Party came aboard to take motion pictures of top of engine room.
1050-1115 Party aboard to check instruments.
1250-1305 Party aboard to work on blast gauges.
1305-1345 Party aboard to work on torpedo room gauges.
USS Appalachian (AGC-1) ARD-29

Task Unit and Function
Appalachian, an amphibious force flagship, served in TU 1.3.2 (Press Unit). Its functions were communications support, messing, berthing, and transportation for newspaper and radio reporters.

Shot ABL (31 July, 0900)

1 July 1409 Underway for an area outside of the lagoon.

1 July 1609 Left the lagoon with USS Henrico (APA-45) for steaming area after taking on transfers from target ship USS Geneva (APA-86) and other personnel.

Shot BAKER (25 July, 0835)

24 July 1429 Underway for an area outside of the lagoon with various transfers.

25 July 1017 Maneuvered near harbor entrance and lowered radiological boats.

25 July Shifted to unidentified berth.

30 July Shifted to unidentified berth.

1 August Shifted to unidentified berth.

2 August 1430 After transferring four LCPIs (previously used during the operation) to USS Hauen (AH-12), underway for Eniwetok Atoll to pick up cargo.

3 August 0949 Arrived at Eniwetok Atoll.

7 August 1615 Underway for Bikini Atoll.

8 August 0905 Anchored at Bikini Atoll to pick up personnel for transportation.

USS APPALACHIAN (APA 58)

Shot BAKER (25 July, 0835)
Shot ABLE (1 July, 0900)

0930
Moored to buoy in berth 270-A, Bikini Atoll.

Shot BAKER (25 July, 0835)

2 July
1300 A boarding team came aboard for an unspecified period of time (Reference 6, pp. VII-1-30-A and VII-1-32-A).

3 July
1500 Beached in shallow water to prevent sinking (Reference 5, p. 6-B-18).

Shot BAKER (25 July, 0835)

Sank as a result of shot BAKER.

USS Arkansas (BB-33)

Crew Size: 441
Bikini Atoll Arrival: 29 May 1946
Crew Location for Shot ABLE: USS Rockbridge (APA-278)
Crew Location for Shot BAKER: Rockbridge
Shot ABLE Location: 110 yards (101 meters) SSW
Shot BAKER Location: 620 yards (568 meters) N
Sunk 25 July 1946, Bikini Atoll

Task Unit and Function
The battleship Arkansas was a target vessel during CROSSROADS. Its crew was evacuated for each shot. It served in Battleship Division 7 in TU 12.1 (Battleship and Cruiser Unit). Arkansas was equipped with ball-crusher and free-piston recording gauges for the Ordnance Group. It also carried test aircraft.

Shot ABLE (1 July, 0900)

30 June Crew evacuated to Rockbridge. Three Congressmen visited during evacuation.

2 July Initial boarding and salvage team (Team A) reboarded. Ship was reported still radioactive.

3 July The captain, two radiate monitors, and Team A reboarded for a radiological inspection of topside, gasoline storage area, ammunition lockers, and turrets 3 and 4.

4 July Captain and Team A boarded to begin opening compartments below decks.

5 July Captain and Team A and B boarded.

6 July Captain and Team A and B departed except for a six-man security detail.

ARD-29

USS Arkansas (BB-33)

2 July
1300 A boarding team came aboard for an unspecified period of time (Reference 6, pp. VII-1-30-A and VII-1-32-A).

3 July
1500 Beached in shallow water to prevent sinking (Reference 5, p. 6-B-18).

Shot BAKER (25 July, 0835)

Sank as a result of shot BAKER.

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Task Unit and Function
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Shot ABLE (1 July, 0900)

30 June Crew evacuated to Rockbridge. Three Congressmen visited during evacuation.

2 July Initial boarding and salvage team (Team A) reboarded. Ship was reported still radioactive.

3 July The captain, two radiate monitors, and Team A reboarded for a radiological inspection of topside, gasoline storage area, ammunition lockers, and turrets 3 and 4.

4 July Captain and Team A boarded to begin opening compartments below decks.

5 July Captain and Team A and B boarded.

6 July Captain and Team A and B departed except for a six-man security detail.

ARD-29

USS Arkansas (BB-33)

2 July
1300 A boarding team came aboard for an unspecified period of time (Reference 6, pp. VII-1-30-A and VII-1-32-A).

3 July
1500 Beached in shallow water to prevent sinking (Reference 5, p. 6-B-18).

Shot BAKER (25 July, 0835)

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Crew Location for Shot ABLE: USS Rockbridge (APA-278)
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Shot ABLE Location: 110 yards (101 meters) SSW
Shot BAKER Location: 620 yards (568 meters) N
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Task Unit and Function
The battleship Arkansas was a target vessel during CROSSROADS. Its crew was evacuated for each shot. It served in Battleship Division 7 in TU 12.1 (Battleship and Cruiser Unit). Arkansas was equipped with ball-crusher and free-piston recording gauges for the Ordnance Group. It also carried test aircraft.

Shot ABLE (1 July, 0900)

30 June Crew evacuated to Rockbridge. Three Congressmen visited during evacuation.

2 July Initial boarding and salvage team (Team A) reboarded. Ship was reported still radioactive.

3 July The captain, two radiate monitors, and Team A reboarded for a radiological inspection of topside, gasoline storage area, ammunition lockers, and turrets 3 and 4.

4 July Captain and Team A boarded to begin opening compartments below decks.

5 July Captain and Team A and B boarded.

6 July Captain and Team A and B departed except for a six-man security detail.
US Arkans (BB-33) 6 July

1655 All parties departed except for a six-man security detail.
7 July 0610 Captain and Teams A, B, and C reboarded. 1630 All parties departed except for a six-man security detail.
8 July 0800 Captain and Teams A, B, and C reboarded. 1645 All parties departed except for a six-man security detail.
9 July Reboarding teams A, B, and C boarded and remained aboard.
10 July Entire crew reboarded.

Shot Baker (25 July, 0835)

24 July 0900 Evacuation plan put into effect.
1550 The ship was empty and closed.

Arkansas sank as a result of the detonation. On 6 August, the crew was transferred to various units. A 21 August diver’s report states there was damage to plating on the starboard side:

USS Artemis (AKA-21)

Crew Size: 160
Bikini Atoll Arrival: 27 May 1946
Bikini Atoll Departure: 18 August 1946
Shot ABLE Location: 13 nmi (24 km) SE (Area Federal)
Shot BAKER Location: 110 nmi (19 km) SE (Area Federal)
Decontamination Location: San Francisco, California
Operational Clearance: 20 November 1946
Final Clearance: 27 December 1946

Task Unit and function
Artemis was an attack cargo ship that served in Transportation Division 94 in TU 1.2.6 (Merchant Type Unit). It served as a base for radiological LCIs and crews and also as an ammunition store ship.

Shot ABLE (1 July, 0900)

30 June 1200 Anchored in berth 191-A, Bikini.
1430 Underway from Bikini Atoll to Kwajalein Atoll.

1 July 1702 Moored to YW-92 in berth K-20, Kwajalein. 155 nmi (287 km) southeast of Bikini.

2 July 0742 Underway from Kwajalein Atoll to Bikini Atoll with YW-92 in tow.

3 July 1142 Anchored in berth 191-A, Bikini Atoll.
1428 Underway to moor alongside target vessel LCI-329 to deliver water.
1445-1637 Underway to go alongside USS Wildcat (AV-2).
1617 Underway to go alongside USS Fulton (AS 11) in vicinity of berth 211.
1715 Underway to go to berth 191-A.
1815 Anchored in berth 191-A.

4 July 0750 Underway to go alongside target submarine USS Porche (SS-384) in berth 211.
0812-1224 Moored to Porche to deliver freshwater.
1240-1345 Moored to target submarine USS Agon (SS-308) to deliver freshwater.
1445-1515 Underway to berth 191-A.
1525 Anchored off bow of USS Fulton (AS 11) in vicinity of berth 211.
1825 Engaged in routine tasks.

9 July 1147 Underway.
1724 Moored to target ship USS New York (BB 34) to receive ammunition.
1800 0800 Underway from New York to target ship USS Pensacola (CA 24).
1845 Moored to Pensacola to facilitate embarkation.

17 August Five members of radiological section boarded to inspect. All areas and spaces except one were pronounced “perfectly safe from a radiological point of view.” Army Engineer equipment from target ship USS LST-545 in Hold 1 and two small crates there were found to be reading 0.112 R/24 hours and were recommended to be secured and marked as dangerous.

18 August 1729 Underway for Pearl Harbor.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 July</td>
<td>Underway to go alongside target submarine USS Skate (SS-305).</td>
</tr>
<tr>
<td>13 July</td>
<td>Moored to USS Skate to load ammunition.</td>
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<tr>
<td>13 July</td>
<td>Underway from USS Skate to ammunition dumping area, 10 nm (18.5 km) off Eniwetok Island.</td>
</tr>
<tr>
<td>13 July</td>
<td>Anchored between berths 147 and 169 after completing dumping mission.</td>
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<tr>
<td>14 July</td>
<td>Underway.</td>
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<tr>
<td>14 July</td>
<td>Moored to LCT-1377.</td>
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<tr>
<td>14 July</td>
<td>Took LCT-1377 in tow.</td>
</tr>
<tr>
<td>14 July</td>
<td>Underway.</td>
</tr>
<tr>
<td>14 July</td>
<td>Moored to Nevada.</td>
</tr>
<tr>
<td>14 July</td>
<td>Underway to go alongside target submarine USS San Marcos (LSD-25) in target array.</td>
</tr>
<tr>
<td>14 July</td>
<td>Moored to target vessel LSM-60 to transfer freshwater.</td>
</tr>
<tr>
<td>14 July</td>
<td>Underway from San Marcos.</td>
</tr>
<tr>
<td>14 July</td>
<td>Moored to target vessel LSM-60 to transfer freshwater.</td>
</tr>
<tr>
<td>14 July</td>
<td>Anchored in berth 191-A, Bikini.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway for VF mooring to pick up three canals for delivery to target ship USS Nevada (BB-36).</td>
</tr>
<tr>
<td>15 July</td>
<td>Moored to Nevada.</td>
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<tr>
<td>15 July</td>
<td>Underway throughout target area to check ships for location of canals.</td>
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<tr>
<td>15 July</td>
<td>Anchored in vicinity of berth 191-A.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway to pick up LCT-1132.</td>
</tr>
<tr>
<td>15 July</td>
<td>Moored to LCT-1132.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway with LCT-1132 in tow to moor LCT to USS Gunston Hall (LSD-5).</td>
</tr>
<tr>
<td>15 July</td>
<td>Moored to LCT-1268, which was moored to USS San Marcos.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway with LCT-1268 to USS San Marcos.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway with LCT-1268 in tow to LCT moorings.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway, having moored LCTs.</td>
</tr>
<tr>
<td>15 July</td>
<td>Laying to off USS Chilton (APA-38).</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway with LCT-1415 to San Marcos.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway to anchorages, having moored LCT-1415 to San Marcos.</td>
</tr>
<tr>
<td>15 July</td>
<td>Anchored in berth 191-A.</td>
</tr>
<tr>
<td>16 July</td>
<td>Underway from berth.</td>
</tr>
<tr>
<td>16 July</td>
<td>Moored to VF-733 to receive steel plate for Nevada.</td>
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<tr>
<td>16 July</td>
<td>Underway from VF-733.</td>
</tr>
<tr>
<td>16 July</td>
<td>Moored to San Marcos to assist in docking LCT.</td>
</tr>
<tr>
<td>16 July</td>
<td>Underway from San Marcos.</td>
</tr>
<tr>
<td>16 July</td>
<td>Anchored in berth 64, preparing to take LCMs from beach.</td>
</tr>
<tr>
<td>16 July</td>
<td>Underway from berth.</td>
</tr>
<tr>
<td>16 July</td>
<td>Moored to Nevada to transfer angle iron beam.</td>
</tr>
<tr>
<td>17 July</td>
<td>Underway.</td>
</tr>
<tr>
<td>17 July</td>
<td>Moored to LCT-1132.</td>
</tr>
<tr>
<td>17 July</td>
<td>Underway from alongside LCT 1132.</td>
</tr>
<tr>
<td>17 July</td>
<td>Moored to ATA 187.</td>
</tr>
<tr>
<td>17 July</td>
<td>Underway to berth 191-A.</td>
</tr>
<tr>
<td>17 July</td>
<td>Anchored in berth 191-A.</td>
</tr>
<tr>
<td>18 July</td>
<td>Underway.</td>
</tr>
<tr>
<td>18 July</td>
<td>Moored to LCT-1268.</td>
</tr>
<tr>
<td>18 July</td>
<td>Underway with LCT-1132 in tow to Rongelap Atoll.</td>
</tr>
<tr>
<td>19 July</td>
<td>Anchored in berth 4, Rongelap Atoll, after mooring LCTs.</td>
</tr>
<tr>
<td>19 July</td>
<td>Underway to Bikini Atoll.</td>
</tr>
<tr>
<td>20 July</td>
<td>Anchored in berth 191-A, Bikini.</td>
</tr>
<tr>
<td>20 July</td>
<td>Underway, after taking on water from Severn, to target submarine USS Skipjack (SS-184).</td>
</tr>
<tr>
<td>20 July</td>
<td>Moored to Skipjack.</td>
</tr>
<tr>
<td>20 July</td>
<td>Moored to target submarine USS Centuara (SS-335).</td>
</tr>
<tr>
<td>22 July</td>
<td>Underway.</td>
</tr>
<tr>
<td>22 July</td>
<td>Moored to target ship USS Arkansas (BB-33).</td>
</tr>
<tr>
<td>22 July</td>
<td>Underway with canals in tow.</td>
</tr>
<tr>
<td>22 July</td>
<td>Moored to Nevada.</td>
</tr>
<tr>
<td>22 July</td>
<td>Underway from Nevada.</td>
</tr>
<tr>
<td>22 July</td>
<td>Underway to tow target ship Nagato.</td>
</tr>
<tr>
<td>22 July</td>
<td>Left canals with ARD-29.</td>
</tr>
<tr>
<td>22 July</td>
<td>Underway to tow target ship Prinz Eugen.</td>
</tr>
<tr>
<td>22 July</td>
<td>Moored to Prinz Eugen.</td>
</tr>
<tr>
<td>22 July</td>
<td>Anchored in berth 191-A, Bikini.</td>
</tr>
<tr>
<td>23 July</td>
<td>Routine activities.</td>
</tr>
<tr>
<td>24 July</td>
<td>Underway in column formation for Rongelap Atoll.</td>
</tr>
<tr>
<td>24 July</td>
<td>Shot BAKER (25 July, 0935).</td>
</tr>
<tr>
<td>25 July</td>
<td>Underway from berth.</td>
</tr>
<tr>
<td>25 July</td>
<td>Underway to Rongelap Atoll.</td>
</tr>
<tr>
<td>26 July</td>
<td>Anchored at berth 4, Bikini Atoll.</td>
</tr>
<tr>
<td>26 July</td>
<td>Underway to Rongelap Atoll.</td>
</tr>
<tr>
<td>26 July</td>
<td>Moored to ATA-187 in berth 10, Rongelap.</td>
</tr>
<tr>
<td>29 July</td>
<td>Underway for Bikini Atoll.</td>
</tr>
<tr>
<td>29 July</td>
<td>Anchored in berth 231-A, Bikini.</td>
</tr>
<tr>
<td>29 July</td>
<td>Worked in vicinity of Rumen Island throughout day, including transporting a pontoon causeway.</td>
</tr>
<tr>
<td>30 July</td>
<td>Anchored in berth 191-A, Bikini.</td>
</tr>
</tbody>
</table>
1737 Underway from YF-990.  
1854 Anchored west of Eneu Island.  
3 August  
1122 Underway from YF-990.  
4 August  
1450 Assisted in mooring and towing whale boats to San Marcos, Anchored in area west of Eneu Island, Bikini.  
6 August  
2055 Towed USS Bolette (AKA-99) to Seabee landing and towed pontoon bridge to Bokaetoktok Island. Anchored 1,500 yards (1.4 km) northeast of Bokaetoktok Island.  
7 August  
1227 Anchored in berth 191-A, Bikini.  
8 August  
9 August  
1655 Underway.  
1710 Standing off target ship USS Cortland (APA-75) to assist in clearing Cortland from alongside USS Dixie (AD-14). Moored alongside Cortland.  
1758 Underway with Cortland to anchor Cortland in assigned berth.  
1827 Underway from alongside Cortland to vicinity of LST landing. Anchored off LST landing, Bikini, to assist in salvaging beached target ship USS LST-125.  
10 August  
1035 Underway to Bokaetoktok Island with pontoon causeway and LCMs in tow.  
1256 Arrived at anchorage off Bokaetoktok Island.  
1325 Underway to boat pool area off Bikini Island with LCM in tow.  
1512 Anchored in berth 165, Bikini, in boat pool area.  
12 August  
0946 Underway.  
1044 Moored to target submarine USS Tuna (SSG-203) to deliver freshwater.  
1153 Underway to Wildcat to take on freshwater.  
1200 Anchored in berth 161, Bikini, after taking on water.  
13 August  
14 August  
1515 Towed YF-733 to berth 190 and spent the rest of the day moored to USS Pollux (AKS-6). Anchored in berth 147, Bikini.  
15 August  
1515 Shifted to vicinity of berth 59.  
16 August  
17 August  
0557 Anchored south of Aomen Island.
ATA-180

14 July 0803 Anchor cleared by diver from USS Clamp (ARS-33). Anchored in berth 52.


16 July 0700-0733 Towed LSM-60 to Albemarle; then proceeded to anchorage. Anchored in berth 52.

18 July 0510-0900 Towed and moored LSM-60. Anchored in berth 52.

20 July 0715-0905 Towed and moored LSM-60. then got underway. Anchored in berth 52.

24 July 0505-0902 Removed LSM-60 in the target array after towing it to Albemarle several times before shot BAKER. Anchored in berth 52. Underway for area outside of lagoon.


30 July 0753 Underway to Kenneth Whiting. Stood off Kenneth Whiting while radiological instrument party went aboard. Underway to inspect vessels in target array and pick up radiological instruments.

2 July 0700-0733 Towed LSM-60 to mooring buoy. Anchored in berth 52.

3 July 0715-0905 Towed and moored LSM-60. then got underway. Anchored in berth 52.


5 July 0510-0900 Towed and moored LSM-60. Anchored in berth 52.

7 July 1520-1717 Towed LSM-60 to mooring buoy. Anchored in berth 52.

8 July 1615-1855 Towed LSM-60 to berth 54. Anchored in berth 52. Bikini Atoll.

12 July 1355-1615 Removed LSM 60 in the target array. Anchored in berth 52.

13 July 0730-1951 Towed ARDC-13 to the target array.

1 July 0530 Underway for area outside the harbor. Anchored in berth Queen. Bikini Atoll.

2 July 0920 Took radiological party aboard from USS Haven (AV-12) to target ship USS Independence (CVL-22). Towed Independence.

6 July 0750-1125 Conducted towing operation and assisted in mooring target ship USS Nevada (BB-36). Underway to pick up instruments from Chickasaw to take them to USS Kenneth Whiting (AV-14). Anchored in berth 52.

7 July 1605-1250 Towed target ship Nagato. Anchored in berth 52.

8 July 0700-0905 Towed LSM-60 to USS Albemarle (AV-5). Anchored in berth 52.

9 July 0800-0805 In vicinity of Nagato. Anchored in berth 52.

11 July 0520-0700 Towed LSM-60 to a buoy and moored it; then got underway. Anchored in berth 52.

12 July 1355-1615 Removed LSM 60 in the target array. Anchored in berth 52.

13 July 0750-1951 Towed ARDC-13 to the target array.

17 July 0700-1745 Moved Independence to area with 22 fathoms (40 meters) of water. Anchored in berth 52.

18 July 0510-0900 Towed and moored LSM-60. Anchored in berth 52.

20 July 0715-0905 Towed and moored LSM-60. then got underway. Anchored in berth 52.

22 July 0505-0902 Removed LSM-60 in the target area after towing it to Albemarle several times before shot BAKER. Anchored in berth 52. Underway for area outside of lagoon.


30 July 0753 Underway to Kenneth Whiting. Stood off Kenneth Whiting while radiological instrument party went aboard. Underway to inspect vessels in target array and pick up radiological instruments.


1 July Shot ABE-1 (1 July, 0900)

2 July Shot ABE-1 (2 July, 0920)
31 July
0702 Underway to vicinity of Kenneth Whiting.
14 August
0752 Underway to target ship USS Geneva (APA-86) to take APL-27 in tow.
0810-0840 Stopped off APL-27.
0840 Underway for berth.
0950 Anchored in berth 50.
1240 Anchored 350 yards (326 meters) south of berth 53.

19 August
1937 Anchored near Wilson.
1157 Underway with Wilson in tow, steering out of the lagoon toward Kwajalein Atoll.

21 August
0855 Anchored Wilson at Kwajalein Atoll.
1024 Anchored at Kwajalein Atoll.

22 August
0815-1120 Assisted USS Preserver (ARS-8) in towing Nevada.
1120 Departed Kwajalein Atoll for Bikini Atoll.

23 August
0630 Anchored in berth 92, Bikini Atoll.
1215 Underway to take target ship USS Wainwright (APA-102) in tow for Kwajalein.
1500 Departed Bikini Atoll for Kwajalein Atoll with Wainwright in tow.

25 August
0550 Reached Kwajalein Atoll and began to anchor Wainwright.
0820 Underway from Wainwright.
1206 Left for Bikini Atoll.

26 August
0650 Reached Bikini Atoll.
1245 Took target ship USS Hughes (DD-410) in tow.
1252 Left Bikini Atoll with Hughes in tow.

28 August
1215 Reached at Kwajalein Atoll and anchored Hughes.

29 August
0606 Anchored in berth 188, Bikini Atoll.

1 September
1345 Left Bikini Atoll for Kwajalein Atoll towing LCI-327 and LCI-332.

3 September
1245 Arrived at Kwajalein and anchored LCI-327 and LCI-332.
0858 Anchored in berth A.

8 September
1215 Departed for Pearl Harbor with YF-733 in tow.

19 September
Arrived at Pearl Harbor.

Crew Size: 43

[ATA-180]

[ATA-185]
ATA-185

Task Unit and Function
ATA-185 was an auxiliary ocean tug used as a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, repairing, and firefighting.

Shot Able (1 July, 0900) 10 July
1 July Streamed in company with TU 1.2.7. 0812 Nagato anchored.
1731 Anchored in berth Roger. Bikini Atoll. 0840 Cast off tow wire from Nagato, proceeding to anchorage.

2 July
0730 Laying to in vicinity of USS Haven (AH-12) to pick up radar safe monitor. 0854 Anchored in berth 73.
0855 Laying to in vicinity of target ship Sakawa.
1042 Sakawa sank.
1110 Underway to target ship USS Independence (CVL-22). 0820 Standing by to assist ATA-192
1115-1442 Transferred radiological equipment from Independence to USS Kenneth Whiting (AV-14).
1522 Anchored in berth Roger.

3 July 0730 Underway to USS Wharton (AP-7). 0945-1250 Received provisions from Fulton.
0812 Laying to in vicinity of berth 89. 0925 Underway en route to target ship USS Nevada (BB-36).
0845 Took aboard boarding party from Wharton. 1010 Arrived at target ship USS Saratoga (CV-3).
0847 Underway to Haven. 0655 Arrived at target ship USS Gasconade (APA-85) and stood by to assist ATA-192 as necessary in towing Gasconade.
0852 Laying to in vicinity of Haven. 0900 Laying to in vicinity of Nevada.
0854 Boarding party aboard. 0920 Secured from assisting Nevada.
0855 Underway to place boarding team aboard target vessel YO-160. 1050 Proceeded to target ship USS Gasconade (APA-85) and stood by to assist ATA-192 as necessary in towing Gasconade.
1200 Anchored in berth 73.

4 July
0730 Underway to USS Wharton (AP-7). 0920 Secured from assisting Nevada.
0812 Laying to in vicinity of berth 89. 1050 Proceeded to target ship USS Gasconade (APA-85) and stood by to assist ATA-192 as necessary in towing Gasconade.
0845 Took aboard boarding party from Wharton. 1400 Underway, proceeding to target submarine USS Tuna (SS-203).
1042 Sakawa sank.
1110 Underway to target ship USS Independence (CVL-22).
1155 Standing by
1210 Anchored in berth 73.

5 July
0730 Underway to USS Wharton (AP-7). 0600 Moored portside to target ship USS Saratoga (CV-3).
0812 Laying to in vicinity of berth 89. 0655 Arrived Saratoga, standing by to assist in shifting it to new berth.
0845 Took aboard boarding party from Wharton. 0900 Passed main tow line to Saratoga and commenced maneuvering as necessary in placing it in a new berth.
0847 Underway to Haven. 1010 Cast off from Saratoga, laying to in vicinity.
0852 Laying to in vicinity of Haven. 1150 Secured from assisting Nevada.
0854 Boarding party aboard. 1200 Secured from standing by duty with Gasconade.
0900 Passed main tow line to Saratoga and commenced maneuvering as necessary in placing it in a new berth.
1040 Cast off from Saratoga, laying to in vicinity.
1105 En route to Wharton. 1220 Proceeded to target ship USS Gasconade (APA-85) and stood by to assist ATA-192 as necessary in towing Gasconade.
1122 Laying to in vicinity of Wharton: boarding team disembarked. 1725 Anchored in berth 73.
1210 Anchored in berth 73.

6 July
1115 Arrived at target ship Nagato, laying to awaiting instructions. 0815 Observed explosion in vicinity of target vessel ARDC-13.
1415 Moored to Nagato's starboard side.
1430 Passed main wire to Nagato through its stern chocks. 19 July Underway, proceeding to target submarine USS Tuna (SS-203).
1930 Boarding team returned aboard: underway to await further orders.
2010 Laying to in vicinity of Wharton. 1120 Arrived at target ship USS Saratoga (CV-3).
1210 Anchored in berth 73.

7 July
0530 Underway, proceeding to Nagato. 0600 Standing by to prevent swinging.
0630 Anchored in berth 73.
0600 Moored portside to portside of Tuna and began heaving in Tuna's port anchor. Tuna's anchor secured aboard ATA-165. Proceeding with heaving in chain.
0630 Moored portside to portside of Tuna and began heaving in Tuna's port anchor. Tuna's anchor secured aboard ATA-165. Proceeding with heaving in chain.
0600 Moored portside to portside of Tuna and began heaving in Tuna's port anchor. Tuna's anchor secured aboard ATA-165. Proceeding with heaving in chain.
0600 Standing by to prevent swinging.
1150 Secured from assisting Tuna and got underway for USS Fulton (AS-11).
1830 Anchored in berth 73.

8 July
0735 USS Current (ARS-22) commenced towing Nagato forward. ATA-185 standing by Nagato's stern and assisting Current as necessary. 22 July Underway, proceeding to target submarine Apoquo (SS-308).
0800 Anchored in berth 73.
1400 Anchored in berth 73.

9 July
0735 USS Current (ARS-22) commenced towing Nagato forward. ATA-185 standing by Nagato's stern and assisting Current as necessary. 0701 Arrived at Apoquo and lay to, awaiting instructions.
1400 Anchored 240 yards (120 meters) from Apoquo.
0715 Passed 7-inch manila line to Apogon and commenced heaving around to bring its heading to 85° prior to submerging.
1050 Apogon submerged.
1052 Buoyed line to Apogon and cast off from submarine.
1606 Underway for anchorage.
1629 Anchored in berth 73.

23 July
1615 Underway to Rongelap Atoll with LCT-1184 and LCT-1420 in tow.

24 July
1525 Underway for Bikini.
Shot BAKER (25 July, 0835)

25 July
0835 Rendezvoused with TU 1.2.7 in Mercury area before BAKER detonation.
1155 Anchored in Bikini Lagoon.
1830 Radiological monitors reported aboard.

29 July
0758 Proceeded to target array to retrieve radiological instruments from target ships Nagato (BB-34) (1000), and USS Pensacola (CA-24) (1020). These instruments went to Whiting for study.

30 July
0852-0900 Recovered radiological instruments from target ship USS Banner (APA-60).
0910-0915 Recovered radiological instruments from target ship Prince Eugen.
0940-0950 Recovered radiological instruments from target ship USS Pennsylvania (BB-38).
1000-1020 Recovered radiological instruments from target ship USS Catron (APA-71).
1023-1027 Recovered radiological instruments from Casca"onade.
1038 Recovered radiological instruments from target ship USS Bisacow (APA-65).
1100 Recovered radiological instruments from target ship USS Salt Lake City (CA-25).
1118 Recovered radiological instruments from Nevada.
1144 Recovered radiological instruments from USS Brule (APA-68).
1223 Recovered radiological instruments from Independence.
1248-1315 Laying to in vicinity of Kenneth Whiting to transfer all instruments.
1318 Crew reached radiological tolerance.
1429 Anchored in berth King.

1 August:
0730 Underway for Ken. Whiting.
0815 Arrived at Kenneth Whiting.
0857 Recovered radiological instruments from Brule.
0912 Recovered radiological instruments from Independence.
0935 Recovered radiological instruments from target ship USS Barbaw (APA-61).
0948 Recovered radiological instruments from Casca"onation.
1017 Arrived vicinity of Kenneth Whiting and transferred radiological instruments to small boat.
1020 Ship and crew reached detly tolerance of radioactivity.
1108 Anchored in berth K. Bikini.
### ATA-187

**8 September**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1140</td>
<td>Monitors left after declaring ship radio-logically safe.</td>
</tr>
<tr>
<td>1555</td>
<td>En route to Pearl Harbor.</td>
</tr>
</tbody>
</table>

**20 September**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1130</td>
<td>Moored alongside Skipjack and commenced supplying it with water.</td>
</tr>
<tr>
<td>1140</td>
<td>Secured from transferring water.</td>
</tr>
<tr>
<td>1147</td>
<td>Moored to LSM-60 and commenced transferring water.</td>
</tr>
<tr>
<td>1445</td>
<td>Secured transferring water.</td>
</tr>
<tr>
<td>1450</td>
<td>Cast off all lines.</td>
</tr>
<tr>
<td>1455</td>
<td>Dropped anchor in berth 198.</td>
</tr>
</tbody>
</table>

**Crew Size:** 33

**Bikini Atoll Arrival:** Before 1 July 1946

**Bikini Atoll Departure:** 24 August 1946

**Shot ABLE Location:** 28 nmi (52 km) NE

**Decontamination Location:** San Diego

**Operational Clearance:** 6 November 1946

**Final Clearance:** By 22 November 1946

**10 July**

8110-0910 Transferred water to target submarine USS Skate (SS-305).

**13 July**

0848-1109 Moored alongside target ship USS Fallon (APA-81).

**24 July**

1004-1200 Moored alongside target ship USS Fallon (APA-81).

**1800**

Arrived at Bikini Atoll with LCT-1415 in tow.

**10 August**

0637-0946 Moored next to target ship USS Stack (DD-406) to pick up depth charges. Dumped depth charges overboard.

**1900**

Anchored near berth K.

**5 August**

Picked up one camel from Pennsylvania, underway for various ships to deliver camels.

**7 July**

1052 Underway for target submarine USS Skipjack (SS-184) to supply water.

**10 August**

0637-0922 Assisted in sinking LCI-620.

**1313**

Anchored in vicinity of berth 168.

**ATA-186**

<table>
<thead>
<tr>
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<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1330</td>
<td>Moored alongside Skipjack and commenced supplying it with water.</td>
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<td>1340</td>
<td>Secured from transferring water.</td>
</tr>
<tr>
<td>1347</td>
<td>Moored to LSM-60 and commenced transferring water.</td>
</tr>
<tr>
<td>1445</td>
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</tr>
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<td>1450</td>
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<td>Dropped anchor in berth 198.</td>
</tr>
</tbody>
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<td>1130</td>
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<td>Secured from transferring water.</td>
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<tr>
<td>1147</td>
<td>Moored to LSM-60 and commenced transferring water.</td>
</tr>
<tr>
<td>1445</td>
<td>Secured transferring water.</td>
</tr>
<tr>
<td>1450</td>
<td>Cast off all lines.</td>
</tr>
<tr>
<td>1455</td>
<td>Dropped anchor in berth 198.</td>
</tr>
</tbody>
</table>

**ATA-188**

<table>
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<tr>
<th>Time</th>
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</tr>
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<tr>
<td>1130</td>
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<td>Secured from transferring water.</td>
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<tr>
<td>1147</td>
<td>Moored to LSM-60 and commenced transferring water.</td>
</tr>
<tr>
<td>1445</td>
<td>Secured transferring water.</td>
</tr>
<tr>
<td>1450</td>
<td>Cast off all lines.</td>
</tr>
<tr>
<td>1455</td>
<td>Dropped anchor in berth 198.</td>
</tr>
</tbody>
</table>
10 August  
ATA-187

1700 Underway to target ship USS Geneva (APA-86) to deliver two camels.
1816 Anchored in berth 149.

12 August  
1549 Moored portside to target ship USS LST-125, remaining there until 14 August.

14 August  
0500 Underway from alongside LST-125 shifting positions.
0602 Moored starboard to portside of LST-125.
0610 USS Munsee (ATF-107) underway with LST-125 in tow.
0735 Underway from alongside LST-125, laying to to prepare to put bow line over to stern of LST-125.
0805 One bow line made fast to stern of LST-125 to assist Munsee in controlling tow.
0838 Munsee underway towing LST-125 and ATA-187 astern.
1108 Let go of bow line.
1158 USS Fall River (CA-131) opened fire on ATA-192.

15 July  
0850-1236 Anchored in berth 64.
1429 Anchored in berth 43.

18 August  
0840-1024 Anchored in berth 223.
1042 Anchored in berth 43.

22 August  
0920 Underway to assist ATA-124 in mooring target ship USS Hughes (DD-410).
0930 Laying to off ARD-29 waiting undocking of Hughes.
0952 Moored to starboard side of ATA-124.
1111 Underway, standing off ARD-29.
1135 Hughes clear of ARD-29.
1405 Hughes moored to mooring buoy.
1432 Underway from Hughes to assist Enoree.
1508 Anchored in berth 44.
1555 Underway to USS Wharton (AP-7) for pontoon camels.
1625 Received two camels from motor whaleboat.
1827 Received two more camels from motor whaleboat en route back to anchorage.
1846 Anchored in berth 44. Bikini.

24 August  
0739 Underway from alongside USS LST-661 with YF-990 in tow, standing out of Bikini Lagoon.
0930 Underway with YF-990 in tow for Kwajalein in company with YOG-70, YO-132, and YO-199.

25 August  
1550 YOG-70, YO-132, and YO-199 ordered to proceed independently and carry out previous anchorage instructions.
1635 Commenced taking tow alongside.
1655 Cast off main tow wire from YF-990.
1850 Anchored at Kwajalein Atoll.

28 August  
0930-1010 Radiosonde monitors boarded ship to rest for radioactivity -- "Results, vessel safe."

13 September  
0809 Underway to assist USS Current (APM-22) to replace anchor on target ship USS Citlindten (APA-77).
1229 Let go all lines, underway for anchorage.
1303 Let go anchor in vicinity of K-19, Kwajalein.

5 September  
1000 Underway to go alongside target vessels LCI-327 and LCI-332.
1030 Moored to starboard side of LCI-332 and commenced dragging them to northwest corner of Berch AA3.
1133 Anchored in berth A-B, Kwajalein.

11 September  
Departed Kwajalein for Pearl Harbor.
22 September  
Arrived at Pearl Harbor.

ATA-192

Crew Size: 15
Bikini Atoll Arrival: 19 May 1946
Bikini Atoll Departure: 2 September 1946
Shot ABL Location: Approximately 27 nmi (50 km) ESE
Shot BAKER Location: >14 nmi (26 km) SE
Decontamination Location: San Francisco
Operational Clearance: 14 November 1946
Final Clearance: 10 February 1947

ATA-152 was an auxiliary ocean tug used as a support ship in TU 1.2.7 (Salvage Unit). Its functions included salvaging, firefighting, and repairing damaged target vessels.

Shot ABL (1 July, 0900)

30 June  
1253 Underway for area outside of lagoon steaming with TU 1.2.7.

3 July  
Entered the channel and proceeded to fight fires on target ships USS Niagara (APA-87), USS Bladen (APA-63), and USS Bracken (APA-64).
1416 Ordered to withdraw to east of target area.
1517-1629 Radiological officer with monitor aboard to inspect firefighting equipment for radioactivity.

1755 Anchored in berth Sugar, Bikini Atoll.

2 July  
0945-1000 Shooting water on target vessel YO-160.
1045-1254 Moored YO-150 to buoy.
1254 Stand by to assist mooring target ship USS Independence (CVL-22).
1528 Anchored in Berth Sugar.

3 July  
1039-1433 Assisted in beaching target vessel ARDC-13 near Eneu Island.
1517 Anchored in Berth Sugar.

5 July  
1145 Proceeded to target array to inspect target ships.
5 July

1227 Underway to inspect target ships.
1402 Completed inspection.
1539 Anchored in berth 74.

6 July
1122-1731 Reentered target area to assist in shifting target ship NAGATO to another berth.
1830 Anchored in berth 74.

7 July
0528-1220 Reentered target area to assist in shifting NAGATO to a new berth.
1329 Anchored in berth 230.

10 July
0725-1236 Assisted in shifting target ship USS ARKANSAS (BB-33) to new berth.
1624 Placed boarding party aboard YO-100 in order to tow it.
1905 Proceeded to anchorage.
1905 Anchored in berth 74.

11 July
1010-1705 Assisted in moving target ship USS Nevada (BB-36) to buoy in target array.
1719 Anchored in berth 74.

12 July
0841-1130 Assisted in moving target ship USS SARATOGA (CV-3) to new berth.
1153 Anchored in berth 74.

15 July
0810-1240 Assisted in towing and moving target vessel YO-83 to new berth.
1137 Anchored near berth 131-A.

16 July
0554-0817 Assisted in moving SARATOGA to new berth.
0854 Anchored in berth 251.

17 July
0645-0940 Assisted in moving target ship USS Citi- tenden (APA-77) to new berth.
1059-1420 Assisted target ship USS Salt Lake City (CA-25) in shifting berths.
1539 Anchored in berth 74.

23 July
1721-1813 Moored to target ship USS MAYRANT (DD-402).
1824-1901 Moored to USS Palmyra (ARS(T)-3).
1911 Anchored in berth 74.

Shot BAKEF (25 July, 0835)

24 July
1255 Underway for area outside of lagoon, steaming with TU 1.2.7.

25 July
1150 Anchored in berth 1309.
1209-1334 Assisted in attempted salvage of sinking SARATOGA.
1331 Anchored in berth 1309.

26 July
1735-1827 Assisted in beaching damaged target ship USS Hughes (DD-410).
1859 Anchored in berth 1309.

28 July
1256-1545 Assisted in towing and beaching target submarine USS LENTUS (SS-335).

29 July
0830-1210 Took inspection teams to various target ships.
1805 Anchored near berth 377.

30 July
Towed target vessel LCT-816 to beached area off Eneu Island.
1154 Anchored in berth 1309.

1 August
0838-1155 Sprayed MAYRANT.
1155-1417 Proceeded to USS Avery Island (AG-76).
1154 Anchored in berth 1309.

2 August
Shifted anchorage 1.675 yards (1.5 km) south of berth 77.

3 August
0359-1023 Sprayed MAYRANT.
1056 Anchored near berth 377.

6 August
1305-1631 Sprayed TRIPPE.
1640 Proceeded to anchorage.
1717 Anchored near berth 74.

7 August
Began assisting in decontaminating MAYRANT.
1220 Radiological technicians boarded MAYRANT, then returned.
1309-1341 Assisted in moving target ship USS Stack (DD-406).
1359 Anchored near target ship USS Stack (DD-406).
1522 Proceeded to MAYRANT.
1532-1723 Washed down MAYRANT with saltwater.
1725 Proceeded to anchorage.
1739 Anchored in berth 74.

9 August
1759-1827 Moored to target ship USS Cortland (APA-75).
1851 Anchored in southern edge of berth 5.

17 August
0805-1046 Assisted in turning target ship USS GASCONADE (APA-85) around to clear fouled anchor chain.
1046 Proceeded to USS Wildcat (AV-21).
1554 Anchored in berth 18.

19 August
1628-1700 Moored next to Stack.
1708 Departed for Kwajalein Atoll with Stack in tow.

21 August
0830-1005 Anchored Stack at Kwajalein.
1005 Anchored in berth C, Kwajalein Atoll.

22 August
0638-1500 Assisted in towing and anchoring target ships Nevada and Prinz Eugen before departing Kwajalein Atoll for Bikini Atoll.

23 August
Arrived at Bikini Atoll.

24 August
Towed GASCONADE in tow for Kwajalein Atoll.
26 August
0830 Anchored Gasconade at Kwajalein.
1351 Departed for Bikini.

27 August
1019 Moored alongside target ship USS Banner (APA-60).
1326 En route to Kwajalein with Banner in tow.

28 August
En route to Kwajalein.

29 August
0850 Anchored Banner in berth 51, Kwajalein.
1005 Moored in assigned anchorage.

30 August
Departed for Bikini.

31 August
0136 Anchored in berth 220, Bikini Atoll.

2 September
0750 Moored next to target vessel LCT-1013.
1520 Left Bikini Atoll for Kwajalein Atoll with target vessels LCT-1013 and LCT-705 in tow.

4 September
0734-1007 Anchored LCT-1013 and LCT-705 at Kwajalein.
1047 Underway to anchorage.
1109 Anchored in assigned anchorage.

7 September
1345-1459 Towed target vessel LCT-1078 to berth.

8 September
Left Kwajalein for Pearl Harbor.

21 September
Arrived at Pearl Harbor.

ATR-40

Shot BAKER (25 July, 0835)

2 July
0600-1200 Assisted in clearing damaged target ships from target array.
1133 Witnessed sinking of target ship Sakawa.
1420 Proceeded to anchorage after standing by in target array while ATR-192 moored target vessel YO-160.
1501 Anchored in berth Jig.

6 July
0723-0947 Towed target ship USS Salt Lake City (CA-25) to its new berth.
1032-1355 Assisted USS Achomawi (ATF-148) in towing target ship USS Pensacola (CA-24) to new berth.
1457-1641 Reanchored Salt Lake City twice.
1706 Anchored in berth 139.

7 July
1113-1251 Assisted in towing target ship USS Dawson (APA-79).
1310 Anchored in berth 139.

9 July
1343 Moored next to target ship USS Hughes (IQ-410).

10-11 July
Moored next to Hughes.

12 July
0834 Hughes underway.

17 July
0700-0917 Assisted ATR-192 in moving target ship USS Crittenden (APA-77) to new position.
1202-1413 Assisted in moving target ship Nagato.
1516 Anchored in berth 139.

20 July
0730-1045 Assisted in anchoring YO-160.
1111 Anchored in berth 139.

Shot BAKER (25 July, 0835)

24 July
1125 Underway for area outside of lagoon, steaming with TU 1.2.7.

25 July
1137 Anchored in berth Oboe, Bikini Atoll. A radiological monitor came aboard.
1627-1645 Another monitor came aboard under the direction of Director of Ship Materials.

26 July
Underway to assist USS Reclaimer (AG-42) Beach Hughes, then anchored in unidentified special anchorage near Enew Island.

27 July
0903-1115 Obtained Geiger readings and washed down Hughes.
1245-1414 Towed target ship USS Kannon (APA-81) to beaching area.
1528 Reanchored in berth Oboe.

28 July
Shifted to unidentified special berth.

29 July
1125-1430 Washed down target ship USS New York's (BB-34) weather surfaces using three monitors.
1630 Anchored in unidentified special berth.

285
30 July
0731-1312 Washed down New York's weather surfaces. 1340 Anchored in unidentified berth.

31 July
1101 Disposed of all rubbish overboard at the lagoon's entrance.
1155 Obtained another reading of New York.
1215-1530 Foamed New York. 1752 Anchored in Berth Oboe.

2 August
0955 Towed ATR-87 to a new berth and anchored next to it.

6 August
0720-1523 Took readings of target ship USS Pennsylvania (BB-38) and washed it down twice. 1544 Anchored in unidentified berth.

7 August
0852-1110 Washed down Pennsylvania and Dawson. 1519-713 Washed down Pennsylvania again. 1725 Anchored in Berth 139.

8 August

9 August
0813-1618 Provided pumps to Pennsylvania to pump seawater through portable eductors. 1658 Anchored in unidentified berth.

10 August

12 August
0925-1129 A diver inspected the bottom of USS Palmyra (ARG(T)-3). 1521 Anchored in unidentified berth.

14 August
Shifted to Berth 9.

19 August
0728 Moored next to target ship USS Mugford (DD-389). 0937 Underway for Kwajalein with Mugford in tow.

21 August
1025 Anchored Mugford at Kwajalein. 1158-1217 Proceeded to target ship USS Halden (APA-83) to transfer working party. 1217 Departed for Bikini.

22 August
1444 Anchored in Berth 20, Bikini.

23 August
Towed target submarine USS Skate (SS-305) from Bikini Atoll to Kwajalein Atoll.

24 August
1931-1943 Red Skate at Kwajalein. 1943 Red in assigned berth.

25-27 August
Kwajalein: worked around Pennsylvania for about 3 hours on 25 August and about 7 hours on 26 and 27 August.

29 August
0825-0908 Three radsafe monitors aboard to check ship cleared of radiological activity.

8 September
Departed Kwajalein en route to Pearl Harbor via Johnston Island with YF-991 in tow.

21 September
Arrived Pearl Harbor.

ATR-87

Crew Size: 69
Bikini Atoll Arrival: Before 13 June 1946
Bikini Atoll Departure: 1 September 1946
Shot ABLE Location: Approximately 27 nmi (50 km) E
V
Shot BAKER Location: 35 nmi (65 km) S
Operational Clearance: 13 December 1946
Final Clearance: By 4 January 1947

Task Unit and function
ATR-87 was a rescue ocean tug used as a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, repair work, and firefighting on damaged target vessels.

Shot ABLE (1 July, 0900)
30 June
1258 Underway for area outside of lagoon, steaming with TU 1.2.7.

1 July
1425-1446 Arrived at target ship USS Pennsylvania (BB-38) and began fighting fires. 1527 USS Current (ARS-22) alongside to port; checking firefighting equipment for radioactivity.

8 September
Departed Kwajalein en route to Pearl Harbor via Johnston Island with YF-991 in tow.

21 September
Arrived Pearl Harbor.

ATR-87

Crew Size: 69
Bikini Atoll Arrival: Before 13 June 1946
Bikini Atoll Departure: 1 September 1946
Shot ABLE Location: Approximately 27 nmi (50 km) E
Shot BAKER Location: 35 nmi (65 km) S
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30 June
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1425-1446 Arrived at target ship USS Pennsylvania (BB-38) and began fighting fires. 1527 USS Current (ARS-22) alongside to port; checking firefighting equipment for radioactivity.

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ATR-87

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Bikini Atoll Arrival: Before 13 June 1946
Bikini Atoll Departure: 1 September 1946
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Task Unit and function
ATR-87 was a rescue ocean tug used as a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, repair work, and firefighting on damaged target vessels.

Shot ABLE (1 July, 0900)
30 June
1258 Underway for area outside of lagoon, steaming with TU 1.2.7.
11 July
0745-1450 Assisted shifting berths of target ships USS Brule (APA-66) and USS Fallon (APA-81). Anchored in berth 156.
1814 Assisted shifting berths of target ships

12 July
1100 Assisted towing and shifting berths of target ships USS Salt Lake City (CA-25) and Nagato. Anchored in berth 156.
1452 Assisted towing and shifting berths of target ships USS Salt Lake City (CA-25) and Nagato. Anchored in berth 156.

23 July
0600-0905 Anchored the stern of target ship USS Briscoe (APA-65). Photographs were taken of target submarine USS Skate (SS-305) and Independence. Anchored in berth 156.
1451-1740 Photographs were taken of target submarine USS Skate (SS-305) and Independence. Anchored in berth 156.

17 July
0923-1438 Assisted towing and shifting berths of target ships USS Salt Lake City (CA-25) and Nagato. Anchored in berth 156.
1452 Assisted towing and shifting berths of target ships USS Salt Lake City (CA-25) and Nagato. Anchored in berth 156.

24 July
1224 A radiological monitor reported aboard. Underway for area outside of lagoon. Steaming with TU 1.2.7.
1248 Underway for area outside of lagoon. Steaming with TU 1.2.7.

25 July
1139 Anchored at Bikini Atoll in berth Nan.

26 July
1541 Underway to stand clear of berth while USS Reclaimer (ARS-42) beached Hughes. Anchored near berth Jig.

28 July
1840 Anchored near berth 377.

29 July
1607-1727 Washed down Hughes and target submarine USS Dentuda (SS-335). Anchored in unidentifed berth.
1840 Washed down Hughes and target submarine USS Dentuda (SS-335). Anchored in unidentified berth.

30 July
1358 Anchored in berth Nan.

31 July
0955-1105 Laid a blanket of chemical foam on Pensacola. Anchored in berth Nan.
1300 Anchored in berth Nan.

2 August
0957-1505 Towed by ATR-40 to new berth How.

6 August
1459-1512 Radiological monitors were on board Bracken. Anchored in berth 156.
1631 Anchored in berth 114.

7 August
0805-0955 Washed down Brule and took Geiger readings. Washed down Bracken. Anchored in berth 156.
1230-1528 Washed down Bracken. Anchored in berth 156.
1545-1612 Radiological monitors were on board Bracken. Anchored in berth 156.
1652 Anchored in unidentified berth.

8 August

9 August
0832 Standing by in vicinity of Dawson. Proceeded to anchorage.
0931 Washed down Dawson and took Geiger readings. Anchored in berth 16.
1227-1420 Washed down Dawson and took Geiger readings. Anchored in berth 16.
1443 Washed down Dawson and took Geiger readings. Anchored in berth 16.

10 August
0824 Washed down Pensacola. Connected firehoses to forward monitor in order to wash down the decks of Nevada. Disconnected all hoses. Anchored in berth 16.
0830 Washed down Pensacola. Connected firehoses to forward monitor in order to wash down the decks of Nevada. Disconnected all hoses. Anchored in berth 16.

11 August
0906 Anchored Mustin at Kwajalein, then proceeded to anchorage. Departed for Bikini.
1020 Moored next to target ship USS Trippe (DD-403). Departed Bikini Atoll for Kwajalein Atoll with Trippe in tow.
1120 Moored next to target ship USS Trippe (DD-403). Departed Bikini Atoll for Kwajalein Atoll with Trippe in tow.

12 August

13 August
20 August
1020 Washed down Pensacola. Anchored in berth Nan.
1120 Washed down Pensacola. Anchored in berth Nan.

14 August
1250 Departed Bikini Atoll for Kwajalein Atoll with Trippe in tow.

15 August
1538 Departed Bikini Atoll for Kwajalein Atoll with Trippe in tow.

16 August
1840 Anchored near berth 377.

17 August
1538 Departed for Bikini.

18 August
1840 Anchored near berth 377.

20 August
1010 Washed down Pensacola. Anchored in berth Nan.

21 August
1010 Washed down Pensacola. Anchored in berth Nan.

22 August
1250 Departed for Bikini.

23 August
1538 Returned to Bikini Atoll.

24 August

25 August
1118 Washed down Bracken. Anchored in berth Nan.

26 August
1010 Washed down Pensacola. Anchored in berth Nan.

27 August
0906 Washed down Pensacola. Anchored in berth Nan.

28 August
0945 Washed down Pensacola. Anchored in berth Nan.

29 August
1010 Washed down Pensacola. Anchored in berth Nan.

30 August
0945 Washed down Pensacola. Anchored in berth Nan.

31 August

1 September
1551 Washed down Pensacola. Anchored in berth Nan.

2 September
1551 Washed down Pensacola. Anchored in berth Nan.

297
3 September
0814-1208 Anchored LCT-1112 and LCT-818 in Kwajalein.
1242 Moored next to ATR-40.

4 September
1245-1430 Radiating inspection party boarded; ship declared radiologically safe.

8 September
Departed Kwajalein for Pearl Harbor via Johnston Island.

20 September
Arrived Pearl Harbor.

USS AVERY ISLAND (AG-76)

Crew Size: 480
Bikini Atoll Arrival: Spring 1946
Bikini Atoll Departure: 7 August 1946
Shot BAKER Location: 15 nm (28 km) SE, Area Federal
Shot BAKER Location: 4.5 nm (8.8 km) SE, Area Federal
Decommissioning Location: San Francisco
Operational Clearance: 3 December 1946
Final Clearance: 4 January 1947

Task Unit and Function
Avery Island, classified as a miscellaneous ship, was used as a support ship in TU 1.1.2 (instrumentation unit). Its primary function was furnishing laboratories and base facilities for the Instrumentation Unit and Electronics Group. It aided in still photography, telemetering equipment for measuring clouded clouds, and infrared measuring on target vessels.

Shot BAKER (1 July, 0900)
30 June
1217 Completed abandoning ship.

2 July
1610 Commanding officer with four officers and six enlisted men returned to Banner to inspect for damage; declared radiologically safe.

1840 Twenty-two additional men returned aboard from Bottineau.

3 July
1135 Remainder of the crew returned to Banner.

A 4 July damage report stated there was no major damage warranting any special inspection (Reference 2).

9 July
1100 Jettisoned one FM-2 Navy aircraft.

Shot BAKER (25 July, 0835)
23-24 July Crew evacuated to Bottineau.

25 July
Ship heavily contaminated from detonation. Crew remained aboard Bottineau.

11 August
1500 Crew transferred to USS Bexar (APA-23).

9 August
1945-1950 Commanding officer, four officers, and nine enlisted men boarded Banner with Director of Ship Material representatives to inspect for damage. Inspection party returned to Bexar.

Banner dock log gives no evidence that the crew reboarded after 9 August.

11 August
1100 Commanding officer reported no major damage or flooding that required special inspection.

17-19 August Crew dispersed to USS George Clymer (APA 23), USS Haver (APA-17), USS Tall River (CA-140), USS Eglite (APA-24), renowned target ship USS Glines (APA-08), and Bexar for transportation to the U.S. West Coast for decommissioning.

23 August
Topside average 5.13 F/24 hours (Reference 7).
USS Banner (APA-60)

- Decommissioned and towed to Kwajalein by APA-192 for radiological tests.
- Shot ABLE (1 July, 1946): Sighted various unidentified target ships after detonation.
- Crew Size: 174
- Bikini Atoll Arrival: 30 May 1946
- Shot BAKER Location: 10 nmi (19 km) NE

USS Barrow (APA-61)

- Crew Size: 174
- Bikini Atoll Arrival: 30 May 1946
- Shot BAKER Location: 10 nmi (19 km) NE

USS Barton (DD-772)

- Crew Size: 290
- Bikini Atoll Arrival: 15 June 1946
- Bikini Atoll Departure: 29 August 1946
- Shot ABLI Location: 10 nmi (19 km) NE

27 August
- Decommissioned and towed to Kwajalein by APA-192 for radiological tests.
- Towed to Kwajalein by USS Arbutus (ATF-148) for radiological studies and observation.
- Arrived at Kwajalein.

1 October
- Topside average 0.21 R/24 hours (Reference 7).
- Topside average 0.22 R/24 hours (Reference 7).

28 August
- Decommissioned.
- Topside average 0.22 R/24 hours (Reference 7).

1 October
- Topside average 0.23 R/24 hours (Reference 7).

USST Barton (DD-772)

- Crew Size: 290
- Bikini Atoll Arrival: 15 June 1946
- Bikini Atoll Departure: 29 August 1946
- Shot ABLI Location: 10 nmi (19 km) NE

Task Unit and Function
- The destroyer Barton was a support ship in Destroyer Division 74, to the 1.7 Surface Patrol. It functioned as a survey ship throughout the operation; therefore special oceanographic and radiological equipment was installed.

Shot ABLI (1 July, 0900)

- Sighted various ships on unidentified target ships after detonation.
- Commenced taking soundings.
- Started taking oceanographic soundings.
- Left the lagoon area west of the atoll.

1 July
- Anchored in berth 362-A, Bikini Atoll.
- Changed anchorage to 251-A.

1 July
- Received PGM-23 alongside to pick up oceanographic survey party and water samples.

8-14 July
- Took oceanographic soundings.
- Returned to berth 147-W, Bikini Atoll.

24 July
- Underway for patrol area outside of lagoon.

25 July
- Began the safety survey of the lagoon.
- Departed the lagoon for a radio safe patrol station west of the atoll.

26 July
- Anchored in berth 342, Bikini Atoll.

28-29 July
- Took oceanographic soundings.

29 July
- Anchored.
- Shifted berths.

30 July
- Underway to fuel, then anchored in berth 147-W.

3 July
- Shiftd to berth 147-W.

2 August
- Shiftd to berth E.
USS Barton (DD-772)

10 August

1112 Departed Bikini Atoll to rendezvous with Destroyer Squadron 7 en route to Pearl Harbor.

USS Bayfield (APA-33)

Crew Size: 428

Bikini Atoll Arrival: 1 June 1946
Bikini Atoll Departure: 3 August 1946
Shot ABLE Location: 25 nmi (46 km) NE
Shot BAKER Location: 15 nmi (28 km) ENE
Decontamination Location: Puget Sound
Operational Clearance: 7 December 1946
Final Clearance: 10 February 1947

Task Unit and function

Bayfield, an attack transport, was a support ship in Transportation Division 31, TU 1.3.1 (Transport Unit). Its function was the evacuation andberthing of personnel from target vessels.

Shot ABLE (1 July, 0900)

30 June

1527 Underway to evacuate target vessel crews to area outside of lagoon with TG 1.3.

1 July

1728 Anchored in berth 298.

2 July

Shifted to berth 717.

Shot BAKER (25 July, 0035)

24 July

1525 Underway with TG 1.3 with personnel from various target ships for area east-southeast of surface zero.

29 July

0625 Anchored in berth A, Bikini Atoll and started disembarking teams and personnel of target ships.

30 July

Shifted to berth 279.

2 August

Shifted to berth 378.

3 August

1600 Departed Bikini Atoll for Kwajalein Atoll.

4 August

Arrived at Kwajalein.

8 August

Departed Kwajalein for San Francisco.

USS Bego (APA-127)

Crew Size: 155

Bikini Atoll Arrival: 5 June 1946
Bikini Atoll Departure: 3 August 1946
Shot ABLE Location: 15 nmi (28 km) SE
Shot BAKER Location: 15 nmi (28 km) SE, Area Franklin
Decontamination Location: San Diego
Operational Clearance: 30 September 1946
Final Clearance: 25 January 1947

Task Unit and function

Bego was a high-speed transport used as a support ship in TU 1.3.1. (Drone Boat Unit). Its function was the support of drone boats that collected water samples from the lagoon after the detonations. LCVP drones were directed to desired sample areas to obtain water samples after an adequate Geiger reading had been transmitted to controllers. When the mission was completed, drones returned to Begor where they were washed down with hoses by Begor and boarded by a safety officer. When safe, Underwater Demolition Team 3 (UDT-3) boat crew took over and transferred water samples.

Shot ABLE (1 July, 0900)

30 June

1519 Underway for area Graham, steering with TG 1.8.

1 July

1845 Anchored in berth 268, Bikini Atoll.

USS Benevolence (AH-13)

Crew Size: 673

Bikini Atoll Arrival: 22 May 1946
Bikini Atoll Departure: 25 August 1946
Shot ABLE Location: 21 nmi (39 km) NNE
Shot BAKER Location: 16 nmi (30 km) E
Decontamination Location: San Francisco
Operational Clearance: 24 September 1946
Final Clearance: 25 January 1947

Task Unit and function

Benevolence was a hospital ship used as a support ship in TU 1.8.4 (Medical Unit).

Shot ABLE (1 July, 0900)

1 July

Underway en route to area Franklin.

0715 On station, Area Franklin, maneuvering to keep on station.

1015 Maintaining station off Bikini Atoll for drone boat operation.

1130 Underway for assigned anchorage off Eniwetok Island, Bikini.

1215 Anchored off Eniwetok Island.

1528 Underway to berth 38, Bikini.

1610 Anchored at Bikini Atoll in berth 37.

Shot BAKER (25 July, 0835)

25 July

0540 Underway to reach station (Area Franklin) designated for BAKFR day.

0709 Arrived on station for BAKER day.

0840 Steaming to assigned station off Eniwetok Island, Bikini.

1054 Anchored in area off of Eniwetok Island.

Two LCVP drones were monitored by boarding parties after detonation and were found very radioactive. Water samples collected were left aboard drones and recovered 2-1/2 hours later. Forty water samples (5 gallons [18.9 liters] each) were collected on BAKER Day.

28 July

1630 Shifted to Berth J1g.

30 July

Shifted to berth 37.

2 August

Shifted to berth D.

3 August

1012 Departed Bikini Atoll for Pearl Harbor.
USS Benevolence (AH-13)

2 July 1536 Anchored in berth 145.

Shot BAKER (25 July, 0835)

24 July 1518 Underway for area Packard outside of lagoon.

30 July 0751 Anchored in berth 145, Bikini Atoll.

2 August Shifted to Berth Nan.

7 August Shifted to berth 145.

14 August Shifted to berth 34A.

25 August Departed for Pearl Harbor via Kwajalein Atoll.

USS BEXAR (APA-237)

Crew Size: 293

Bikini Atoll Arrival: 30 June 1946

Shot ABL Location: 15 nmi (28 km) NE

Decontamination Location: San Diego

Operational Clearance: 24 January 1947

Final Clearance: 1 February 1947

Function and Task Unit

Bexar, an attack transport, was a support ship in Transportation Division 31 of TU 1.3.1 (Transportation Units). Its function was to house target vessel crews during the detonations.

Shot ABE (1 July, 0900)

30 June 1530 Underway for area outside of lagoon after embarking target vessel personnel, steaming with TU 1.3.

1 July 1739 Anchored in berth 297, Bikini Atoll.

2 July 1218 Shifted to berth 140. Completed disembarking target ship personnel.

16 July 1220-1420 Target ship YOC-83 came alongside to fuel Bexar.

Shot BAKER (25 July, 0835)

24 July 1526 Underway after embarking target vessel personnel for area Franklin, steaming with TU 1.3.1.

30 July 0649 Anchored in berth 278, Bikini Atoll.

2 August Shifted to berth 351.

3 August Shifted to berth 355.

7 August Shifted to berth 278.

USS Bladen (APA-63)

17 August 1310 Began personnel disembarkation from target ships USS Barrow (APA-61), USS Crittenden (APA-77), and USS Banner (APA-60), and support ship USS George Clymer (APA-27).

19 August Shifted berths.

24 August Arrived at Kwajalein.

29 August Departed Kwajalein for San Pedro, California, via Pearl Harbor.

USS BLADEN (APA-63)

Crew Size: 111

Bikini Atoll Arrival: 31 May 1946

Bikini Atoll Departure: 20 August 1946

Crew Location for Shot ABE: USS Henrico (APA-45)

Crew Location for Shot BAKER: Henrico

Shot ABE Location: 10 nmi (19 km) NE

Shot BAKER Location: 2.400 yards (2.3 km) SW

Operational Clearance: 6 November 1946

Final Clearance: 21 December 1946

Decommissioned 26 December 1946, Norfolk, Virginia

Function and Task Unit

Bladen, an attack transport, was a target vessel during CRUSTAAU, its crew was evacuated before each shot. It served in Transportation Division 93 of TU 1.2.6 (Merchant Type Unit).

Shot Able (1 July, 0900)

1 July 1420-1433 ATA-192 fought a fire aboard Bladen.

1730 Bladen cleared for boarding.

2 July The ship's crew reboarded Bladen.

13 July 0900 The commanding officer commenced a personnel and upper deck inspection of the ship.

Shot BAKER (25 July, 0835)

24 July Crew evacuated to Henrico.

25 July 1137 Bladen cleared for boarding.

1230 Geiger readings showed Bladen at 0.0002 R/24 hours (Reference 6. p. 1-7-8).

28 July 1552-1602 Medical research unit removed test animals to USS Conserv (ARS-39).

29 July The crew returned aboard ship.

30 July Shifted to berth 246.

2 August Shifted to berth 331.

7 August Shifted to berth 262.

20 August Departed Kwajalein Atoll.
USS Bladen (APA-63)

21 August  Arrived at Kwajalein.
27 August  Radiological clearance issued.
30 August  Departed for Pearl Harbor.

BLISH, JOHN: see USS JOHN BLISH (AGS-10)

USS Bountiful (AH-9)

28 July 1552 Anchored in berth 357, Bikini.
30 July 1000 Underway for Pearl Harbor via Rongelap Atoll.

USS Bottineau (APA-235)

Crew Size: 299
Bikini Atoll Arrival: 7 June 1946
Bikini Atoll Departure: 10 August 1946
Shot ABLE Location: 23 nmi (39 km) NE
Shot BAKER Location: 20 nmi (37 km) E
Decontamination Location: San Francisco
Operational Clearance: 19 December 1946
Final Clearance: 27 December 1946

Task Unit and function
Bottineau, an attack transport, was a support ship in Transport Division 31 of TU 1.3.1. Its function was to house target vessel crews during the operation.

Shot ABF (1 July, 0900)
30 June 1452 Underway for area outside of lagoon after disembarking personnel from target vessels.
1 July 1730 Anchored in berth 299, Bikini Atoll.
2 July 1421 Shifted anchorage to berth 224.

Shot BAKER (25 July, 0835)
24 July 1450 Underway for area Harmon, outside of the lagoon, steaming with Divisions One and Two of TG 1.3.
30 July 0533 Anchored in berth 261, Bikini Atoll.
2 August 1645 Shifted to berth 356.
7 August 1730 Shifted to berth 261.
10 August 0528 Departed Bikini Atoll for Pearl Harbor.

USS BOUNTIFUL (AH-9)

Crew Size: 585
Bikini Atoll Arrival: 18 June 1946
Bikini Atoll Departure: 27 July 1946
Shot ABLE Location: 23 nmi (39 km) NE
Shot BAKER Location: 19 nmi (37 km) E
Operational Clearance: 27 September 1946
Final Clearance: 27 September 1946

Task Unit and function
Bountiful, a hospital ship, was a support ship in TU 1.6.4 (Medical Unit).

Shot ABF (1 July, 0900)
30 June 1449 Left the lagoon for area outside of the atoll, steaming with TG 1.8.
USS Bountiful (AH-9)

1 July 1945
Anchored in the lagoon.

Shot BAKER (25 July, 0835)

24 July 1945
Left Bikini Lagoon for area outside the atoll, steaming with TG 1.8.

27 July 1945
Departed Bikini Atoll en route to Pearl Harbor.

4 August 1945
Moored at Pearl Harbor.

13 September 1945
Decommissioned at Seattle, Washington.

USS Bracken (APA-64)

4-26 August 1945
Anchored at Bikini, conducting routine activities.

27 September 1945
Departed Bikini Atoll for Pearl Harbor via Kwajalein Atoll.

USS Bracken (APA-64)

Crew Size: 108

Bikini Atoll Arrival: Before 30 June 1946
Bikini Atoll Departure: 19 August 1946
Crew Location for Shot ABLE: USS Henrico (APA-45)
Crew Location for Shot BAKER: Various units
Shot ABLE Location: 2,010 yards (1.8 km) S
Shot BAKER Location: 1,475 yards (1.3 km) SSE

Crew Size: 296

Bikini Atoll Arrival: 5 March 1946
Bikini Atoll Departure: 27 September 1946
Shot ABLE Location: 23 nmi (45 km) NE
Shot BAKER Location: Rongelap Atoll
Decontamination Location: San Francisco
Operational Clearance: 20 November 1946
Final Clearance: 20 November 1946

Task Unit and Function

Bracken was an attack transport used as a target vessel during CROSSROADS. Its crew was evacuated before ABLE. It served in Transportation Division 93 of TG 1.2.6 (Merchant Type Unit). Bracken was equipped by the Electronics Group with Geiger counters coupled to radio transmitters. It also carried water-pressure-telemetering channels to measure ionized clouds.

Shot ABLE (1 July, 0900)

30 June 1945
1145 Three officers and eighty-four enlisted men evacuated to Henrico. Last-minute detail of two officers and ten enlisted men remained on board.

1 July 1945
Remaining Bracken crew evacuated before ABLE.

1402-1435 ATA-192 alongside target ships USS Magenta (APA-87), USS Bladen (APA-63), and Henrico to fight fires caused by nuclear detonation (Reference 1, p. B-11).

1403-1435 ATA-192 alongside target ships USS Magenta (APA-87), USS Bladen (APA-63), and Henrico to fight fires caused by nuclear detonation (Reference 1, p. B-11).

1412 ATA-192 alongside target ships USS Magenta (APA-87), USS Bladen (APA-63), and Henrico to fight fires caused by nuclear detonation (Reference 1, p. B-11).

1435 ATA-192 alongside target ships USS Magenta (APA-87), USS Bladen (APA-63), and Henrico to fight fires caused by nuclear detonation (Reference 1, p. B-11).

1535 ATA-192 alongside target ships USS Magenta (APA-87), USS Bladen (APA-63), and Henrico to fight fires caused by nuclear detonation (Reference 1, p. B-11).

1542 ATA-192 alongside target ships USS Magenta (APA-87), USS Bladen (APA-63), and Henrico to fight fires caused by nuclear detonation (Reference 1, p. B-11).

2 July 1945
0840-0854 Boarding party from Henrico or Bracken (Reference 1, p. B-11).

0940-1054 Cleared for boarding (Reference 5, p. B-16).

3 July 1945
Bracken crew resumed berthing aboard ship.

Shot BAKER (25 July, 0835)

25-26 July 1945
Ship abandoned before test BAKER. Personnel were aboard USS Rockbridge (APA-228), Henrico, USS Appling (APA-58), and USS Gunston Hall (LSD-5).
**USS Bracken (APA-64)**

27 July

1004-1020 A boarding team boarded Bracken to recover instruments after monitors declared Bracken Gerger sour (Reference 1, Conserv.
1027 Bracken reported Gerger sour (Reference 1, Conserv.
1400 All Bracken personnel on Rockbridge were transferred to Henricia.

28 July

1140 Monitor boarded Bracken.
1352 All animals instruments, and teams were placed back on board USCG Conserv (ARS-39) (Reference 1, Conserv.

31 July

0940-1015 Conserv washed down Bracken
0940-1641 Conserv sprayed foam on Bracken (Reference 1, Conserv.

1 August

USS Current (ARS-22) washed down Bracken, 
A boarding team was aboard Bracken for 13 minutes (Reference 1, Current). After three hours, Gerger sour, 2 to 4 R/24 hours.

3 August

Current washed down Bracken: boarded Bracken for 30 minutes (Reference 1, Current).

6 August

0831 ATR 81 underway, approaching Bracken.
1040-0933 ATR 81 washed down Bracken (Reference 1, ATR 81).
1054-1056 USS Chickasaw (ATF-81) washed down Bracken (Reference 1, Chickasaw).

7 August

1220 Sprayed with decontamination solution by Chickasaw.
1628 ATR 81 approached Bracken.
1628 ATR 81 washed Bracken down.
1545 ATR 81 moored portside to Bracken: radiological monitor boarded Bracken.
1612 Radiological monitor returned aboard Bracken (Reference 1, ATR 81).

8 August

1555-1622 DSM boarding team from USCG Deyler (ARS-23) on Bracken (Reference 1, Deyler).

9 August

1500 Ten Bracken crewmembers were transferred to remained target ship USS Geneva (APA-86).

10 August

0900-1130 Party boarded ship to open it and make inspection for DSM inspection party. No damage due to bomb explosion except radiological contamination and displacement of about a quarter of the upper deck hatch boards. Party departed ship, leaving USCG instrument salvage team on board. Although the ship's log does not indicate when the USCG boarding team departed, it is believed that they left later that day.

The weather decks on 10 August showed considerable contamination after various washes by tugs, radiating 0.4 to 0.5 R/24 hours. After 630 nm (1.16 km) of water, the value rose to as much as 1.0 R/24 hours.

Cargo nets on the deck on each side of the #2 hatch showed 2.0 and 2.5 R/24 hours. which may have been caused by soaking up water used to wash off the deck. Below deck there was an average radiation of 0.03 R/24 hours, except where water had entered the ship through the two main hatches partly opened by the explosion and through doors and ports left open by advance boarding parties. The highest reading was about 1.0 R/24 hours from water on the main deck near the #2 held (Reference 2).

13 August

0900 Four men reboarded ship to assist DSM radiological monitor in collecting test equipment.
1000 Ship abandoned. All Bracken personnel on Henricia transferred to Rockbridge.

14 August

Topside average 0.7 R/24 hours (Reference 7).

15 August

Ship abandoned, crew on Rockbridge, Geneva, and Gunston Hall.

0900-1200 Party reboarded ship to take in the starboard anchor and close condenser sea valves. USCG Etiah (AN-79) alongside to furnish power to the windlass. Ship abandoned with starboard anchor housed.

17-18 August

Bracken crewmembers transferred to USCG George Clymet (APA-21), Geneva, and Gunston Hall.

19 August

0900 Four Bracken crewmembers transferred to Chickasaw for temporary duty to anchor Chickasaw at Kwajalein.

1010 Port bow chain cut above waterline and taken into town by Chickasaw. Anchor detail on board 25 minutes.

21 August

Anchored at Kwajalein. Anchor detail was aboard 1 hour and 5 minutes.

26 August

Bracken decommissioned.

30 September

Topside average 0.20 R/24 hours (Reference 7).

**USCG Bramble (WAGL-392)**

8 August

0300-0515 USCG Bramble (WAGL-392) alongside to Chickasaw.

9 August

1100-1800 Party aboard USCG Bramble at Bikini Atoll for temporary duty to anchor Chickasaw.

10 August

1830-1900 Party aboard USCG Bramble at Bikini Atoll for temporary duty to anchor Chickasaw.

12 August

0300-0530 USCG Bramble alongside to Chickasaw.

24 June

Left Pearl Harbor for Kwajalein Atoll.

Crew Size: 49

Bikini Atoll Arrival: 6 July 1946

Bikini Atoll Departure: 24 August 1946

Shot ABL1 Location: 630 nm (1.16 km) W

Shot ABL2 Location: 21 nm (39 km) WSW

Dystraining Location: Pearl Harbor

Final Clearance: By 22 November 1946

Task Unit and Function

Bramble served as a support ship in Task Unit 18.5 (Survey Unit). Its function was to survey the effects of the nuclear tests on fish and wildlife and to conduct oceanographic surveys to determine the character of the ocean currents around and inside the atoll.

Shot ABL1 (1 July, 0900)
USS Bramble (WAGL-392)  
4 July 0816 Arrived at Kwajalein Atoll.  
5 July 1910 Underway for Bikini Atoll.  
6 July 1212 Arrived at Bikini Atoll and anchored in berth 150.  
Shot BAKER (25 July, 0835)  
24 July 1400 Departed Bikini Lagoon to sortie with TU 1.8.7 in area Packard.  
25 July 0855 Changed course for Rongelap Atoll.  
1545 Anchored at Rongelap Atoll.  
30 July 1732 Underway for Bikini Atoll.  
31 July CT19 Anchored in berth 250, Bikini Atoll.  
2 August Moved to an anchorage off of Eneu Island.  
7 August Returned to berth 250.  
23 August 1320 A monitor from USS Haven (AH-12) came on board to measure any radioactivity on moorings that were to be loaded.  
1330 Loaded small boat moorings.  
1639 Monitor left having found no radioactivity on moorings; the ship then completed picking up moorings.  
24 August 1203 Underway for Kwajalein Atoll.  

USS Briscoe (APA-65)  
4 July 1600 Last-minute personnel joined ship's company on Bayfield.  
1630 USS Reclaimer (ARS-42) proceeded to investigate Briscoe and other target ships (Reference 1, Skipjack).  
2 July 0901 Boarding team from USS Clamp (ARS-73) boarded Briscoe for inspection.  
0905 Fire aboard Briscoe extinguished.  
0925 Firefighting party departed Briscoe.  
0947 Boarding party departed Briscoe (Reference 1, Clamp).  
0948 Briscoe reported Geiger reading (Reference 6, p. 2-25-A). Damage reported as negligible (Reference J, p. 3).  
1400 Departed Bikini Lagoon to sortie with TU 1.2.6 (Merchant Type Unit). Its crew was evacuated before shot ABLE. Briscoe carried transmitters for the Electronics Group and was also equipped with water-pressure-telemetering channels to measure ionized clouds.  
31 July 1158 Commence and opening ship.  
1245-1450 Technicians read ordnance instruments.  
23 August 1510 Technicians came aboard to read ordnance instruments.  
1645 Technicians came aboard to read ordnance instruments.  
1705-1715 Technicians came aboard to read ordnance instruments.  
3-23 July Technicians periodically boarded.  
12 July 0900-1125 Diving party aboard to install underwater instruments.  
0915-1015 Diving party underwater.  
1040-1125 Diving party underwater.  
14 July 0903-1115 Divers working from an LCM on CROSSROADS instrumentation engaged in operations on the portside.  
15 July Bureau of Ships Instrumentation Group began working on underwater blasting to test instilled gauges.  
20 July 0605-1015 Diving operations conducted in connection with gauge installation and tests.  
23 July 0615 USS Achenawal (ATF-148) and ATF-87 alongside to assist ship in dropping stern anchor.  
30 June 1020 Crew evacuated to Bayfield except for several crew members and two civilians left aboard as last-minute personnel.  
1 July 0405 Last-minute personnel evacuated to USS George Clymer (APA-27).  
24 July 0815-0945 Crew evacuated ship for Bayfield with the exception of six crew members and two civilians conducting last-minute details.  
25 July 0815-0945 Last-minute detail evacuated to USS Rockbridge (APA-228) prior to BAKER.
USS Briscoe (APA-65)

25 July

1355-1446 Last minute casualty from Briscoe departed Rock Wall to join the crew on Payfield.

29 July

0932 Briscoe had a 30-minute tolerance level (Reference 8, p. 389). Naval Medical Research Service (NMR) team boarded Briscoe to remove instruments and animals.

1001 Briscoe Geiger sour. All animals recovered. Average Geiger readings on main deck 30 R/24 hours.

1002 All animals, instruments, and NMR personnel returned to USS Payfield (APA-97).

30 July

1927-1038 ATA-185 recovered instruments from Briscoe.

31 July

0627-0802 USS Conserver (AMS-39) washed down Briscoe with saltwater.

1146-1213 Conserver sprayed mechanical and chemical teams on Briscoe.

1416-1452 Conserver sprayed mechanical and chemical teams on Briscoe (Reference 9, Consecut yet).

1 August

0000 USS Current (ARS-22) washed down Briscoe. Boarding team onboard for 2 minutes. After a 3-hour backing, Briscoe declared Geiger sour. Spot reading from frame 100, upper deck, was 4 to 5 R/24 hours.

2 August

Members from Current boarded Briscoe for 64 minutes for an inspection (Reference 1, Current).

3 August

0000 Transferred crew and officers to USS Rockwall (APA-33).

0446 ATA-116 underway to Briscoe.

0952-1000 ATA-116 alongside Briscoe (Reference 1, ATA-116).

10 August

0446 Commanding officer and inspection party of DSM personnel and 14 crewmembers boarded the ship for a survey of damage and material conditions.

1245 Commanding officer and inspection party left the ship; remained on board between 20 minutes and 1 hour.

13 August

1000 Four-man boarding party came on to take draft and soundings with one monitor accompanying the boarding party. Boarding party left the ship.

15 August

0650 Commanding officer and 22-man boarding party reboarded and inspected the ship in company with DSM representatives and radiological monitors.

1120 Reboarding and inspecting party returned to Rockwall. Having operated emergency diesel life pumps.

16 August

1200 Commanding officer with radiological monitor and 8 crewmembers reboarded Briscoe for the purpose of boisting the starboard anchor and slipping the stern anchor.

USS Brule (APA-66)

25 July

1336 1409 USS Suncoek (AN-80) alongside to take up the anchor. Briscoe lipside average 0.7 R/24 hours (Reference 7).

1430 Special boarding detail returned to Rock Wall.

17 August

Some crewmembers transferred to other units.

18 August

Majority of remaining crew transferred to remaining target ship USS Niagara (APA 81).

20 August

1336 Taken in tow by USS Desilva (APA-79) for Kwajalein. A four-man anchor detail from Briscoe boarded Desilva.

22 August

Anchored at Kwajalein. Four-man anchor detail returned to Niagara.

30 September

Lipside average 0.40 R/24 hours (Reference 7).

USS Brule (APA-66)

Crew Size: 331

Brule (APA-66)

Picket Option: Before 19 June 1944

Picket Option: Departure: 28 August 1944

Crew Location for Shot AB 1: USS Brule (APA-66)

Shot AB 1: Location 4,000 yards (3,660 meters) W

Shot AB 2: Location 6,000 yards (5,400 meters) W

Shot AB 1: 11 May 1944 near Kwajalein Atoll

Task Unit and Function

Brule, an attack transport, was a target vessel during CHUGAS. Its crew was evacuated for both shots. It served in Transportation Division 91 of TU 126 (Merchant Type Unit).

Shot AB 1 (1 July, 0600):

30 June

2400 All personnel evacuated to Beaufort.

2 July

0842 Brule declared Geiger sour.

1316 Team A and B began returning to ship and took soundings.

1420 The ship was pronounced free of radioactivity.

4 July

Entire crew had reboarded.

13 July

1245 An F6F airplane was brought on board.

Shot AB 2 (25 July, 0836):

24 July

0825 All personnel were aboard Beaufort.

25 July

Sustained only minor physical damage from Baker. But it received a considerable amount of radiological contamination.

29 July

Radiological readings indicated no change in Brule's condition. It was assigned a one-half hour radiological tolerance
USS Butte (APA-68)

Shot BAKER (25 July, 1600)

24 July
1644 Left Bikini Lagoon for area Graham.

25 July
1255 Anchored in berth Uncle, Bikini Atoll.

26 July
1600 Reported distilling plant clear of radiation and ready for use.

28 July
1410 All evaporators were secured due to radioactivity in the water.

1531 Ordered out of the lagoon to area Mercury to await the return of an LCVP with an animal-retrieving party aboard.

1700 Animal party returned; Burleson steamed out of lagoon.

29 July
0405 Anchored in berth 383.

30 July
1125-1130 Conducted diving operations to release clothing caught in starboard condenser intake.

1311 Underway for Kwajalein Atoll.

31 July
1441 Anchored at Kwajalein Atoll.

3 August
1814 Departed for Bikini Atoll.

4 August
0956 Anchored in berth D, Bikini Atoll. Personnel came on board for transfer to the United States.

5 August
1440 Departed for Pearl Harbor.

USS BUTTE (APA-68)

Crew Size: 126

Shot Able (1 July, 0900)

30 June
1640 Underway for area outside of the lagoon in area Graham.

1 July
1527 Anchored in berth 13A, Bikini Atoll.
1118 Anchored in berth 115, B-12.
1146 Boats 10 and 14 were detached to target ships USS Niagara (APA-87), USS Geneva (APA-86), and ICF-32 to remove animals from only the topsides of the ships.
1200 Boats returned.

2 July
1117 Shifted to berth 107.

7 July
1705 Underway for Kwajalein Atoll.

19 July
1138 Left for Bikini Atoll.

20 July
0913 Arrived Bikini Atoll.

Shot Able (1 July, 0900)

30 June
0910:0335 Most crew members were evacuated to Bexar; a small contingent boarded Rockbridge.

1 July
1019 Butte reported Geiger sweep by radiate patrol.

USS Burleson (APA-68)

Crew Size: 244

Shot Able (1 July, 0900)

29 July
126 Personnel being transferred from Burleson to other units.

13 August
Burleson was inspected by a party from USS Whigton (AP-7) (Reference 8); due to the low readings the inspection was brief.

23 August
Topsides average 2.7 R/hour (Reference 7).

28 August
Personnel transfers completed; Burleson decommissioned. Departed Bikini Atoll for Kwajalein Atoll in tow by USS Chomolyn (APF-16).

29 August
Arrived Kwajalein.

30 September
Topsides average 0.72 R/hour (Reference 7).

USS BURLESON (APA-68)

Crew Size: 244

Bikini Atoll Arrival: 14 June 1946
Bikini Atoll Departure: 5 August 1946
Shot Able Location: Approximately 11.5 to 15 nm.
(237 to 28 km, 144)
Shot Baker Location: 11.5 nm (23 km, 144)
Decontamination Location: Norfolk, Virginia
Final Clearance: By 14 October 1946

Task Unit and Function

Burleson, an attack transport, was a Support ship in the operation. Its function was to provide laboratory and base facilities for the Instrumentation Unit. It housed the test animals used in the operation, providing animal pens, feed bins, autopsy rooms, and pathology and radiobiology and biochemistry laboratories.

Shot Able (1 July, 0900)

30 June
1640 Underway for area outside of the lagoon in area Graham.

1 July
1527 Anchored in berth 13A, Bikini Atoll.
1118 Anchored in berth 115, B-12.
1146 Boats 10 and 14 were detached to target ships USS Niagara (APA-87), USS Geneva (APA-86), and ICF-32 to remove animals from only the topsides of the ships.
1210 Boats returned.

2 July
1117 Shifted to berth 107.

7 July
1705 Underway for Kwajalein Atoll.

19 July
1138 Left for Bikini Atoll.

20 July
0913 Arrived Bikini Atoll.
USS Butte (APA-68)

1 July

- A fire was reported on board (Reference 6, p. 1-14-A; Reference 5, p. B-14).

2 July

- 2026 An inspection team reboarded Butte.
- 1615-1945 Preliminary damage inspection conducted.

3 July

- 0845 All Butte personnel reboarded.

Shot BAKR (25 July, 0835)

- Ship's crew was again evacuated to Bexar; last-minute personnel boarded Rockbridge.

24 July

- 1020 Butte declared Geiger sour (Reference 6, p. 1-12-B).

Butte's crew remained aboard Bexar and Rockbridge after BAKER.

31 July

- Washed down by USS Current (ARS-22) with high-pressure streams (Reference 6, p. 1-58-B).

3 August

- USS Clamp (ARS-33) reported Geiger team inspected ship: Geiger sour.

7 August

- 0600-1100 Radiate monitor and boarding team boarded Butte: Inspection results unknown.

8-9 August

- Entire ship's company returned to Butte and conducted decontamination procedures for approximately 8 hours each day, returning to Bexar each night for berthing. Butte readings are given in Table A.1. Contaminated items were either washed with a high-pressure hose or thrown overboard. Scraping of the ship went below the waterline. Further decontamination ordered stopped by order of DSM.

Table A.1. USS Butte (APA-68) decontamination.

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Reading (R/24 hrs)</th>
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<td>Waterline Average</td>
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<td></td>
<td>Average Exterior</td>
<td>0.5</td>
</tr>
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<td>Maximum Exterior</td>
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</tr>
<tr>
<td></td>
<td>Average Interior</td>
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<td>Topside Average</td>
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</tr>
</tbody>
</table>

Sources: References 4 and 7.

17-28 August Butte personnel transferred to various units of the task force.

USS Carteret (APA-70)

28 August

- Towed to Kwajalein and decommissioned. Butte remained at Kwajalein for further radiological study until it was sunk.

USS Carlisle (APA-69)

Crew Size: 104

Bikini Atoll Arrival: Before 30 June 1946

Crew Location for Shot ABLE: USS Bexar (APA-237)

Shot ABLE Location: 1,710 yards (1,600 meters) SE

Sunk 1 July 1946, Bikini Atoll

Task Unit and Function

Carlisle, an attack transport, was a target vessel during CROSSROADS. Its crew was evacuated before ABLE and never returned to the ship. It served in Transportation Division 92 of TU 1.2.6 (Merchant Type Unit).

Shot ABLE (1 July, 0900)

Carlisle sank due to test ABLE damage. Diving operations were conducted for examination of the ship after shot ABLE until about 14 July.

Shot BAKER (25 July, 0835)

By 25 July Carlisle's crew had been transferred to various units of the fleet for the remainder of CROSSROADS. The units included USS Coucal (ASR-8), USS Oca (AVP-49), CTG 1.2.6, CTU 1.2.7, ComserDiv Eleven, and CTU 1.2.5.

USS Carteret (APA-70)

Crew Size: 119

Bikini Atoll Arrival: Before 8 June 1946

Bikini Atoll Departure: 25 August 1946

Crew Location for Shot ABLE: USS Bexar (APA-237)

Shot ABLE Location: 1,710 yards (1,600 meters) SE

Shot BAKER Location: 1,710 yards (1,600 meters) WSW

Sunk 19 April 1948, Kwajalein Atoll

Task Unit and Function

Carteret was an attack transport used as a target vessel during CROSSROADS. Its crew was evacuated before each shot. It served in Transportation Division 91 of TU 1.2.6 (Merchant Type Unit).

Shot ABLE (1 July, 0900)

- 0930 Commenced evacuating ship.
- 1214 Commanding officer evacuated ship; ship completely evacuated to Bexar.

Sources: References 4 and 7.
USS Carteret (APA-70)

2 July

1530 Radiologist departed, having reported Carteret to be free of radioactivity.
1652 All hands returned to Carteret.

6 July

0543 Underway to shift berths.
0621 Anchored between berths 185 and 197.
1055 YO-63 hoisted to starboard.
1110-1125 Took on fuel from YO-63.

Shot BAKER (25 July, 0815)

24 July

0915 Commenced evacuating personnel to Bexar.
1034 Commanding officer left Carteret; completed evacuating the ship.

25 July

1404 USS Suncock (AN-80) was advised that Carteret was clear for boarding and directed to place a team aboard.
1420 The water around Carteret was Geiger sour (1 R/24 hours); Suncock awaited further instructions.
1621 Suncock directed to proceed from Carteret to special anchorage (Reference 1, Suncock).

27 July

1217-1224 USS Conserver (ARS-39) recovered instruments from Carteret (Reference 1, Conserver).
1225 Ship reported Geiger sour, and it was not cleared for boarding (Reference 6, p. 1-22-B).
1230 Carteret Geiger sour; team not placed aboard; Geiger reading 0.25 R at 8-foot (2.44-meter) distance. Two Instruments hanging over stern recovered.

29 July

1430 Carteret declared Geiger sour (1 R/24 hours).
1450 Carteret approved for reboarding for a limited time; monitor present to guard against exceeding tolerance.

USS Current (ARS-22) hoisted alongside Carteret for 15 minutes; boarding team aboard for 15 minutes (Reference 1, Current).

31 July

1101 USS Preserver (ARS-8) underway to Carteret to take Geiger readings and spray with foam.
1137 Preserver completed taking Geiger readings; commenced spraying Carteret with powdered chemical foam.
1235 Preserver completed spraying Carteret and proceeded to target vessel LCT-705 (Reference 1, Preserver).

1 August

0742 Preserver underway to wash down Carteret in target array.
0810-1004 Preserver washed down Carteret with two 5-inch water monitors.
1017-1027 Preserver monitor team aboard Carteret to take Geiger readings (Reference 1, Preserver).
1054-1105 Radiological monitor from Clamp boarded Carteret (Reference 1, Clamp).

USS Carteret (APA-70)

2 August

1115 Average radioactivity aboard Carteret to be 0.14 R/24 hours; boarding team returned to Clamp.

2 August

1345-1645 The captain and working party with a radiologist boarded to conduct decontamination operations, returned to Bexar.
1720 Decontamination crew boarded Carteret after instructions on target ship USS Musford (DD-389). The survey by the Geiger men indicated that the ship was clear below deck. Diesel generators were started and the boiler lit off. Decontamination work was carried out on the weather deck and upper deck throughout the day (Reference 4).

3-11 August

Decontamination work continued. Working parties generally boarded at 0745, returning to Bexar about 1630. A radiologist accompanied the teams each day. From 3 August to 1000 on 11 August, the commanding officer and a skeleton crew of engineers remained aboard at night to operate the ship's boilers.

13 August

0930 Captain, accompanied by the radiologist, returned to ship to obtain chronometers.

14 August

0905-1100 Captain and working party boarded ship with radiologist to receive paint stores.

16 August

0830 Captain boarded ship with radiologist and working party to rig ship for painting.
1630 Captain and working party returned to Bexar.

17 August

0830 Captain boarded ship with radiologist and working party and commenced painting.

18 August

0830-1715 Preserver completed spraying Carteret to complete painting.

19 August

Decontamination operations were ordered discontinued, and the crew was transferred to USS George Clymer (APA-27).

20 August

Crew transferred to other ships: captain and one petty officer continued to live on Bexar.

25 August

USS Chownan (ATF-100) prepared Carteret for towing; Chownan departed for Kwajalein with Carteret in tow.

26 August

Ship decommissioned.
USS Carteret (APA-70)

27 August 0946 Influence on the ship's materiel from the test (Reference 3).

Table A.2 lists the Geiger readings taken aboard Carteret.

Table A.2: USS Carteret (APA-70) radiation readings.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topside Maximum</th>
<th>Topside Average</th>
<th>Inside Maximum</th>
<th>Inside Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 August</td>
<td>1.5</td>
<td>0.6</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td>4 August</td>
<td>1.2</td>
<td>0.6</td>
<td>0.6</td>
<td>...</td>
</tr>
<tr>
<td>5 August</td>
<td>1.0</td>
<td>0.5</td>
<td>0.8</td>
<td>...</td>
</tr>
<tr>
<td>6 August</td>
<td>0.9</td>
<td>0.4</td>
<td>1.2</td>
<td>0.06</td>
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<td>7 August</td>
<td>0.75</td>
<td>0.37</td>
<td>0.6</td>
<td>0.06</td>
</tr>
<tr>
<td>8 August</td>
<td>0.45</td>
<td>0.13</td>
<td>0.55</td>
<td>...</td>
</tr>
<tr>
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<td>11 August</td>
<td>0.6</td>
<td>0.090</td>
<td>0.6</td>
<td>0.04</td>
</tr>
<tr>
<td>20 August</td>
<td>...</td>
<td>0.1</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>29 September</td>
<td>...</td>
<td>0.014</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Note: *a* **...** signifies no reading available.

Sources: References 4 and 7.

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USS Carteret (APA-70)

Crew Size: 116

Bikini Atoll Arrival: Before 30 June 1946

Bikini Atoll Departure: 26 August 1946

Crew location for Shot ABLE: USS Henrico (APA-45)

Crew location for Shot BAKER: Henrico

Shot ABLE Location: 1,800 yards (1.7 km) S

Shot BAKER Location: 2,215 yards (1.2 km) SSE

Sunk 6 May 1948 near Kwajalein Atoll, after being retained there for radiological studies.

Task Unit and Function

Carteret, an attack transport, was a target vessel during CROSSROADS. Its crew was evacuated for both shots. It served in Transportation Division 93 of TU 1.2.6 (Merchant Type Unit).

Shot ABLE (1 July, 0900)

1015 Crew was evacuated to Henrico.

1 July 1531 Carteret declared Geiger sour by USS Clamp (ARS-31) (Reference 6, p. 1-12-A).


An 11 July commanding officer's damage report stated that the damage was superficial. While the animals aboard the ship were exposed, there was no real

---

USS Catron (APA-71)

Influence on the ship's materiel from the test (Reference 3).

Shot BAKER (25 July, 0835)

24 July 1030 Crew evacuated to Henrico.

27 July 0946 Catron showed a 1-hour tolerance level from 30 feet (9 meters) (Reference 6, p. 1-20-B).

28 July 1429-1436 Half the test animals were removed while the ship was still Geiger sour.

29 July 1344-1357 Remaining test animals were removed.

2 August Clamp administered a coat of foam to Catron (Reference 6, p. 1-71-B).

12 August Ten men boarded for 3 hours to open and inspect ship.

13 August Boarding team boarded for 45 minutes to recover casualty badges. Crew transferred from Henrico to USS Rockingham (APA-229).

14 August All crewmembers who were in reboarding teams on Catron were examined, with their clothing, for radioactivity by radiological monitors. No personnel showed any radioactivity. The shoes of two men showed radioactivity and were disposed of.

16 August Fifteen men boarded for 4 hours in the morning to pump out engine room; eight men boarded for 1 hour in the afternoon to continue pumping out the engine room.

17 August Seven men boarded for 1-1/2 hours in the morning to pump out engine room. Nine men boarded in the afternoon for a 2-hour inspection.

19 August Nine men boarded for 1 hour in the morning to conduct pumping operations; pumping continued for 2 hours 45 minutes in the afternoon.

20 August Twelve men boarded for 2 hours in the morning to conduct pumping operations; pumping continued for 2 hours 15 minutes in the afternoon.

21 August Ten crewmen boarded in the morning for 2 hours 30 minutes to conduct pumping operations; six men boarded for almost 3 hours in the afternoon to continue pumping.

22 August Eleven crewmen pumped the ship for 2 hours 20 minutes.

26 August Went to Kwajalein Atoll.

28 August Arrived at Kwajalein.

29 August Decommissioned.
Average topside intensities measured aboard *Catron* were as listed below (Reference 33: 0834 Underway for Bikini Atoll.):  

<table>
<thead>
<tr>
<th>Date</th>
<th>Reading (R/24 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 August</td>
<td>6.0</td>
</tr>
<tr>
<td>6 August</td>
<td>4.0</td>
</tr>
<tr>
<td>8 August</td>
<td>2.5</td>
</tr>
<tr>
<td>12 August</td>
<td>1.5</td>
</tr>
<tr>
<td>22 August</td>
<td>0.87</td>
</tr>
<tr>
<td>25 September</td>
<td>0.35</td>
</tr>
</tbody>
</table>

**USS Cebu (ARG-6)**

- Crew Size: 317
- Bikini Atoll Arrival: 20 May 1946
- Bikini Atoll Departure: 23 August 1946
- Location for Shot ABLE: Kwajalein Atoll
- Location for Shot BAKER: 15 nautical miles (28 km) ENE of Kwajalein Atoll
- Decontamination Location: San Francisco
- Operational Clearance: 16 December 1946
- Final Clearance: 21 December 1946

**Task Unit and Functions**

Cebu was an amphibious ready group repair ship used as a support ship in TU 1.8.1 (Repair and Service Unit). Its functions were salvaging, towing, and emergency repair work.

**Shot ABLE (1 July, 0900)**

- 1 July
  - 0511 Underway for Bikini Atoll from Kwajalein.
  - 1419 Shifted to Berth 207-A.
- 2 July
  - 0913 Anchored in berth 251-A, Bikini Atoll.
  - 1400 Left for Rongelap Atoll.
- 18 July
  - 1400 Departed lagoon for area Packard.
- 19 July
  - 0740 Arrived at Rongelap Atoll.
  - 0812 Departed for Bikini Atoll, completing transfers to USS Bowditch (AGS-4) before leaving.
  - 1642 Anchored in Berth 207-A, Bikini Atoll.
- 21 July
  - 0940 PCM-32 came alongside for repairs.
  - 1049 PCM-29 came alongside for repairs.
- 22 July
  - 0400 PCM-31 came alongside for repairs.
  - 0050 A diving party left to make underwater repairs on USS Creon (ARL-111).
  - 1630 Diving party returned.
- 23 July
  - 1532 All RPCMs had cast off.

**Shot BAKER (25 July, 0830)**

- 24 July
  - 1359 Departed lagoon for area Packard.
- 25 July
  - 0825 Operating in area Graham.
  - 0949 Left for Rongelap Atoll.
  - 1604 Anchored at Rongelap Atoll.

**USS Charles P. Cecil (DD-835)**

- Crew Size: 287
- Bikini Atoll Arrival: 4 June 1946
- Bikini Atoll Departure: 25 July 1946
- Shot ABLE Location: 42 nautical miles (78 km) ESE of Bikini Atoll
- Shot BAKER Location: Approximately 48 nautical miles (89 km) SE
- Operational Clearance: By 22 November 1946

**Task Unit and Functions**

The destroyer Cecil was a support ship in Destroyer Division 5 of Commander Destroyer Squadron 5. Its function was to provide support for the drone and photographic aircraft operations.

- Shot ABLE (1 July, 0900)
- Shot BAKER (25 July, 0830)
1 July
0547 Anchored at Kwajalein Atoll.

2 July
1605 Left for Bikini Atoll.

3 July
0620 Arrived Bikini Atoll.
0616 Underway to join TU 1 6.1.
0945 Anchored in berth 269.
1616 Departed for Kwajalein.

4 July
0654 Anchored at Kwajalein Atoll: conducted aircraft-tracking runs, fighter direction exercises, and battle exercises.

13 July
Left Kwajalein Atoll for operating area to conduct flight operations in company with USS Shangri-La (CV-38) and USS Turner (DD-408).

14 July
1334 Anchored at Bikini Atoll in berth 248.

15 July
1615 Underway for Kwajalein Atoll after transferring personnel from USS Chickasaw (ATF-83).

16 July
0816 Arrived Kwajalein Atoll.

Shot BAKER (25 July, 0035)

24 July
1610 Underway with TG 1.6 for area outside of Bikini Lagoon.

25 July
1722 Anchored at Kwajalein Atoll.

28 July
1640 Departed for Pearl Harbor.

**USS Chickasaw (ATF-83)**

Crew Size: 78
Bikini Atoll Arrival: 31 May 1946
Bikini Atoll Departure: 26 August 1946
Shot ABLE Location: Approximately 24 nmi (44 km) SE
Decontamination Location: San Francisco
Operational Clearance: 13 January 1947
Final Clearance: 28 January 1947

Task Unit and Function
The fleet ocean tug Chickasaw was a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, firefighting, towing, and emergency repair work.

Shot ABLE (1 July, 0900)

1 July
0528 Underway for operating area for shot ABLE.
1305 Entered Bikini harbor in formation.
1330 Laying to, awaiting orders.
1425 Laying to, clear and east of target ships: awaiting radiological clearance.
1815 Anchored in berth F, Bikini Atoll.

2 July
0900 Picked up radiological monitors from USS Haven (AM-12).
1104-1205 Alongside target ship USS Independence (CVL-22) to collect pressure instruments.
1738 Completed assisting ATA-180 in towing Independence.
1800 Anchored near berth 307, Bikini Atoll.

3 July
0855 Ordered to stay in the vicinity of Independence.
0953 Anchored in berth 292.

7 July
0844-1337 Assisted shifting target ship USS Dawson (APA-79) to new berth.
1403 Anchored in berth 289.

9 July
0718-1105 Towed Independence to berth 214.
1137 Anchored in berth 75.

10 July
0846-1328 Towed target ship USS Arkansas (BB-33) to new berth.
1356 Anchored in berth 75.

11 July
1231-1645 Towed target ship USS Nevada (BB-36) to its position in the target array.
1713 Anchored in unidentified berth in Bikini.

12 July
0050-1100 Towed target ship USS Saratoga (CV-3) to its new mooring.
1145 Anchored in berth 75.

15 July
1310-1521 Towed target ship USS Crittenden (APA-77) to new berth.
1540 Anchored in berth 75.

16 July
0635-0829 Towed Saratoga to assigned mooring buoy.
1450-1758 Towed target ship USS Mayrant (DD-402) to new berth.
1820 Anchored in berth 75.

18 July
1156-1304 Towed ATA-185 to new berth.

Shot BAKER (25 July, 0035)

24 July
1252 Underway for area outside of lagoon with TU 1.2.7.

25 July
1116 Reentered lagoon.
1143 Anchored in berth H.

28 July
1248-1649 Underway towing target submarine USS Tuna (SS-203) to lee side of Rokashari Island.
1725 Anchored near berth 378.

29 July
0905 Underway to spray foam on target ship USS Hughes (DD-410).
0940-1829 Anchored in vicinity of Hughes.
1902 Anchored in unidentified berth in Bikini.
USS Chickasaw (ATF-83)

30 July
1:58 Underway for Rongelap Atoll.

31 July
0658 Anchored Rongelap Atoll.
1319 Underway to Bikini Atoll with LCT-1420 and LCT-1184 in tow.

1 August
0929 Anchored at Bikini Atoll in berth H, after casting off both LCTs.

2 August
Shifted to anchorage near Berth 378.

5 August
1447-1558 Washed down target ship USS Caspian (APA-85).
1449 Anchored near Berth 378.

6 August
0912-1012 Sprayed Caspian with a special solution.
1024-1056 Washed down target ship USS Bracken (APA-66), then got underway.
1110 Anchored near Berth 378.

7 August
1023-1056 Sprayed Bracken with decontamination solution, then got underway.
1121 Anchored in berth 75.

8 August
1300-1402 Lifted three boxes from target ship USS LST-945 to LCM-26.
1438 Anchored in berth 75.

9 August
1327 Washed down Dawson.
1159 Anchored in berth 53.

13 August
1339-1427 Washed down target submarine USS Perch (SS-384).
1515-1628 Washed down target submarine USS Skate (SS-305).
1711 Anchored in berth 54.

19 August
1010 Underway to Kwajalein Atoll with Bracken in tow.

21 August
1204 Anchored Bracken at Kwajalein.
1124 Underway to Bikini.

22 August
1045 Anchored in berth 53, Bikini Atoll.

23 August
1059 Departed for Kwajalein Atoll with target ship USS Salt Lake City (CA-25) in tow.

25 August
1155 Anchored Salt Lake City at Kwajalein Atoll.
1617 Left for Bikini Atoll.

26 August
1147 Anchored Bikini Atoll.
1257 Underway for Kwajalein Atoll with target ship USS Caspian (APA-71) in tow.

USS Chikaskia (AO-54)

28 August
1229 Anchored Caspian at Kwajalein, then proceeded to anchorage.

31 August
1425-1629 Moored Crittenden to Dawson.

7 September
Departed Kwajalein for Guam.

Crew Size: 176

Bikini Atoll Arrival: Before 1 July 1946
Bikini Atoll Departure: 23 August 1946
Shot ABLE Location: 28 nmi (52 km) N
Shot BAKER Location: Kwajalein Atoll
Decontamination Location: San Francisco
Operational Clearance: 31 December 1946
Final Clearance: 4 January 1947

Task Unit and Function:
Chikaskia, an oiler, was a support ship in TUSL (Repair and Service Unit). Its function was to provide provisions, fuel, and water to other support ships.

Shot ABLE (1 July, 0900)

1 July
Steaming in column with seven other ships.
1815 Anchored in berth 324.

6 July
0848-1340 Refueled target ship USS Saratoga (CV-3).

10 July
0716-1155 Refueled target ship USS Pennsylvania (BB-38).
1612 Anchored next to target ship USS Nevada (BB-36). Remained anchored next to Nevada overnight.

11 July
0752 Underway from Nevada.

14 July
0730-1050 Fueled target ship USS Arkansas (BB-33).
1744 Anchored in berth 267.

21 July
Departed for Kwajalein.

22 July
Anchored at Kwajalein to replenish fuel supply.

Shot BAKER (25 July, 0835)

25 July
0925 Departed Kwajalein for Rongelap.

26 July
0925 Anchored at Rongelap.

30 July
1040 Departed Rongelap for Bikini after refueling ships.
1735 Anchored in berth 250, Bikini.

2 August
1629 Underway to discharge contaminated oil believed to be contaminated from foreign material, not from radiation.

303
**USS Chikaskia (AO-83)**

**2 August**

1832 Anchored 600 yards (549 meters) southwest of buoy 1.

3 August Left Bikini for Kwajalein after refueling.

4 August Anchored at Kwajalein.

5-12 August Refueled and serviced ships at Kwajalein.

13 August Departed Kwajalein for Bikini.

14 August Returned and anchored at Bikini, berth 205.

20 August 1150-1340 Fueled target vessel LCT-1115.

1430-1510 Radsafe party Inspected ship; ship found free of radioactivity.

23 August Underway for Kwajalein.

24 August Arrived at Kwajalein. Departed for Pearl Harbor with barracks ship APL-34 in tow.

2 September Arrived at Pearl Harbor.

**USS Chowanoc (ATF-100)**

**13 July** 0912-1226 Unloaded Army gear from target ship USS Pennsylvania (BB-38) to LCT-1415 and towed LCT to anchorage and YF to Sioux. Ordered to assist USS Safeguard (ARS-25), which was in trouble northeast of the lagoon.

1500 Underway to Safeguard.

1604 En route to rendezvous with Safeguard.

14 July 0906 Departed Safeguard to Rongelap Atoll.

15 July Towed Safeguard to Enewetak Atoll.

16 July Released Safeguard and departed for Bikini Atoll.

17 July Anchored at Bikini Atoll. Went alongside target ship USS Independence (CVL-22) for about 5 minutes. Washed down YW beside it; moored to target ship USS Arkansas (BB-33) for 1 hour to unload cargo.

18 July Underway to Independence for 10 minutes.

23 July 0836 Departed for Rongelap Atoll with YF-990 in tow.

2142 Moored at Rongelap Atoll.

24 July 0518 Departed for Bikini Atoll after mooring YF-990 to USS Quartz (IX-150).

25 July 0905 Changed course for Rongelap.

1516 Anchored at Bikini Atoll.

26-30 July At Rongelap: routine activities.

30 July Left Rongelap Atoll.

31 July 0815 Anchored in berth 207, Bikini Atoll.

1232 Shifted to berth 191A.

1-3 August Scientific party attempted to recover recording equipment from Nam and Iroli Islands. Bikini Atoll.

3 August 1606 Anchored in berth 364.

6 August Washed down target ship USS Ralph Talbot (DD-390) for about 4-1/2 hours.

7 August Washed down target ship USS Rhind (DD-404) for 2 hours. Washed down target submarine USS Searaven (SS-196) for 1 hour.

8-9 August Routine activities.

10 August Pumped water from target ship USS Gasconade (APA-87) for an unspecified period of time.

11-13 August Routine activities.
USS Chowanoc (ATF-100)

14 August  Alongside target ships USS Wilson (DD-408) for 21/2 hours, USS Trippe (DD-403) (2 hours), and USS Mayrant (DD-402) (1 hour, 50 minutes) to retrieve torpedoes; all torpedoes were placed on LCT-1116.

15 August  Alongside target ship USS New York (BB-34) for 20 minutes, to transfer torpedoes to LCT-1116.

16-19 August  Routine activities.

20 August  Alongside target ship USS Pennsylvania (BB-38) for 4 hours, 20 minutes, assisting in swinging it to remove twists in anchor chains.

21 August  Prepared Pennsylvania for tow and departed for Kwajalein.

22-23 August  En route to Kwajalein with Pennsylvania in tow.

24 August  At Kwajalein: cast off tow and set return course for Bikini.

25 August  At Bikini, prepared target ship USS Pennsylvania (APA-10) for tow; departed for Kwajalein.

26 August  En route to Kwajalein with Carteret in tow.

27 August  At Kwajalein: cast off tow; underway for Bikini.

28 August  At Bikini, prepared target ship USS Brule (APA-66) for tow; departed for Kwajalein with Brule in tow.

30 August  Arrived at Kwajalein, cast off tow, and proceeded to anchorage.

31 August  Assisted target ship USS George (APA-86) for 25 minutes.

9 September  Assisted target submarine USS Skipjack (SS-184) in drydocking.

10 September  Radiosonde monitors boarded Chowanoc for 40 minutes to test the ship's hull for radioactivity (results unknown).

16 September  Departed Kwajalein for Pearl Harbor with ANP-29 in tow. That evening heaved over five radioactive fenders.

3 October  Arrived at Pearl Harbor.

USS Clamp (ARS-33)

USS Clamp (ARS-33) was a salvage ship used as a support ship in TY 1.2.7 (Salvage Units). Before the operation, the ship was involved in towing, diving, demolition, and underwater photography functions in preparation for the arrival of the task force. During the operation its function was as a submarine rescue ship.

Shot ABLE (1 July, 0900)

30 June  Underway for area outside of lagoon, steaming with TU 1.2.7.

1 July  Underway from alongside Carteret.

1443  Ordered to put boarding team No. 2 aboard target ship USS Caron (APA-71) after receiving radiological clearance.

1450  Underway from alongside Carteret.

1510  Moored next to Carteret.

1515  Boarding team returned; underway from alongside, laid to southwest side of target ship USS Saratoga (CV-3).

1632  Underway, proceeded to target ship USS New York (BB-34).

1646  Moored next to New York after receiving radiological clearance.

1648-1742  Boarding team boarded New York.

1750  Underway from New York to anchorage.

1905  Anchored in berth, Item.

2 July  0820-0850  Boarding team boarded Carteret for an inspection.

0901  A boarding team boarded target ship USS Briscoe (APA-65) for an inspection.

0917  The fire aboard Briscoe was extinguished.

0945  The boarding party departed Briscoe.

1011  A boarding team boarded target ship USS Carteret (APA-70).

1012  A fire party boarded Carteret after a report of a fire.

1020  The fire aboard Carteret was out.

1115-1150  The parties returned to Clamp.

1242-1320  A boarding team boarded target ship USS Banner (APA-60) to inspect ship.

1415  A fire party boarded Nagato.

1417  A fire party boarded Nagato.

1509  The fire aboard Nagato was out.

1625  A boarding team boarded target ship USS Nevada (BB-36).

1657  The fire party boarded Nevada.

1721  The boarding party returned to Clamp.

1821  Moored near USS Deliver (ARS-23) after disembarking initial boarding team to USS Wharton (AV-7).

5 July  Towed target ship USS Hughes (DD-410) to its new berth.

1332-1441  Moored alongside Nagato, remaining at that location overnight.

6 July  Alongside Nagato, conducting operations to hoist its anchor.

7 July  Underway from alongside Nagato.
USS Clamp (ARS-33)

7 July

0944 Anchored in berth 49.
8-10 July Moored to buoy in target array. Installing assemblies on mooring buoys in target area for purpose of mooring target ships.
11 July Retrieved target vessel ARDC-13’s anchor and took it in tow to its new berth. 1855 Anchored in berth 74.
12 July Conducted diving operations to clear fouled line from propeller shaft. Worked in target area installing assemblies on mooring buoys.
13 July 0925-2033 Towed ARDC-13 to target array. 2103 Anchored in berth 51.
14 July Conducted diving operations to retrieve ATA-180 anchor. Conducted diving operations to retrieve ARDC-13 anchor. 1520 Anchored in berth 74.
15-16 July Prepared mooring buoys in the target array.
16 July 1845 Anchored in berth 74.
Shot BAKER (25 July, 0835)

24 July 1246 Underway for operating area after picking up a rad safe team.
25 July 1207-1225 Boarding team boarded target ship USS Bladen (APA-63).
1304-1306 Boarding team boarded target ship LCIC(L)-549.
1413 Underway for target vessel LCT-1013.
1451-1459 Boarding team boarded LCT-1013.
1500 Underway from LCT-1013.
1609 Observed the sinking of Saratoga.
1641 Returned to anchorage in berth Baker.
27 July 0835 Underway for USS Kenneth Whiting (AV-14) to pick up members of the Instrumentation Group.
1019-1144 Alongside target ship USS Niagara (APA-87).
1200-1201 Alongside target ship USS Geneva (APA-86) to pick up instruments.
1209 Alongside Bladen.
1212-1317 Instrumentation Group boarded Bladen.
1330-1341 Boarded target ship USS Fillmore (APA-53) for an inspection.
1426 Instrumentation Group members returned to Whiting.
1623 Moored near USS Chickasaw (ATF-85).
28 July Shifted to anchorage 1.450 yards (1.3 km) south of berth 380.

30 July 0917-1017 Moored portside to instrument tank with the technical directors aboard to retrieve the tank, after which the directors returned to Whiting.
1352-1505 Covered target ship USS Conyngham (DD-371) with chemical foam.
1523-1543 Alongside target ship USS Mugford (DD-389) to cover it with foam.
1728 Anchored in berth Baker.
31 July 1116-1235 Washed down target ship USS Salt Lake City (CA-25).
1241 Anchored off Bikini Island.
1422-1800 Alongside USS Tolland (AO-11) and then USS Sylvania (AKA-48).
1843 Anchored in berth Baker.
1 August 0911-0932 Washed down target ship USS Pensacola (CA-74).
1010 Investigated smoke on target ship USS Wayne (DD-419).
1020-1031 Alongside target ship Prinz Eugen while a radiological monitor boarded.
1053-1105 Alongside Carteret while a radiological monitor boarded the target ship.
1123-1145 Washed down Pensacola.
1359 2 August 0740 Picked up boarding team from Wharton and proceeded to Catron.
0826-1056 Washed down Catron.
1100-1108 A boarding team conducted an inspection on Catron.
1120-1149 Applied foam to target vessel LCT-1013.
1405-1435 Sprayed LCT-1113.
1440-1447 A boarding team boarded LCT-1113.
1512-1557 Washed down LCT-1113.
1625-1630 Boarding team boarded LCT-1013.
1815 Anchored near berth 380.
3 August 0835-0851 Boarding team from Wharton boarded target ship USS Butte (APA-69).
0925-0924 A boarding team boarded Talbot.
0950-1058 Washed down Talbot.
1104-1126 A boarding team boarded Butte.
1446 Moored next to Chickasaw.
7 August 0845 Began washing down Nevada.
1014 A seven-man party boarded Nevada to assist decontamination operations.
1203 Decontamination operations on Nevada ceased.
1449-1531 Renewed decontamination operations aboard Nevada.
9 August 0828 Began decontamination operations on target ship USS Dawson (APA-79).
0838 A party of six boarded Dawson to assist decontamination operations.
0914 Completed re-decontamination operations aboard Dawson.
1034-1155 Washed down target ship USS Butte (APA-68).
1350-1442 Washed down Butte.
1501 Anchored in berth 33.

306
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 August</td>
<td>Conducted towing operations on Hughes. Moored Hughes to buoy 18 near Ilonchebi Island and remained moored next to it.</td>
</tr>
<tr>
<td>14 August</td>
<td>Underway from alongside Hughes to anchorage.</td>
</tr>
<tr>
<td>15 August</td>
<td>Conducted diving operations to repair damage on Hughes.</td>
</tr>
<tr>
<td>21 August</td>
<td>Moored next to Salt Lake City. Moored next to Pensacola.</td>
</tr>
<tr>
<td>22 August</td>
<td>Moored to Pensacola. Anchored near Eneu Island, preparing to take target ship USS Fallon (APA-81) in tow.</td>
</tr>
<tr>
<td>23-24 August</td>
<td>Anchored near Fallon, which was beached off Eneu Island.</td>
</tr>
<tr>
<td>25 August</td>
<td>Towed Fallon to mooring buoy. Conducted diving operations on Fallon. Anchored in berth 218.</td>
</tr>
<tr>
<td>26 August</td>
<td>Left Bikini for Kwajalein with target ship USS LST-52 in tow.</td>
</tr>
<tr>
<td>27 August</td>
<td>Entered Kwajalein Atoll harbor and let go LST-52. Underway for Bikini Atoll.</td>
</tr>
<tr>
<td>28 August</td>
<td>Anchored at Bikini Atoll. Left for Kwajalein Atoll with target ship USS LST-545 in tow.</td>
</tr>
<tr>
<td>30 August</td>
<td>Anchored LST-545 at Kwajalein Atoll.</td>
</tr>
<tr>
<td>31 August</td>
<td>Target ship LCI(L)-549 alongside.</td>
</tr>
<tr>
<td>5 September</td>
<td>Departed Kwajalein for Pearl Harbor.</td>
</tr>
<tr>
<td>16 September</td>
<td>Arrived Pearl Harbor.</td>
</tr>
</tbody>
</table>

**USS Clamp (ARS-33)**

**USS Conserver (ARS-39)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1459-1653</td>
<td>Conducted towing operations on Hughes. Moored Hughes to buoy 18 near Ilonchebi Island and remained moored next to it.</td>
</tr>
<tr>
<td>0933</td>
<td>Underway from alongside Hughes to anchorage.</td>
</tr>
<tr>
<td>0937</td>
<td>Anchored near Ilonchebi Island.</td>
</tr>
<tr>
<td>1015-1042</td>
<td>Conducted diving operations to repair damage on Hughes.</td>
</tr>
<tr>
<td>0937</td>
<td>Moored next to Salt Lake City. Moored next to Pensacola.</td>
</tr>
<tr>
<td>0952-0857</td>
<td>Moored to Pensacola. Anchored near Eneu Island, preparing to take target ship USS Fallon (APA-81) in tow.</td>
</tr>
<tr>
<td>1146</td>
<td>Anchored near Fallon, which was beached off Eneu Island.</td>
</tr>
<tr>
<td>1358-1400</td>
<td>Towed Fallon to mooring buoy. Conducted diving operations on Fallon. Anchored in berth 218.</td>
</tr>
<tr>
<td>1211</td>
<td>Left Bikini for Kwajalein with target ship USS LST-52 in tow.</td>
</tr>
<tr>
<td>1630</td>
<td>Entered Kwajalein Atoll harbor and let go LST-52. Underway for Bikini Atoll.</td>
</tr>
<tr>
<td>1802</td>
<td>Anchored at Bikini Atoll. Left for Kwajalein Atoll with target ship USS LST-545 in tow.</td>
</tr>
<tr>
<td>1225</td>
<td>Anchored LST-545 at Kwajalein Atoll.</td>
</tr>
<tr>
<td>1536-1600</td>
<td>Target ship LCI(L)-549 alongside.</td>
</tr>
<tr>
<td>15 August</td>
<td>Departed Kwajalein Atoll with crew of target ships USS Bracken (APA-64), USS Barrow (APA-61), USS Butte (APA-68), USS Carteret (APA-70), USS Nevada (BB-36), USS Pensacola (CA-24), and USS Wainwright (DD-419) aboard.</td>
</tr>
<tr>
<td>1350-1500</td>
<td>JTF-1 radsafe section boarded, inspected, and declared ship free of all radioactivity.</td>
</tr>
<tr>
<td>16 August</td>
<td>Arrived Kwajalein.</td>
</tr>
<tr>
<td>17 August</td>
<td>Departed Kwajalein for Pearl Harbor.</td>
</tr>
<tr>
<td>28 August</td>
<td>Arrived Pearl Harbor.</td>
</tr>
</tbody>
</table>

**Clymer, George; see USS George Clymer (APA-27)**

**USS Coasters Harbor (AG-74)**

Crew Size: 195

- Bikini Atoll Arrival: Prior to 1 June 1946
- Bikini Atoll Departure: 15 August 1946
- Shot ABLE Location: 23 nmi (43 km) N

**USS Conserver (ARS-39)**

Crew Size: 86

- Bikini Atoll Arrival: 29 March 1946
- Bikini Atoll Departure: 5 September 1946
- Shot ABLE Location: Approximately 27 nmi (50 km) E
- Shot BAKER Location: 17 nmi (32 km) E
- Decontamination Location: Los Angeles
- Operational Clearance: 7 December 1946
- Final Clearance: 13 December 1946
- Task Unit and Function: Coasters Harbor was a survey ship used as a support ship in TU 1.8.1 (Repair and Service Unit). Its function was to aid in the repair of damaged target vessels.

- Shot ABLE (1 July, 0900)
  - 30 June 1946
    - Underway for area Packard.
  - 1 July 1946
    - Reentered Bikini Lagoon.
  - 10 August 1946
    - Anchored in berth 286, Bikini Atoll.
  - 2-23 July 1946
    - Shifted to berth 108, Bikini Atoll.
  - 30 July 1946
    - Departed for Bikini Atoll.
    - Anchored in berth 9, Bikini.
  - 1 August 1946
    - Underway to sea to pump contaminated fuel oil (contamination believed to be from foreign matter and not from radiation).
    - Pumped contaminated oil overboard.
    - Anchored in berth 269.
  - 3 August 1946
    - Shifted to berth Nan.
  - 7 August 1946
    - Shifted to berth 269.
  - 14 August 1946
    - JTF-1 radsafe section boarded, inspected, and declared ship free of all radioactivity.
  - 15 August 1946
    - Departed for Kwajalein Atoll with crew of target ships USS Bracken (APA-64), USS Barrow (APA-61), USS Butte (APA-68), USS Carteret (APA-70), USS Nevada (BB-36), USS Pensacola (CA-24), and USS Wainwright (DD-419) aboard.
  - 16 September 1946
    - Arrived Kwajalein.
  - 17 September 1946
    - Departed Kwajalein for Pearl Harbor.
  - 28 September 1946
    - Arrived Pearl Harbor.
USS Conserver (ARS-39)

Operational Clearance: 4 May 1947

Task Unit and Function
Conserver was a salvage ship used as a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, firefighting, and emergency repairs.

Shot ABLE (1 July, 0800)

30 June
1255 Underway for area outside of the lagoon, steaming with TU 1.2.7.

1 July
1338 Anchored in berth Baker, Bikini Atoll.

2 July
1015-1115 Placed a boarding team on target ship USS Rhind (DD-404).
1115-1142 Boarding team on target ship USS Stack (DD-406).
1300-1310 A boarding team and fire party boarded target ship USS Dawson (APA-79) to extinguish a fire.
1322 Boarding and fire teams left Dawson.
1451 Inspected target ship Prince Eugen.
1454 Proceeded to target ship USS Arkansas (BB-33).
1601 Extinguished fires aboard Arkansas.
1640 Boarding teams returned to Conserver.
1740 Reanchored in berth Baker.

4 July
0805-1055 Removed stack of target ship USS Salt Lake City (CA-25).
1126 Dropped stack of Salt Lake City in water.
1812 Anchored in berth 50.

6 July
1330-1712 Cleared damaged equipment from target ship USS Nevada (BB-36).

7 July
Continued salvage operations on Nevada.

9-10 July
Continued salvage operations on Nevada.

11 July
Removed heavy gear from Arkansas.

12 July
0744-1115 Removed a half-track and an armored car from Nevada and transferred them to LCT-1420.

13 July
0944-1144 Removed 155-mm guns from Arkansas.

14 July
0743-0925 Transferred 155-mm gun and carriage from Arkansas to LCT-1420.
0902-0945 Conducted salvage operations on Arkansas.
1030 Anchored in Bikini Lagoon.

15 July
0725-1340 Removed a half-track and an armored car from target ship USS Pennsylvania (AB-38) and transferred them to LCT-1420.
1559-1744 Engaged in other salvage operations on Pennsylvania and transferred equipment to LCT-1420.

16 July
0950-1132 Conducted operations to recover sunken LCVP.
1455-1645 Anchored off target ship USS Butte (APA-68).

20 July
1345-1715 Removed a 12-1/2-ton armor plate from Salt Lake City and transferred it to LCT-1420.

21 July
1012-1454 Removed 90-mm and 155-mm guns from Nevada and transferred them to LCT-1420.

22 July
1120-1335 Removed a tank turret from Arkansas and placed it aboard LUT-1420.
1355-1530 Removed a tank from Nevada and transferred it to LCT-1420.

23 July
1515-1227 Worked with USS Elah (AN-79) in putting anchors on target submarine USS Skipjack.

Shot BAKER (25 July, 0835)

25 July
0455 Underway.
0530 Picked up target ship USS Casconade (APA-85) personnel.
1125 Anchored off Eneu Island.
1402 Underway to place a boarding team on Butte.
1440 Butte found to be still radioactive and Conserver proceeded to southeast of array.
1638 Anchored off Eneu Island.

27 July
1004-1200 A boarding team boarded target ship USS Bracken (APA-64) to recover instrument.
1217-1224 Recovered instruments from target ship USS Carteret (APA-70).
1238 Removed 155-mm guns from Arkansas.
1239-1250 A boarding team boared Cortland.
1410 All recovered instruments were transferred to USS Kenneth Whiting (AV-14).
1511 Anchored in unidentified berth.

28 July
1310 A Naval Medical Research Service (NMRS) team came aboard.
1341 A monitor boarded Bracken.
1341-1352 The NMRS team boarded Bracken and returned to Conserver with all animals, instruments, and monitor.
1429-1436 The animals and instruments were removed from target ship USS Cation (APA-71).
1508-1528 All instruments were retrieved from target ship USS Fillmore (APA-83).
1552 Teams boarded target ship USS Bladen (APA-63) to remove instruments.
1602 Recovered instruments aboard Bladen.
1652 NMRS parties returned to USS Burleson (APA-67) with all instruments and animals for further studies.
1734 Anchored in unidentified berth.
USS Conserver (ARS-39)  

29 July  
1344-1357 NMRS team boarded Gasconade and removed instruments and animals.  
1422 NMRS team at Gasconade to remove instruments and animals; too contaminated to board.  
1455-1504 NMRS team boarded target ship USS Conyngham (APA-65) to remove instruments and animals.  
1602 All animals, instruments, and NMRS personnel returned to Burleson.  
1640 Anchored in unidentified berth.  

30 July  
1320-1405 Animals and instruments were retrieved from Gasconade.  
1426 NMRS personnel and all animals transferred to Burleson.  
1724 Anchored off Eniwetok Island.  

31 July  
0822-0902 Washed down Briscoe with saltwater.  
0907-1015 Washed down Bracken.  
1148-1213 Sprayed mechanical and chemical foams on Briscoe.  
1414-1452 Sprayed mechanical and chemical foams on Briscoe.  
1505-1524 Monitors boarded Salt Lake City.  
1604-1641 Sprayed foam on Bracken.  
1703 Anchored in unidentified berth.  
1 August  
0810-1048 Conducted salvage operations on Salt Lake City. Salt Lake City was declared very contaminated.  
1340 Anchored in unidentified berth.  

2 August  
0815-1617 Conducted salvage operations on Salt Lake City.  
1755 Anchored in unidentified berth.  

7 August  
1751-1836 Retrieved Army equipment from target ship USS LST-565.  
1854 Anchored.  

8 August  
0810-0842 Transferred Army equipment from LST-545 to LCT-1116.  
1130-2025 Moored to YF buoys to conduct diving operations to recover Bureau of Ordnance instruments.  

9-10 August  
Continued diving operations to recover Bureau of Ordnance instruments.  

12-13 August  
Continued diving operations to recover Bureau of Ordnance instruments.  

14 August  
Located target submarine USS Parche (SS-386).  

16-21 August  
Continued diving operation on Arkansas.  

25 August  
0900 Cast off lines to Arkansas buoy and moored to diving buoy.  

26 August  
Shifted mooring over sunken target ship USS Saratoga (CV-33).  

27 August-1 September  
Conducted diving operations on Saratoga.  

USS Conyngham (DD-371)  

2 September  
0801-1937 Prepared target vessel LCT-874 for towing.  

3 September  
Conducted salvage operations on target submarine USS Skipjack (SS-184).  

4 September  
0734-0832 Alongside target vessel LCT-816, conducting operations to remove it from beach and sink it.  
0907 Assisted USS Widgeon (ASR-33) with Skipjack.  

5 September  
Left Bikini Atoll for Kwajalein Atoll towing target vessel YOG-83 and support vessels LCT-1420 and LCT-1184.  

7 September  
1207 Arrived at Kwajalein Atoll; remained until February 1947. Conducted salvage work on various target ships.  

30 July  
1300-1405 Animals and instruments were retrieved from Gasconade.  

1426 NMRS personnel and all animals transferred to Burleson.  

1724 Anchored in unidentified berth.  

1 August  
0815-1617 Continued salvage operations on Salt Lake City.  

1330-2025 Moored to YF buoys to conduct diving operations to recover Bureau of Ordnance instruments.  

1414-1452 Sprayed mechanical and chemical foams on Bracken.  

1515-1524 Monitors boarded Salt Lake City.  

1604-1641 Sprayed foam on Bracken.  

1703 Anchored in unidentified berth.  

2 August  
The destroyer Conyngham was a target vessel during CROSSROADS. Its crew was evacuated before each shot. It served in Destroyer Division 3 of TF 12.3.  

Shot AB (1 July 0900).  

30 June  
Crew evacuated to Bottineau.  

1 July  
1600 Conyngham declared radiologically clear.  

2 July  
1245 The captain, a monitor, and Team A returned to inspect for radioactivity and explosive gases.  

Navy data indicate that Conyngham was found safe for reboarding and that remaining crew members returned on 2 July. Except for shifting anchorages on 7 July, Conyngham remained anchored in Bikini Lagoon.  

Shot BAKR (25 July, 0835).  

21-24 July  
1110 Crew evacuated to Bottineau.  

30 July  
0940-1140 Washed down with seawater and foamite by USS Bellwort (ARS-23).  

1420 Washdown with foamite completed.  
1502 Radi
de ad teams and monitors were placed aboard.  

309
USS Conyngham (DD-371) 31 July

1907 Radiological conditions were such that work parties could be put aboard for limited periods of time to carry out local, intensive decontamination work.

1 August The decontamination party came on board Conyngham for the allowed 4 hours to scrub the top decks.

2 August Conyngham scrubbed and hosed down. The hull and the waterline were slightly higher than average.

3 August Scrubbing and hosing of Conyngham was continued, cleaning rusted or flaked paint areas was begun. and its hull was scrubbed with lye water and diesel oil (Reference 4).

2000 Boarded by the BuShips Inspection parties and declared Geiger sweet (below 0.1 rem gamma/24 hours).

4 August Marine growth from Conyngham's port waterline was scrubbed.

6 August Took readings of ship (Reference 4).

7 August Crew returned to Bottineau each night except for engineering watch (Reference 4).

Radiological readings for Conyngham (31 July through 7 August) are listed in Table A.3.

Table A.3. Radiological readings (R/24 hours), USS Conyngham (DD-371) (31 July through 7 August).

<table>
<thead>
<tr>
<th>Date</th>
<th>Maximum Topside</th>
<th>Average Topside</th>
<th>Maximum Below</th>
<th>Average Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 July</td>
<td>0.5</td>
<td>0.3</td>
<td>0.15</td>
<td>0.05</td>
</tr>
<tr>
<td>1 August</td>
<td>0.25</td>
<td>0.25</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>2 August</td>
<td>0.3</td>
<td>0.35</td>
<td>0.15</td>
<td>0.25</td>
</tr>
<tr>
<td>3 August</td>
<td>0.3</td>
<td>0.35</td>
<td>0.15</td>
<td>0.25</td>
</tr>
<tr>
<td>4 August</td>
<td>0.1</td>
<td>0.08</td>
<td>0.25</td>
<td>0.05</td>
</tr>
<tr>
<td>5 August</td>
<td>0.1</td>
<td>0.25</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>6 August</td>
<td>0.1</td>
<td>0.25</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>7 August</td>
<td>0.1</td>
<td>0.25</td>
<td>0.15</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Notes:

* After decontamination efforts.
* No reading.

Source: Reference 4.

17 August Conyngham declared radiologically safe for reboarding (Reference 4).

22 August Left Bikini for Kwajalein Atoll.

23 August Arrived at Kwajalein.

28 August Departed for Pearl Harbor.

5 September Arrived at Pearl Harbor.

11 October Left for San Francisco.

17 October Arrived at San Francisco.

USS Cortland (APA-75)

Crew Site: 89

Bikini Atoll Arrival: 30 May 1946

Bikini Atoll Departure: 19 August 1946

Crew location for Shot ABLE: USS Artemis (AKA-21)

Crew Location for Shot BAKER: Artemis

Shot ABLE Location: 3,140 yards (2.9 km) WSW

Shot BAKER Location: 3,870 yards (3.5 km) WSW

Decontamination Location: San Francisco

Operational Clearance: 6 November 1946

Final Clearance: 16 December 1946

Decommissioned 30 December 1946, Norfolk, Virginia

Scrapped 31 March 1948

Task Unit and Function

Cortland, an attack transport, was a target vessel during CROSSROADS. Its crew was evacuated for each shot. It served in Transportation Division 92 of TU 12.6 (Merchant Type Unit).

Shot ABLE (1 July, 0900)

1 July 1402 Fire was reported aboard ship (Reference 5, p. B-11).

1619 Cortland reported Geiger sweet.

2 July 1440 The initial boarding team returned to Cortland.

1831 Remainder of the crew returned and normal routine on board was resumed.

A 16 July damage report stated that there was no major damage and no need for an examination by the technical staff of the Director of Ship Material.

Shot BAKER (25 July, 0835)

24 July 0950 All personnel evacuated to Artemis.

25 July 1142 Cortland cleared for boarding.

1309 Reported Geiger sweet.

2312 Declared radiologically free (Reference 5, pp. D-19 and D-12).

29 July 1305 Teams A and B reboarded Cortland (Reference 5, p. VI-D-77).

30 July Cortland crew returned; normal routine resumed.

310
A 30 July Commanding Officers Damage Report No. 11 stated that the ship was slightly over tolerance in radioactivity near the waterfront (Reference 3).

2 August  Shifted to berth 349.

4-5 August  Went on a scheduled practice run.

18-19 August  Received aboard: 9 officers and 275 enlisted men from target ship USS Nevada (BB-36).

19 August  Departed Kwajalein Atoll.

20 August  Arrived at Kwajalein.

21 August  Departed Kwajalein for Pearl Harbor.

USS Coucal (APD-75)

Crew list: 1.

Bikini Atoll Arrival: Before 1 July 1946

Bikini Atoll Departure: 4 September 1946

Shot AB(1): Location: 21 nmi (39 km) E

Shot BAKER Location: 12 nmi (22 km) S

Operational Clearance: 10 January 1947

Final Clearance: 18 January 1947

Task Unit and function:

Coucal, a subsurface rescue vessel, was a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, firefighting, and emergency repairs.

Shot AB(1) (1 July, 0900):

30 June 1945

15 July 1945

Diving operations on target ship USS Lamson (DD-367). Ran a cable from port and bow to target ship USS Nevada's (BB-36) mooring buoy.

16-17 July 1945

Continued diving operations around Lamson.

20 July 1945

Ran a manila line to target ship USS Fallon (APA-81).

0830-1130 Conducted diving operations on target ship Seawar.

1400-1800 Conducted diving operations on Seawar.

22 July 1945

Made a two-point mooring 100 feet (31 meters) off portside of target submarine USS Apogon (SS-308).

0930 Began working Apogon's ballast tanks. After Apogon was submerged, conducted diving operations.

23 July 1945

Engaged in diving operations in the vicinity of Apogon.

24 July 1945


25 July 1945

In formation with USS Conserver (ARG-39), USS Widgeon (ASR-1), and USS Etah (AN-76).

0640 Anchored in berth F, Bikini Lagoon.

0800 Took position in formation of TU 1.2.7, underway.

1030 Underway; tested all sea locks with Pumpkin.

1130 Commenced blower 95°F per minute in Ballast tanks.

1130 Anchored in unidentifiable berth.

1230 Underway to target submarine USS Tuna (SS-203), ran air hoses to Tuna.

1240 Commenced blowing Tuna's ballast tanks. Tuna broke surface.

1830 Underway; tested all sea locks with pumpkin. Conditions found normal.

1345 Shifted to unidentifiable berth.

1445 Underway to go alongside target submarine USS Dendy (SS-335).

2245 Commenced blowing ballast tanks on Dendy after engaging in diving operations.

2250 Anchored in unidentifiable berth.

2300 Underway to go alongside target submarine USS Seawar (SS-195), mooring buoy.

2345 Commenced hooking air hoses to Seawar.

2430 Commenced blowing Seawar's ballast tanks. Underway.

0130 Anchored in unidentifiable berth.
**USS Coucal (ASR-8)**

29 July

1800 Widgeon moored alongside to take on freshwater.

30 July

1005-1155 Made a two-point mooring over submerged target submarine USS Skipjack (SS-184) and began blowing Skipjack's ballast tanks.

1200-1225 Conducted diving operations on Skipjack.

1430-1530 Made a two-point mooring over submerged submarine Pilsfissh and began blowing its ballast tanks.

1559 Broke two-point mooring.

1646 Anchored in unidentified berth.

31 July

1030 Moored portside to Searaven.

1235 Began blowing Searaven's ballast tanks.

1355 Underway from alongside Searaven.

1401 Came alongside target submarine USS Skipjack (SS-384); sent a boat with a Geiger monitor to check radioactivity on Parche.

1418 Boat returned from Parche.

1746 Anchored near Enne Island.

1 August

1240 Underway to take soundings with a Geiger meter over Pilsfissh, Apogee, and Skipjack.

1615 Moored to USS Sylvania (AKA-44) to take on freight.

1830 Anchored in unidentified berth.

2 August

Engaged in diving operations to lay a four-point moor.

3 August

Moored over Skipjack; conducted salvage and diving operations.

4-9 August

Conducted diving operations on Skipjack.

10 August

1015 Completed four-point moor over Apogee.

1230-1400 Conducted diving operations on Apogee.

11 August

1015 Conducted diving operations on Apogee.

12 August

Made four-point mooring over Apogee and engaged in diving operations.

13 August-1 September

Diving and salvaging operations continued over Apogee.

2 September

Underway to Apogee to assigned anchorage.

3 September

Moored to Skipjack to aid Widgeon in salvaging Skipjack.

1200 Skipjack surfaced.

1438 Underway to anchorage.

4 September

0400 USS Conserver (ARS-39) came alongside to bring target vessel LCT-874 alongside.

1000 USS Palmero (ARS(T)-3) towed NAKED target vessel LCT-412 alongside; commenced rigging LCT-412 and LCT-844 for towing.

1630 Departed Bikini for Kwajalein with LCT-874 and LCT-412 in tow.

**USS Creon (ARL-11)**

6 September

0740 Entered Kwajalein Lagoon and anchored LCT-412 and LCT-874. Anchored in berth A-C.

7 September

0810-1030 Radsafe inspection party, consisting of three officers from Haven, aboard to inspect for radioactivity. Results not recorded in log.

11 September

1640 Departed Kwajalein for Pearl Harbor with Skipjack in tow.

22 September

1500 Moored at Pearl Harbor after releasing Skipjack from its tow.

USS CREON (ARL-11)

Crew Size: 144

Bikini Arrival: 1 June 1946

Bikini Atoll Departure: 21 August 1946

Shot ABLI Location: Kwajalein Atoll

Shot BAKER Location: 17 km [13 km] ENW

Decontamination Location: Los Angeles

Operational Clearance: 23 January 1947

Final Clearance: 1 February 1947

Task Unit and Function

Creon, a landing craft repair ship, was a support ship in TU 1.8.1 (Repair and Service Unit). It served as a repair facility during CROSSROADS.

1 July

0915 Departed Kwajalein Atoll for Bikini Atoll.

2 July

1125 Arrived at Bikini and anchored in berth 96.

13 July

LCT-412 alongside.

15 July

Target ship LCT-118 alongside.

Shot BAKER (25 July, 0835)

24 July

1131 Steering in column with 11 other ships.

25 July

0902 Departed for Rongelap Atoll.

1115 Anchored at Rongelap Atoll.

30 July

1735 Underway for Bikini Atoll.

31 July

1047 Arrived at Bikini Atoll and anchored in berth 96.

2 August

1704 Shifted anchorage to area between berths Sail and Victor.

7 August

Returned to berth 96.

21 August

Left Bikini Atoll for Kwajalein Atoll.
USS Creon (ARL-11)

23 August
Arrived Kwajalein.

11 September
Departed for Pearl Harbor.

USS Cumberland Sound (AV-17)

Shot BAKER (25 July, 0835)

25 July
0355
Crew evacuated to Bexar.

8 August
Boarding team 5 from USS Suncock (AN-80) boarded. Reported Crittenden Geiger sour. Upper deck average 4.0 R/24 hours; hot spots 10 R/24 hours; inside and main deck 0.5 to 1.5 R/24 hours. Evaporator room and forward engine room 0.15 R/24 hours.

12 August
Commanding officer, 5 officers, and 8 enlisted men boarded for opening the ship. Tolerance time 1 hour topside. 4 to 24 hours below decks.

13, 15, and 21 August
Ship was reboarded but number of personnel and time aboard not known.

22 August
Crittenden was reboarded. Its maximum portside topside reading was 4 R/24 hours, maximum starboardside topside 7 R/24 hours, and maximum inside 0.5 R/24 hours. The monitors returned to Bexar and the ship closed (Reference 9).

24 August
Left Bikini Atoll for Kwajalein towed by USS Reclaimer (ARS-42).

26 August
Arrived at Kwajalein. Topside average 0.75 R/24 hours (Reference 7).

28 August
Crittenden decommissioned.

1 October
Topside average 0.52 R/24 hours (Reference 7).

1 December
Crittenden departed Kwajalein towed by USS Cahuilla (ATF-152) en route to San Francisco.

USS Cumberland Sound (AV-17)

Crew Size: 540

Bikini Atoll Arrival: 3 May 1946
Bikini Atoll Departure: 1 August 1946
Shot BAKER Location: 13 nm (24 km) S
Decontamination Location: Los Angeles
Operational Clearance: 3 December 1946
Final Clearance: 13 December 1946

Task Unit and function
The seaplane tender Cumberland Sound was used as a support ship in TU 1.1.2 (Instrumentation). Its function was to provide laboratory and base facilities throughout the operation.

Shot ABLE (1 July, 0900)

1 July
1421
Reentered the lagoon and anchored in berth 56.
1705
Shifted to berth 147.

2 July
Shifted to berth 56.

313
USS Cumberland Sound (AV-17)

Shot BAKER (26 July, 0835)

25 July
0509 Underway for area outside the harbor (Reference 5, p. 6-5).
1340 Reentered the harbor.
1425 Anchored in berth 384.

28 July
Departed the lagoon.

29 July
Returned to lagoon and anchored in berth G.

30 July
Shifted anchorages to berth 56.

1 August
0547 Underway for San Pedro.

USS CURRENT (ARS-22)

Crew Size: 94

Bikini Atoll Arrival: 3 June 1946
Bikini Atoll Departure: 25 August 1946

Shot BAKER Location: 27 mi (43 km) N

Onset of contamination: Pearl Harbor
Operations clearance: 6 February 1947

Task Unit and Function

Current was a salvage ship used as a support ship in TF 1.2.7 (Salvage Unit). Its functions were salvaging, firefighting, and repairing damaged target vessels.

Shot ABU (1 July, 0900)

1 July
0924 Underway to Bikini Lagoon.
1218 Received orders to remain in reentry area until ordered forward, proceeding ahead with bare headway.
1256 Passed channel buoy 1 abeam to port: observed various fires and explosions in target area.
1415 Underway in company with ATR-87 to put out fire and place boarding party on target ship USS Pennsylvania (BB-38). Withdrawal from Independence (CVL-22) due to heavy explosion from target ship USS Independence (CVL-22).
1443 Underway to place boarding team aboard Pennsylvania and extinguish fires on superstructure deck.
1624 Boarding party and firefighting party aboard Pennsylvania.
1708 Fires extinguished; firefighting party and boarding team aboard.
1715 Underway from alongside Pennsylvania, proceeding westward away instructions.
1716 Underway to berth H.
1825 Anchored in berth H, off Eneu Island, Bikini.

USS Current (ARS-22)

2 July
0349 Underway to complete inspection of target array.
0816 Boarding team member came aboard to resume duties with boarding team.
0850 Moored alongside target ship USS Fallon (APA-81) and placed boarding team on board, also firefighting team of three men aboard to extinguish smouldering fire on forecastle deck.
0920 Boarding party and firefighting party returned aboard from Fallon.
0923 Underway from alongside Fallon, proceeding to go alongside target ship USS Salt Lake City (CA-25).
0938 Moored alongside Salt Lake City.
0940 Placed boarding and firefighting parties on Salt Lake City.
1025 Observed target ship Sakawa sinking by the stern.
1035 Underway to Independence to keep Independence clear of vessels in area.
1125 Underway to new berth. Independence in tow by USS Chickasaw (ATF-83); cast off lines and stood clear. Continued to follow Independence to new mooring.
1200 Withdraw from Independence, proceeding to USS Wharton (AP-7).
1207 Underway from alongside Chickasaw, proceeding to westward area with Independence to assist in mooring.
1214 Underway to Independence to keep Independence clear of vessels in area.
1412 Underway to Independence.

July
1410 Radiological team and boarding team III came aboard Current to conduct radiological and damage survey of Independence later.
0930 Underway to Independence.
1054 Inspection party and boarding teams left ship via boat to go aboard Independence. Anchored in berth 290.
1143 Boarding party and inspection party returned aboard.
1249 Underway to Wharton to discharge inspection and boarding parties.
1312 Laying to off Wharton, discharging inspection and boarding parties.
1448 Anchored in berth 73.
1706 Underway to new berth.
1720 Anchored in berth 31.

4 July
1052 Underway to go alongside target vessel ANUC-11.
USS Current (ARS-22)

4 July

1154 Anchored close to ARDC-13 off Eneu Island. 1205 Anchored in berth 161.
1359 Underway. Maneuvering to go alongside ARDC-13. 1245 Commenced diving operations for mooring buoy riser.
1700 Started pumping afterpump room of ARDC-13. 11 July 0722-1030 Conducted diving operations.
1720 Afterpump room dry. 1233 Anchored in berth 32.
2130 Tank #8 and midship compartment dry. 14 July 0722-1030 Conducted diving operations.

5 July

1113 Disconnected all electrical leads to ARDC-13. 1130-1240 Removed salvage equipment from ARDC-13 to ship.
1128 Underway from ARDC-13 to target submarine USS Skate (SS-305). 1512-1523 Attached kedge anchor to stern of LST-125.
1141 Moored alongside Skate. 1526 Underway to berth.
1145 Started clearing wreckage on Skate. 1640 Anchored in berth 161.
1500 Transferred Skate's diving equipment to Current. 1744-1905 Conducted search for mooring buoy riser aboard ARDC-13.
1720 Afterpump room dry. 1213 Anchored in berth 32.

6 July

0930 Underway to go alongside ARDC-13. 15 July 0832 Underway to go alongside Nagato.
0934 Moored alongside ARDC-13. 16 July 0832 Underway to go alongside Nagato.
1005-1240 Removed salvage equipment from ARDC-13 to ship. 0832 Underway to go alongside Nagato.
1245 Underway. 0730 Moored portside to Nagato in berth 162.
1257 Dropped anchor in unspecified location. 0807-0817 Hauled Nagato's stern anchor aboard Current.
1444 Underway to take target ship Nagato in tow. 0823 Moored starboardside to Nagato.
1501 Dropped anchor alongside portside of Nagato. 0838-0930 Hauled Nagato's stern anchor aboard Current, cleared lines and underway.
1505 Ran line to mooring buoy on bow of Nagato. 1029 Anchored close to target ship Prinz Eugen. In anchorage south of berth 161.
1830 Secured towing cable to Nagato's mooring buoy. 1920-1925 Laying close aboard starboard side of Wharton.

7 July

1008 Underway for berth 162 with Nagato in tow. 1404-1405 Laying close aboard starboard side of Wharton.
1157 Released towing cable from Nagato. 1405-1406 Laying close aboard starboard side of Wharton.
1353 Maneuvering to go alongside Nagato. 1406-1410 Laying close aboard starboard side of Wharton.
1355 Moored portside to Nagato. 1410-1415 Laying close aboard starboard side of Wharton.

8 July

0430 Underway, laying in vicinity of Nagato. 18 July 0728-0807 Conducted diving operations to retrieve 1" cable.
1453 Underway from alongside Nagato. 1705-1730 Conducted diving operations.
1510 Moored portside to starboard side of Nagato: commenced rigging towing wire to bow of Nagato. 1730-1735 Conducted diving operations.
1519 Commenced rigging towing wire: underway from alongside Nagato. 1735-1740 Conducted diving operations.
1901 Anchored to Nagato. 1800-1805 Conducted diving operations.

9 July

0746 Underway with Nagato in tow. 19 July 1300-1305 Circled target ship USS Geneva (APA-86).
0806 Nagato dropped anchor: Current cast off tow. 1320-1325 Circled Falken.
0834 Anchored in berth 31. 1355-1400 Laying close aboard starboard side of Wharton.
20 July 1404-1406 Laying close aboard starboard side of Wharton.

20 July 0828 Anchored in berth 31.
22 July Anchored in center of target array. II minutes: boarding party aboard for 10

21 July Remained at anchor In berth 61 close to 29 July

23 July place a dynamite charge on .CT-lII4.

29 July 1735 Anchored off Eneu Island.

25 July to otf Shot BAKER

24 July

20 July 1224-1551 Moored alongside target ship USS LST-545 for 9 minutes to place aboard and recover a boarding party. Moored alongside target ship USS LST-220 for 8 minutes to put over and recover boarding party. Moored alongside target vessel LCI-329 for 1 hour, 7 minutes: boarding party aboard LCI-329 for 57 minutes. After departing LCI-329, commenced washing down target vessel LCI-327, after which a boarding team was placed on board for 6 minutes. Anchored in unidentified berth In Bikini.

20 July

USS Current (ARS-22)

20 July

0937 Anchored close to starboard bow of target ship USS Saratoga (CV-3).

1432 Divers back on board.

1529-1815 Diver in deep-sea outfit searched for anchor.

21 July Remained at anchor In berth 61 close to Saratoga.

0800 Commenced diving operations for recovery of hawk anchor.

1349 Continued to attempt to recover hawk anchor.

23 July Anchored in center of target array.

0733 Underway en route to berth 31.

1023-1155 Alongside Whiting. loading pressure gauges.

1203 Underway from Whiting to lay instrument buoys.

1232 Anchored In center of target array.

1340 Lower one instrument buoy laid in position.

1434 Underway to lay instrument buoy #2.

1447 Anchored.

1510 Laid instrument buoy #2.

1548 Anchored.

1651 Laid instrument buoy #3.

1733 Made new anchorages.

1855 Underway to new anchorages to keep clear of mooring and instrument buoys In target array.

1922 Anchored 300 yards (274 meters) south of Prinz Eugen.

USS Current (ARS-22)

20 July

23 July

0740 USS Mender (ARS-2) came alongside to take aboard hawk anchor.

0840 Mender underway from alongside.

1241 Underway to conduct diving operations on instrument buoy.

1300 Secured line to target ship USS LST-133.

1415-1850 Conducted diving operations.

1735 Underway to anchorage berth 31.

1805 Anchored in berth 31.

24 July

1207 Boarding party came aboard.

1230 Underway for BAKER day.

Shot BAKER (25 July, 035)

25 July

1105 Entered the harbor.

1206-1219 Alongside Geneva.

1407 Near the north point of Eneu Island.

1450-1502 Alongside target vessel LCT-705.

1620 Anchored in berth D.

26 July

1827 Shifted to anchorage off Eneu Island.

29 July 0841-1620 Moored alongside LCI-327 for 1 hour, 28 minutes. First boarding party aboard for 36 minutes, after which LCI-327 was washed down; a second boarding party aboard for 7 minutes. Moored alongside target ship USS Walwright (DD-419) for II minutes: boarding party aboard for 10 minutes. Placed boarding parties aboard two seaplanes via the ship's motor whale boat. After recovering boarding parties along side target ship USS Mugford (DU-389) for 38 minutes: boarding team aboard for 38 minutes. Moored alongside target ship USS Carteret (APA-10) for 15 minutes: boarding team aboard for 15 minutes. Circed and washed down Mugford for 1 hour. Alongside Magford for 5 minutes: boarding party aboard for 3 minutes.

30 July Washed down Mugford with front monitor for 1 hour, 48 minutes: placed boarding party aboard for 9 minutes to remove and bring back one instrument. Washed down Walwright for 1 hour, 42 minutes: placed boarding party aboard for 16 minutes. Sent boarding party to inspect target vessel LCT-1114: returned within 10 minutes. Boat left again with demolition team to place a dynamite charge on LCT-1114. Eighteen minutes later charge was fired. A second charge was placed and fired 25 minutes later. LCT-1114 sunk in close vicinity of obstruction buoy. Anchored off Eneu Island.

31 July

1018-1726 Safety monitor came aboard from USS Haven (AH-12). Moored alongside Mugford for 3 hours. 9 minutes. washed it down with water from forward and auxiliary monitors: boarding party aboard for 7 minutes. Washed down target ship USN Butte (APA-58) for 2 hours, 28 minutes. Moored alongside Butte for 25 minutes: boarding party placed on board for 25 minutes. Lay to off USS Cumberland Sound (AV-17) for 25 minutes to transfer black box recovered from Mugford to Cumberland Sound. Anchored In lee of Eneu Island.


2 August 0925-1253 Boarded Briscoe for 64 minutes. Washed down LCT-705: boarded LCT for 7 minutes.
3 August Wrecked down Bracken, boarded for 30 minutes. Wrecked down target ship USS Rhim (DD-404) boarded for 5 minutes.

13 August Anchored in Bikini. 14 August Conducted diving operations over wreck of Apehau.

21 August Continued diving operations over Pilotfish. Sunk on 2 December. It returned to mooring, and salvaging vessels until 29 August. Anchored in Kwajalein. Anchored August 28.

22-24 August Completed diving operations over wreck of target submarine USS Pilotfish (SS-386).

25 August Conducted diving operations over Nagato. Departed for Kwajalein with target ship USS Lawson (DD-404) in tow.


28 August Proceeded to Wotho Island. Began towing target ship USS Mayrant (DD-402) to Kwajalein.


**USS Dawson (APA-79)**

Crew Size: 110

Bikini Atoll Arrival: Before 1 June 1946

Bikini Atoll Departure: 19 August 1946

Crew Location for Shot Able: USS Henrico (APA 45)

Shot Able Location: 900 yards (823 meters) NW

Shot Able Location: 1,275 yards (1,112 km) WNW

Sunk 19 April 1948 near Kwajalein Atoll

**Task Unit and Function**

Attack transport Dawson was a target vessel during CROSSROADS. Its crew was evacuated for each shot. It served in Transportation Division 92 of TU 1.2.6 (Merchant Type Unit). Dawson carried Geiger counters and radiotransmitters for the Electronics Group.

**Shot Able (1 July 0900)**

30 June 1115 Crew evacuated to Henrico.

2 July 1217 USS Clam (ARS-13) reported a fire on board Dawson.

1322 Fire extinguished by ATW-81.


1315 Commanding officer Teams A and B boarded to open ship and make radiological surveys.

1340 Dawson declared safe.

3 July 0830 Teams C and D boarded Dawson.

A 3 July damage report stated that the overall condition of the ship was good and that the radiactivity was negligible (Reference 2).

Shot Baker (25 July, 0835)

21 July 0950 Evacuation of Dawson's crew to Henrico began.

13 August Crew transferred to USS Rockbridge (APA-228). Dawson was boarded for 2 hours by a monitor, select members of the ship's company and a representative from GoM to reopen and inspect the ship (Reference 2).

14 August Topside average 0.6 R/24 hours (Reference 2).

16 August Dawson boarded by five personnel to lift anchor in preparation for towing.

25 August Towed by USS Achen's (ATF-148) to Kwajalein Atoll.

28 August Arrived at Kwajalein Atoll.

1 October Topside average 0.15 R/24 hours (Reference 2).

**USS Deliver (ARS-23)**

Crew Size: 04

Bikini Atoll Arrival: 10 June 1946

Bikini Atoll Departure: 20 August 1946

Shot Able Location: Approximately 27 nmi (50 km) [E]

Shot Baker Location: 12 nmi (22 km) [E]

Operational Clearance: 20 December 1946

Final Clearance: 27 December 1946

**Task Unit and Function**

Deliver was a salvage ship used as a support ship in TU 1.2.7 (Salvage Unit). Its functions were salvaging, firefighting, and repair work on damaged target vessels.

Shot Able (1 July, 0900)

30 June 1300 Underway for area outside of lagoon, steaming with TU 1.2.7.

1 July 1340 Anchored in berth No. 1, Bikini Atoll.

31 July 0900 A party left the ship in small boats to inspect the landing craft on the beach. Anchored in berth 94.

0932 1140-1230 Boared target ship USS Clam (ARS-13) for an inspection.

1300-1410 inspected target vessel WDC-13.

1440-1535 Boared target ship USS Pensacola (CA 24) for an inspection.

1622 Extinguished two fires on Pensacola.
1735 Reanchored in berth Dog.
5 July 0840 Shifted to berth 32.
6 July 1226 Underway in vicinity of Bikini to perform routine activities.
1618 Anchored off Adrikian Island.
11 July 1415 Pulled LCM off Bokonejien Island.
2359 Moored in berth 32.
12 July 0921 Pulled LCM off Adrikian Island.
1145 Anchored off Adrikian Island.
13-14 July Anchored off Adrikian Island.
15 July 1020 Underway to shift anchorages.
1157 Anchored in berth 32.
16 July 0741 Underway to perform routine activities.
1047 Anchored in berth 32.
2034 Anchored in berth 129.
20-21 July Anchored in berth 32.
22 July 1147 Underway to perform routine duties.
1753 Anchored in berth 36.
23 July 0556 Underway to perform routine activities and shift berths.
1858 Anchored in berth 261.
Shot BAKER (25 July. 0835)
24 July 1349 Underway for area outside atoll. steaming with TU 1.2.7.
26 July 1511 Underway to clear area for USS Reclaimer (ARS-42), which was towing target ship USS Hughes (DD-410).
1600 Moored in berth B.
27 July Anchored in Bikini.
28 July 1310-1427 Towed target vessel LCT-818 to its new berth.
1548 Circling LCT-818. washing it down to dissipate radioactivity.
1652 Underway from alongside LCT-818.
1756 Anchored near berth 79.
29 July 0802 Boarding team aboard.
0905 Underway to LCT-818.
0900 Moored to LCT-818 to inspect and hose down.

0959 Underway to target ship USS Conyngham (DD-37) to inspect and hose it down if necessary.
1027-1105 Moored to Conyngham.
1125-1145 Underway to USS Haven (AH-12) to take on new Geiger instruments.
1215 Underway to target vessel LCT-1013 to inspect.
1255 Moored to LCT-1013.
1315 Underway to inspect target vessel LCT-705.
1339 Moored to LCT-705.
1349 Underway to inspect and hose down Conyngham.
1410 Alongside Conyngham.
1544 Underway to USS Avery Island (AG-76) to transfer camera from Conyngham to Avery Island.
1739 Anchored near berth 379.
30 July 0702-1010 Hosed down Conyngham.
0752-1210 Hosed down Conyngham's portside.
1402-1420 Covered target ship USS Muford (DD-389) with foam.
1426-1436 The boarding party boarded Muford.
1435-1450 Sprayed foam on Muford.
1451 Underway to anchor.
1534 Anchored in berth E.
1800 Boarding team left Deliver.
21 July 0618 Underway to receive foamite from USS Palmitra (ARS[?]-3).
0850 Underway to go alongside target ship USS Pennsylvania (BB-38).
0925-1318 Conducted operations [operations not specified in ship's log].
1418 Anchored in berth E.
24 July 0812-0925 Sprayed foamite on Pennsylvania.
1415-1635 Conducted operations [operations not specified in ship's log].
1651 Underway to clear area for USS Reclaimer (ARS-42), which was towing target ship USS Hughes (DD-410).
1700 Moored in berth B.
25 July 0000 Moored to LCT-818 to inspect and hose down.
1552 Anchored near berth 379.
27 July Anchored in Bikini.
28 July 0802 Boarding team aboard.
0905 Underway to LCT-818.
0900 Moored to LCT-818 to inspect and hose down.

0830 Moored next to TF 733 to pick up boiler compound and lye.
0931 Anchored in vicinity of Nevada.
1246 Underway to vicinity of target ship USS Muford (DD-410).
1305-1355 Washed down Mustin.
1335 Laying to from Mustin to anchor in vicinity.
1552 Anchored in berth 165.
1557-1733 Washed down Mustin with saltwater.

318
### USS Deliver (ARS-23)

#### 7 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1123</td>
<td>Proceeded to assigned anchorage.</td>
</tr>
<tr>
<td>1137</td>
<td>Anchored in berth 32, Bikini.</td>
</tr>
<tr>
<td>8 August</td>
<td></td>
</tr>
<tr>
<td>0808</td>
<td>Underway to vicinity of USS Wharton (AP-7) to pick up working party, then proceeded to Pensacola.</td>
</tr>
<tr>
<td>1112</td>
<td>Completed washing down Pensacola.</td>
</tr>
<tr>
<td>1115</td>
<td>Anchored in berth 117, Bikini.</td>
</tr>
<tr>
<td>1124</td>
<td>Shifted to berth 32, Bikini.</td>
</tr>
<tr>
<td>1355</td>
<td>LCT-1186 came alongside to deliver boiler compound.</td>
</tr>
<tr>
<td>1545</td>
<td>LCT-1186 departed.</td>
</tr>
</tbody>
</table>

#### 9 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0815</td>
<td>Director of Ship Material (DSM) boarding team came aboard.</td>
</tr>
<tr>
<td>0930</td>
<td>Proceeded to target ship USS Trippe (DD-403).</td>
</tr>
<tr>
<td>0902</td>
<td>Moored starboard side to Trippe to put DSM boarding team aboard.</td>
</tr>
<tr>
<td>0952</td>
<td>Underway to Independence.</td>
</tr>
<tr>
<td>1005</td>
<td>Continued unspecified operations.</td>
</tr>
<tr>
<td>1020</td>
<td>Anchored in berth 198, Bikini.</td>
</tr>
<tr>
<td>1148</td>
<td>Underway to continue operations.</td>
</tr>
<tr>
<td>1240</td>
<td>Moored starboard side to Independence to put DSM boarding team aboard.</td>
</tr>
<tr>
<td>1420-1547</td>
<td>&quot;14 boarding team aboard Independence.</td>
</tr>
<tr>
<td>1547</td>
<td>Underway to target ship USS Bracken (APA-64).</td>
</tr>
<tr>
<td>1555</td>
<td>Moored starboard side to Bracken to put boarding team aboard.</td>
</tr>
<tr>
<td>1555-1620</td>
<td>DSM boarding team aboard Bracken.</td>
</tr>
<tr>
<td>2049</td>
<td>Underway to assigned anchorage.</td>
</tr>
<tr>
<td>2105</td>
<td>Anchored in berth 32, Bikini.</td>
</tr>
<tr>
<td>11 August</td>
<td></td>
</tr>
<tr>
<td>1003</td>
<td>Underway to retrieve drifting rafts.</td>
</tr>
<tr>
<td>1052</td>
<td>Anchored in berth 32, Bikini.</td>
</tr>
<tr>
<td>12 August</td>
<td></td>
</tr>
<tr>
<td>1001</td>
<td>Underway to vicinity of target submarine USS Skate (DD-305).</td>
</tr>
<tr>
<td>1126</td>
<td>Anchored near Skate.</td>
</tr>
<tr>
<td>1150-1225</td>
<td>Continued unspecified operations.</td>
</tr>
<tr>
<td>1228</td>
<td>Underway to vicinity of target submarine USS Parche (SS-384).</td>
</tr>
<tr>
<td>1300-1330</td>
<td>Conducted unspecified operations, then proceeded to Skate.</td>
</tr>
<tr>
<td>1352</td>
<td>Arrived in vicinity of Skate and continued operations.</td>
</tr>
<tr>
<td>1418</td>
<td>Completed operations and proceeded to target submarine USS Saraven (SS-196).</td>
</tr>
<tr>
<td>1435</td>
<td>Arrived near Saraven.</td>
</tr>
<tr>
<td>1450</td>
<td>Proceeded to Parche.</td>
</tr>
<tr>
<td>1544</td>
<td>Arrived near Parche.</td>
</tr>
<tr>
<td>1618</td>
<td>Completed operations and proceeded to assigned anchorage.</td>
</tr>
<tr>
<td>1636</td>
<td>Anchored in berth 32, Bikini.</td>
</tr>
<tr>
<td>13 August</td>
<td></td>
</tr>
<tr>
<td>0558</td>
<td>Underway to vicinity of USS Rockingham (APA-229).</td>
</tr>
<tr>
<td>1003-1731</td>
<td>Moored to Muslin to pump water from boiler rooms.</td>
</tr>
<tr>
<td>1756</td>
<td>Anchored in berth 32, Bikini.</td>
</tr>
<tr>
<td>14-17 August</td>
<td></td>
</tr>
<tr>
<td>18 August</td>
<td></td>
</tr>
<tr>
<td>1850</td>
<td>After taking on fuel and water, anchored in berth 108-A, Bikini.</td>
</tr>
</tbody>
</table>

#### 19 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0621</td>
<td>Underway to assist in bringing in Pennsylvania to anchorage in Kwajalein Atoll.</td>
</tr>
<tr>
<td>0750-1132</td>
<td>Assisted Pennsylvania to anchorage in Kwajalein Atoll.</td>
</tr>
<tr>
<td>0750</td>
<td>Anchored in berth A-14, Kwajalein.</td>
</tr>
</tbody>
</table>

#### 20 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0742</td>
<td>Underway to take target ship USS Briscoe (APA-65) in tow.</td>
</tr>
<tr>
<td>0757</td>
<td>Anchored in berth 202, Bikini.</td>
</tr>
<tr>
<td>1010</td>
<td>Underway.</td>
</tr>
<tr>
<td>1014</td>
<td>Anchored and prepared to take Briscoe in tow.</td>
</tr>
<tr>
<td>1212</td>
<td>Underway for Kwajalein with Briscoe in tow.</td>
</tr>
<tr>
<td>0527</td>
<td>Underway to assist in bringing in Pennsylvania to anchorage in Kwajalein Atoll.</td>
</tr>
</tbody>
</table>

#### 25 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0742-1112</td>
<td>Assisted USS Chickasaw (ATF-83) in towing target ship USS Salt Lake City (CA-25) through Kwajalein Pass to anchorage area.</td>
</tr>
<tr>
<td>0750</td>
<td>Anchored in berth A-14, Kwajalein.</td>
</tr>
</tbody>
</table>

#### 26 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0530</td>
<td>Underway to assist in bringing in Pennsylvania to anchorage in Kwajalein Atoll.</td>
</tr>
<tr>
<td>0645</td>
<td>Passed tow line to stern of Pensacola.</td>
</tr>
<tr>
<td>0843</td>
<td>Let go line to Pensacola, then proceeded to assigned anchorage.</td>
</tr>
<tr>
<td>0915</td>
<td>Anchored in berth A-14, Kwajalein.</td>
</tr>
</tbody>
</table>

#### 27 August

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0638</td>
<td>Underway to assist with Independence.</td>
</tr>
<tr>
<td>0900</td>
<td>Passed tow line to Independence.</td>
</tr>
<tr>
<td>1104</td>
<td>Anchored Independence.</td>
</tr>
<tr>
<td>1415</td>
<td>Let go tow line from Independence and proceeded to assigned anchorage.</td>
</tr>
<tr>
<td>1444</td>
<td>Anchored in berth A-14, Kwajalein.</td>
</tr>
<tr>
<td>28-29 August</td>
<td>Anchored in Kwajalein.</td>
</tr>
</tbody>
</table>
33 August
1611 Underway to assist USS Chouest (APA 66) with target vessels USS Eagle (APA 66), USS Baker (AKA 25).
1730 Passed tow wire to Eagles.
1948 Set go for tow wire from Eagles and proceeded to anchorage.
2308 Moored to berth A-14, Kwajalein.
31 August to September
Anchored in Kwajalein.
7 September
1452 Underway to USS Limestone (IX 248) to take it in tow.
1500 Moored in berth A-11, Kwajalein.
8 September
0643 Underway, maneuvering to take Limestone in tow.
1240 Anchored in berth A-11, Kwajalein.
1340 Underway with Limestone in tow; en route to Pearl Harbor.
23 September
Arrived Pearl Harbor.
7 September
Departed Pearl Harbor.
8 October
Arrived San Francisco.

**USS Dentuda (SS-335)**

**Crew Size:** 58

**Bibs/Atoll Arrivals:**
- 31 May 1946
- 27 August 1946

**Bibs/Atoll Departures:**
- 15 May 1946
- 16 August 1946

**Crew Location for Shot BAKER:** USS Bottineau (APA 23)

**Shot BAKER Location:**
- 1,930 yards (1.8 km)

**Desalination Location:** San Francisco - 11 December 1946, San Francisco

**Task Unit and Function:**

The submarine Dentuda was a target vessel during CROSSROADS. Its crew was evacuated for each shot.

It served in Submarine Division 119 and Unit B-1, 4 (Submarine Unit). Dentuda carried special test torpedoes for studies on their effects from the atomic blast.

**Shot BAKER (15 July, 1946)**

29 June
All nonessential personnel were evacuated to Bottineau.

30 June
0008 Dentuda was rigged.

0130 Remaining crew were evacuated to Bottineau.

2 July
1040 Team A and B reboarded and conducted ops and machinery inspections.

2030 Dentuda opened and found clear of contamination; crew reboarded.

7 July
1544 Reboarded starboard side to target submarine USS Pilotfish (SS 386), alongside USS Bulfinch (SS 111) in anchorage 201, Bikini.

1645 Target submarine USS Reaven (SS 150) moored alongside to port.

1640 Target Submarine USS Tuna (SS 260) moored alongside Bearaven to port.

- 27 July
Dentuda was rigged for diving.

- 0240 Commenced making stationary tank dive.

- 1045 Surfaced from stationary tank dive.

- 21 July
USN Tender (ASCB 1) came alongside to starboard to suspend load weights.

- 1940 Completed suspending load weights for submerged tests.

- 1940 Tender underway.

- 27 July
- 0630 Tender came alongside to suspend load weights for submerged tests.

- 0640 Completed hanging weights; Tender underway.

**USS Widgeon (ASB 1):**

- 23 July
- 0610 USS Widgeon (ASB 1) anchored in position close aboard and commenced operations for submergence of Dentuda.

- 1311 All personnel evacuated to Bottineau. Widgeon submerged Dentuda.

- 27 July
- 1533 Submerged by Widgeon. Radiation readings on Dentuda showed 4 R/hour.

- 28 July
- 0845 Readings were 1.2 R/hour on the boat and 0.4 R/hour in the water.

- 1111 Dentuda surfaced, and reached on Ponape Island by USS General (AG 21).

- 29 July
- 0600
- 1400 The depot monitor had received their daily exposure limits of radioactivity.

- 31 July
- 0845 Ten personnel assisted in clearing decks and rigging.

**Team A and B:**

- 2 August
- 0923 Team A and B boarded Dentuda (roled), at an average of 0.55 R/hour topside.

- 1220 The boat was opened and the air below decks purified.

- 2 August
- 0926 Inspection team cleared the boat and departed.
Between 4 and 13 August boarding teams were aboard Dentuda. The times of their arrival aboard and departure from the boat are listed below:

<table>
<thead>
<tr>
<th>Date</th>
<th>Arrival</th>
<th>Departure</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 August</td>
<td>0900</td>
<td>1500</td>
<td>A.B</td>
</tr>
<tr>
<td>5 August</td>
<td>0930</td>
<td>1530</td>
<td>A.B</td>
</tr>
<tr>
<td>6 August</td>
<td>1045</td>
<td>1615</td>
<td>A.B</td>
</tr>
<tr>
<td>7 August</td>
<td>0900</td>
<td>1615</td>
<td>A.B</td>
</tr>
<tr>
<td>8 August</td>
<td>0945</td>
<td>1605</td>
<td>A.B</td>
</tr>
<tr>
<td>9 August</td>
<td>0915</td>
<td>1615</td>
<td>A.B.C</td>
</tr>
<tr>
<td>10 August</td>
<td>0950</td>
<td>1545</td>
<td>Electricians</td>
</tr>
<tr>
<td>11 August</td>
<td>0805</td>
<td>1545</td>
<td>Electricians</td>
</tr>
<tr>
<td>12 August</td>
<td>0817</td>
<td>1545</td>
<td>A.B.C</td>
</tr>
<tr>
<td>13 August</td>
<td>0830</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 August
- 0900: Teams A and B boarded and continued repairs and cleaning.
- 1045: Pump room pumped dry; commenced removing various panels and motors and associated electrical equipment for treatment after saltwater flooding. The entire top side was again scrubbed down. In addition, the wooden deck on the aftergun platform was lifted up and thrown overboard. The metal deck was then given another scrubbing. The reading dropped to 0.8 R/24 hours. The average reading for the day was 0.32 R/24 hours (Reference 4).
- 1500: Boat sealed and all personnel evacuated.

5 August
- 0930: Teams A and B boarded and continued repairs and cleaning.
- 1530: Boat sealed and all personnel evacuated. Scrubbing was continued. Average reading 0.26 R/24 hours (Reference 4).

6 August
- 0710: Special team boarded boat to assist USS Presever (ARS-8) in refloating Dentuda.
- 0750: Dentuda waterborne.
- 0751: Underway in tow for submarine mooring area.
- 0946: Manned submarine mooring buoy No. 4.
- 0945: Presever underway from alongside.
- 1045: Teams A and B reboarded and continued repair work.
- 1615: All personnel evacuated. Average reading 0.24 R/24 hours (Reference 4).

7 August
- 0900: Teams A and B reboarded to continue repair work.
- 1105-1145: Unloaded ammunition.
- 1615: Teams A and B sealed boat and evacuated. Average reading 0.15 R/24 hours (Reference 4).

8 August
- 0945: Teams A and B reboarded to continue repair work.
- 1605: Teams A and B sealed boat and evacuated. Average reading 0.12 R/24 hours (Reference 4). One source states that Dentuda did not reach tolerance until 9 August (Reference 4). However, another source states, "Dentuda Geiger readings below daily tolerance. This has been reported to Radsafe for final clearance to permit crew to move aboard" (Reference 10).

9 August
- 0830: USS Dentuda (SS-335)
- 0915: Crew was transferred from Bottineau to remanned target ship USS Fillmore (APA-83).
- 1015: Teams A, B, and C reboarded Dentuda to continue repair work.
- 1105-1145: Teams A, B, and C departed leaving aboard a special detail of one officer and four enlisted men.
- 1200: Special detail sealed boat and evacuated. Maximum Geiger reading 0.07 R/24 hours. Recommended crew move aboard when cleared by Radsafe (Reference 10).
- 1615: Teams A and B reboarded to continue repair work.
- 1545: Electrician working party with two officers boarded to continue electrical repair work.
- 1545: Crew sealed boat and evacuated.

9 August
- 0950: Teams A and B reboarded to continue repair work.
- 1050-1645: Target submarine USS Parche (SS-384) alongside.
- 1105-1145: Teams A, B, and C reboarded Dentuda to continue repair work.
- 1200: Electrician working party with two officers boarded to continue electrical repair work.
- 1545: Crew sealed boat and evacuated.

9 August
- 1020: Moored portside to Fulton.
- 1030: Officers and crew berthed and messed aboard Fulton with duty section aboard ship at all times. Maximum Geiger reading aboard Dentuda was 0.07 R/24 hours. Ventilation was cleared by Radsafe, although the boat was not cleared for crew to move aboard (Reference 10).
- 13 August | 0830    |       |       |
- 14 August | 1306    | 1451   |       |
- 17 August | 1255-1330 |       |       |
- 20 August | 1050-1645 |       |       |
- 21 August | 1330-1730 |       |       |
- 22 August | 0903    |       |       |

USS Dentuda (SS-335)

A special detail sealed boat and evacuated. Maximum Geiger reading 0.07 R/24 hours. Recommended crew move aboard when cleared by Radsafe (Reference 10).
USS Dentuda (SS-335)  

23 August  
1117 Moored to Tuna in berth 28, anchorage A, Kwajalein.  
1215 Moored to Tuna in berth 28 South, Kwajalein.  

28 August  
0950 Underway for Pearl Harbor.  

5 September  
0852 Arrived Pearl Harbor.  

14 October  
Arrived at Mare Island Naval Shipyard.  

USS Enoree (AO-69)  

23 August  
1117 Moored to Tuna in berth 28, anchorage A, Kwajalein.  
1215 Moored to Tuna in berth 28 South, Kwajalein.  

28 August  
0950 Underway for Pearl Harbor.  

5 September  
0852 Arrived Pearl Harbor.  

USS Dutton (AGS-8)  

Crew Size: 60  
Bikini Atoll Arrival: 3 August 1946  
Bikini Atoll Departure: 14 September 1946  
Location for Shot ABLE: Pearl Harbor  
Location for Shot BAKER: En route from Pearl Harbor to Kwajalein Atoll  
Decontamination Location: Los Angeles  
Operational Clearance: 16 December 1946  
Final Clearance: 10 January 1947  

Function  
Dutton was a surveying ship. Its functions were to survey the probable effects of the atomic bomb on fish and wildlife and to conduct an oceanographic survey on ocean currents in and around the atoll area to determine their characteristics.  

Shot ABLE (1 July, 0900)  
Dutton was moored in Pearl Harbor for Shot ABLE.  
22 July  
1357 Underway from Pearl Harbor to Marshall Islands.  

Shot BAKER (25 July, 0835)  
Dutton was en route to Kwajalein Atoll during Shot BAKER.  
3 August  
0840 Anchored at Bikini Atoll in Open Roads.  
14 August  
1445 Underway to shift berths.  
1452 Anchored in berth 207A.  
18 August  
1100 Anchored in berth 231.  
22 August  
0923 Anchored in berth 231.  
26 August  
1615 Anchored in Open Roads.  
27 August  
0950 Underway to conduct survey-sounding operations.  
30 August  
Conducted survey-sounding operations.  
1-7 September  
Conducted survey-sounding operations.  
11 September  
Conducted survey operations.  
14 September  
0614 Departed for Kwajalein Atoll.  
15 September  
2055 Arrived at Kwajalein.  
25 September  
1025 Departed Kwajalein for Pearl Harbor.  

USS Enoree (AO-69)  

Crew Size: 152  
Bikini Atoll Arrival: Before 1 July 1946  
Bikini Atoll Departure: 24 August 1946  
Shot ABLE Location: Anchored at Kwajalein Atoll
**USS Enoree (AO-69)**

Shot BAKER Location: 17 nmi (32 km) E

Decontamination Location: San Francisco

Operational Clearance: 3 December 1946

Task Unit and Function:

*Enoree* was an oiler in TU 1.8.1 (Repair and Service Unit). Its function was to provide fuel to the other ships during CROSSROADS.

Shot ABLE (1 July, 0900)

*Enoree* was anchored at Kwajalein Atoll for shot ABLE.

4 July

Arrived at Bikini and anchored in berth 305.

During the period between shots ABLE and BAKER, *Enoree* provided fuel to many task force ships.

13 July

Departed Bikini for Kwajalein Atoll.

14 July

Arrived at Kwajalein Atoll.

16 July

Departed Kwajalein for Bikini Atoll.

17 July

Arrived at Bikini Atoll, anchored in berth 305.

24 July

Underway from Bikini Lagoon.

Shot BAKER (25 July, 0835)

25 July

Steam with *USS Dixie* (AD-14).

30 July

Anchored in berth 305, Bikini.

2 August

Shifted to berth Oboe.

24 August

Departed for Kwajalein Atoll.

25 August

Arrived Kwajalein.

31 August

Departed for Eniwetok.

3 September

Underway for Kwajalein.

4 September

Arrived at Kwajalein.

7 September

Underway for Pearl Harbor with APL 30 (a vessel that did not participate in CROSSROADS) in tow.

20 September

Arrived at Pearl Harbor and moored at Fuel Oil Dock after casting off tow.

23 September

Three of *Enoree*’s small boats were inspected by Radiosafe Representatives; all three boats were declared radiologically safe for operation.

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**USS Etlah (AN-79)**

Crew Size: 36

Bikini Atoll Arrival: 1 April 1946

Bikini Atoll Depature: 27 August 1946

Shot BAKER Location: 12 nmi (22 km) E

Decontamination Location: Puget Sound

Operational Clearance: 3 December 1946

Final Clearance: 21 December 1946

Task Unit and Function:

*Etlah* was a net laying ship in TU 1.2.7 (Salvage Unit). Its functions were to place buoys and targets in the proper places in the target array and after the detonations to place boarding teams on the target vessels.

Shot ABLE (1 July, 0900)

30 June

Underway to take position for ABLE in area Mercury.

1 July

1340 Proceeding on duty assigned by CTU 1.2.7.

1347 Alongside target vessel LCI-529; placed a boarding party aboard.

1352 Underway to target vessel LCI-329.

1404 Alongside target vessel LCI-327.

1432-1444 Alongside LCI-327.

1500 Anchored in vicinity of target ship USS LST-133.

1526 Boarding party returned on board.

1549-1607 Alongside target submarine USS Pilotfish (SS-203); boarding team placed aboard.

1655 Underway for target ship USS LST-220.

1700 Laying to in vicinity of LST-220.

1708-1724 Dispatched boarding party and boat for LST-220; team did not board.

1715 Dispatched boat to target ship USS Pilotfish.

25 July

1742 Departed for Kwajalein. Boarding party returned aboard; did not board LST-220.

1835 Anchored in berth Oboe.

2 August

1029 Departed from Bikini Lagoon. Laying to in vicinity of LST-220.

0729 Anchored in berth 305, Bikini.

1708-1714 Dispatched boat to target ship USS Pilotfish.

2 August

1742 Left LST-220 for LST-545; team did not board.

1835 Underway for Kwajalein.

31 August

0800 Departed Eniwetok.

3 September

Underway for Kwajalein.

4 September

Arrived at Kwajalein.

7 September

Underway for Pearl Harbor with APL 30 (a vessel that did not participate in CROSSROADS) in tow.

20 September

Arrived at Pearl Harbor and moored at Fuel Oil Dock after casting off tow.

23 September

Three of *Etlah*’s small boats were inspected by Radiosafe Representatives; all three boats were declared radiologically safe for operation.

323
3 July
1411 Shifted anchorages; anchored in berth M., Bikini.

7 July
0710 Underway to USS Suncock (AN-80).
0820-0930 Engaged in buoy operations with Suncock.
1210 Underway to USS Oneota (AN-85).
1255 Moored to Oneota.
1350 Underway for USS Ottawa (AKA-10).
1430 Moored to Ottawa.
1510 Underway for buoy area.
1534-1649 Moored to Oneota; engaged in stretching third leg and underway to Ottawa.
1733 Moored to Ottawa.
1930 Anchored in overnight berth.

8 July
0710 Underway for buoy area to assist Suncock with moor.
0820 Moored to Suncock.
0935 Underway for Ottawa.
1002-1020 Moored to Ottawa.
1100-1141 Moored to Ottawa; engaged in operations.
1420-1525 Moored to Ottawa.
1740-1840 Moored to Suncock.
1905-2005 Moored to Ottawa.
2008 Moored to Ottawa.

9 July
0900-1000 Moored to Suncock; completed operations.
1215-1310 Moored to Ottawa.
1220-1320 Moored to Oneota; completed mooring operations.
1330-1540 Moored to Ottawa; completed mooring operations.
1547-1620 Moored to Suncock; completed mooring operations.
1633-1715 Moored to Ottawa.
1720 Moored 200 yards (183 meters) forward of Ottawa.

10 July
0650-0745 Moored to Suncock; mooring operations.
0825-0930 Moored to Ottawa.
1025-1130 Conducted buoy operations off Eneu Island.
1135 Anchored in berth 87, Bikini.

11 July
1123-1250 Alongside Ottawa.
1505 Completed operations.
1520 Anchored.

12 July
0910-0930 Moored to USS Rolette (AKA-99).
0945-1130 Moored to USS Henrico (APA-45).
1205 Anchored.

13 July
1440 Underway for mooring operations on target vessel ARDC-11.
1810 Completed operations on ARDC-13; proceeding to USS Cebu (ARG-6).
1830 Moored to Cebu.

17 July
0650 Underway for Henrico for mooring chains.
0740 Moored port side to Henrico.
1010 Underway for Ottawa.
1033-1140 Moored to Ottawa.
1330 Anchored.

22 July
1230 Underway for Searaven.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 July</td>
<td>Anchored in berth 90. Bikini</td>
</tr>
<tr>
<td>3 August</td>
<td>Engaged in operations on instrument buoy recovery</td>
</tr>
<tr>
<td>7 August</td>
<td>Underway to pick up boarding team and make assigned ships in array</td>
</tr>
<tr>
<td>8 August</td>
<td>Boarding team aboard</td>
</tr>
<tr>
<td>8 August</td>
<td>Underway for buoy operations</td>
</tr>
<tr>
<td>12 August</td>
<td>Underway to repair buoy</td>
</tr>
<tr>
<td>12 August</td>
<td>Engaged in unspecified operations</td>
</tr>
<tr>
<td>15 August</td>
<td>Underway on assigned duty in target area</td>
</tr>
<tr>
<td>16 August</td>
<td>Underway to assist destroyer in raising anchor</td>
</tr>
<tr>
<td>17 August</td>
<td>Alongside Gasconade to furnish auxiliary power to clear fouled anchor</td>
</tr>
</tbody>
</table>

**USS Etlah (AN-79)**

- **1:28** Anchored in berth y.
- **3:00** Engaged in operations on instrument buoy recovery.
- **19 Aug** Anchored in berth 90. Bikini.
- **24 Aug** Anchored in Bikini Atoll in berth 94.
- **28 Aug** Anchored in vicinity of Eneu Island.
- **2 Sep** Anchored in berth 7.
- **12 Sep** Engaged in unspecified operations.

**USS Fall River (CA-131)**

- **0845-1115** Alongside Gasconade to furnish auxiliary power to clear fouled anchor.
- **1045** Anchored in berth 90. Bikini.
- **1155** Anchored in berth 90. Bikini.
- **0845-1145** Anchored in Bikini Atoll in berth 94.
- **0953-1030** Anchored in Bikini Atoll in berth 94.
- **0805** Arrived Pearl Harbor.
- **0805** Anchored in berth 90. Bikini.

**Crew Size:** 817

**USS FALL RIVER (CA-131)**

- **Shot ABL (1 July, 0900)**
- **1 July** Underway for operating area outside of the lagoon.
- **2 July** Underway for operating area outside of the lagoon.
- **25 July** Underway for operating area outside of the lagoon.

**Shot Baker (25 July, 0835)**

- **25 July** Underway for operating area outside of the lagoon.
- **26 July** Anchored in berth 86.

**Shot Baker (25 July, 0835)**

- **25 July** Underway for operating area outside of the lagoon.
- **26 July** Anchored in berth 86.
28 July
1536 Underway for area 2 nm (3.7 km) off entrance of atoll.

1807 Fires were reported aboard ship (Reference 6, p. 1-11-A).

29 July
1319 Anchored in berth 336, Bikini Atoll.

0925 Fallon reported Geiger sweet.

30 July
0922 Shifted anchorage to berth 91.

1604 Boarding team A, consisting of three officers and twenty-two enlisted men, came aboard.

31 July
1723 Fallon declared radiologically safe. The remainder of the teams returned to Fallon.

August 1
1536 Anchored in berth 91.

1922 Team C, consisting of two officers and thirty enlisted men, came aboard.

2 August
1645 Shifted anchorage to berth 359.

1422 Team D, consisting of 35 enlisted men, came aboard.

USS FALLON (APA-81)

Crew Size: 127

Bikini Atoll Arrival: 28 May 1946
Bikini Atoll Departure: 1 September 1946

Shot ABLE Location: 1,350 yards (1.2 km) SW
Shot BAKER Location: 540 yards (494 meters) NNW

Salvage party boarded to rig salvage pumps.

Ship's crew left for Kwajalein.

Salvage party boarded to complete rigging salvage pumps.

USS CLAYTON (ARS-33) towed ship to mooring buoy for further salvage work.

Commanding officer and engineering officer returned to Bikini.

Decommissioned.

22 August
1330-1430

Ship's crew left for Kwajalein.

Salvage party boarded to complete rigging salvage pumps.

USS CLAYTON (ARS-33) towed ship to mooring buoy for further salvage work.

Commanding officer and engineering officer returned to Bikini.

30 June
1130 All personnel had been evacuated to Bikini.
USS Fallon (APA-81)

3 September Arrived at Kwajalein.

USS Fillmore (APA-83)

Crew Size: 109
Blank Atoll Arrival: 31 May 1946
Blank Atoll Departure: 72 August 1946
Crew Location for Shot ABLE: USS Bayfield (APA-33)
Crew Location for Shot BAKER: Bayfield
Shot ABLE Location: 2,433 yards (2.2 km) SSW of ship
Shot BAKER Location: 2,012 yards (1.8 km) 3
Decommission Location: San Francisco
Operational Clearance: By 22 November 1946
Decommissioned 24 January 1947, Norfolk, Virginia

Shot ABLE (1 July, 0800)

30 June
0900 Officers and crew evacuated to Bayfield.
1031 All boarding teams departed.
1300 The special animal detail departed.

1 July
1730 Fillmore given radiological clearance for reboarding.

2 July
1245 Refueling party A with a radiological monitor boarded Fillmore.
1503 Reboarding party B returned.
1529 Reboarding party C embarked.
1535 The radiation monitor declared Fillmore sufficiently free of radioactivity to allow complete operation and occupation.
1538 Monitor departed.

18 July
William Day operation was in effect and the crew left Fillmore.

19 July
Crew returned to Fillmore.

Shot BAKER (25 July, 0835)

24 July
0937 The officers, crew, and reboarding teams were evacuated to Bayfield.

25 July
1226 Fillmore cleared for reboarding.
1309 Fillmore declared Geiger sweet.
1338 The first boarding team returned to Fillmore (Reference 5, p. D-12).
2312 Radiological clearance given (Reference 5, p. D-19).

28 July
0835 A section of party A with a radiological monitor returned to Fillmore. The monitor left and returned with another monitor at 0940.
0955 The captain returned.
1010 Remainder of party A with party B came aboard.
1155 Monitors declared Fillmore safe except for four areas of the ship.
1530 The monitors reboarded.

USS Flusser (DD-368)

1945 Party C returned to Fillmore.
22 August
Departed Bikini for Kwajalein.
23 August
Arrived at Kwajalein.
27 August
1610 Five radiological monitors boarded to monitor ship and men.
Radiological monitors finished inspection of ship: pronounced the ship radiologically safe and left.
28 August
0820 Departed for Pearl Harbor.
5 September
0938 Moorred to pier H-3, Pearl Harbor.
6 September
1345 Two radiological officers came aboard to clear ship.
1545 Radiological officers left ship: results of the inspection unknown.

Later in September, a radisafe inspection of small boats aboard Fillmore found 11 of these craft had been contaminated. Nine of these had been received on board from USS Bottineau (APA-235) on 9 August 1946.

USS Flusser (DD-368)

Crew Size: 146
Bikini Atoll Arrival: Before 1 July 1946
Bikini Atoll Departure: 4 September 1946
Shot ABLE Location: 18 to 27 nmi (33 to 41 km) 5
Shot BAKER Location: Kwajalein Atoll
Decontamination Location: Pearl Harbor
Operational Clearance: By 22 November 1946
Final Clearance: 13 December 1946

Task Unit and Function
The destroyer Flusser served in Destroyer Division 3 of TU 1.2.3 (Destroyer Unit). Its functions were to patrol the surface area, conduct oceanographic surveys, and do radiological monitoring inside and outside of atoll.

Shot ABLE (1 July, 0800)

30 June
1241 Underway for ABLE test.
1222 Received orders to proceed to area Mack.

1 July
Steaming independently in accordance with CTG 1.7 Op Plan 1-46, patrolling the south border of area Mack.
Anchored in berth 342, Bikini Atoll.

2 July
0920 Underway to Orono Island to carry out Operation Ivory in connection with radiological unit dispatch.
Lowered motor whale boat off Orono Island.
Party embarked in whale boat to go to Orono Island.
Completed Operation Ivory: motor whale boat returned with landing party.
Proceeded from Orono Island to Bikini. Anchored in berth 116, Bikini.
Members of the radiological unit returned to USS Haven (AN 12).
6 July 0944 Underway from berth for Harbor Entrance Control Vessel (HECV) duty. 1036 Relieved USS Allen M. Summer (DD-692) of HECV duty. 1042 Anchored in berth 386, Bikini. 12 July 1405 Underway for berth 116S, having been relieved of HECV duty by Huntington (DD-781). 1551 Anchored in berth 116S, Bikini. 14 July 0534 Underway to operate as station destroyer for shot BAKER. 1313 Anchored in berth 116S, Bikini. 15 July 1006 Relieved Huntington as HECV. 1016 Anchored in berth 386, Bikini. 17 July 0800 Secured as HECV. 0900 On station at Point Zebra. 1300 Resumed duties as HECV. 1303 Anchored in berth 386, Bikini. 18 July 1145 Relieved of HECV duty by Summer; underway to approach nearby anchorage. 1204 Anchored in berth near HECV. 1304 Underway for BAKER rehearsal. 19 August 1655 Anchored in berth 270A, Bikini. 20 July 1615 Anchored in berth 189, Bikini. 22 July 1510-1825 Engaged in temporary patching of hole in engine room. 23 July 0805 Relieved USS Leary (DD-724) of HECV duty. 0811 Anchored in berth 386, Bikini. 24 July 1132 Underway from berth 386; relieved of HECV duty by Summer; stood out for Kwajalein. Shot BAKER (25 July, 0835)
USS Flusser (DD-388)

5 September 1946
1411 Anchored in berth K-6, Kwajalein.

9 September 1946
1600 Underway for Pearl Harbor.

14 September 1946
0920 Moored to berth H-2, Pearl Harbor.

USS Fulton (AS-11)

Crew Size: 730

 Bikini Atoll Arrival: 23 May 1946
 Bikini Atoll Departure: 25 August 1946
 Shot ABLE Location: 21 nmi (39 km) NE
 Shot BAKER Location: 14 nmi (25 km) NE
 Decontamination Location: San Francisco
 Operational Clearance: 24 December 1946
 Final Clearance: 10 January 1947

Task Unit and function:
FULTON was a submarine tender in TU 1.8.1 (Repair and Service Unit). Its function was to service submarines used as target vessels during CROSSROADS.

Shot 48E (1 July, 0900)
1 July Steamed in operating area with USS Dixie (AD-14) during shot ABLE.
1512 Anchored in berth 231, Bikini Atoll.

2 July Alongside target submarines USS Pilotfish (SS-380), USS Dentuda (SS-335), USS Tuna (SS-203), and USS Searaven (SS-196) to discharge freshwater and fuel.

3 July
1515 Pilotfish moored alongside to port.
1546 Dentuda moored alongside to port outboard Pilotfish.
1630 Searaven moored alongside to port outboard of Dentuda.
1843 Tuna moored alongside to port outboard Searaven.

5 July
1045 Pilotfish got underway from alongside to moor outboard of Tuna.
1119 Commenced discharging freshwater to Dentuda.
1120 Pilotfish stood in and moored outboard of Tuna.
1205 Completed discharging freshwater to Tuna.
1230-1250 Discharged freshwater to Searaven.
1253-1319 Discharged freshwater to Tuna.
1337 Searaven got underway from alongside to shift berths.
1356 Skijack moored alongside to port outboard of Pilotfish, having shifted berths.
1404 Commenced discharging freshwater to Tuna.
1412 Completed discharging freshwater to Pilotfish.
1421 Completed discharging freshwater to Tuna.
1443 Completed discharging freshwater to Pilotfish.

6 July
1000 Target ship USS Nevada (BB-36) got underway to shift berths.
1500-1525 Discharged battery water to Tuna.
1525-1530 Discharged diesel fuel to Skipjack.
1530-1546 Discharged diesel fuel to Pilotfish.
1546-1555 Discharged diesel fuel to Skipjack.
1555-1600 Discharged diesel fuel to Pilotfish.

USS Fulton (AS-11)

7 July
1000-1055 Discharged diesel oil to Tuna.
1115-1130 Discharged diesel oil to Pilotfish.
1210 Commenced discharging freshwater to Searaven.
1220 Completed discharging freshwater to Searaven.
1230-1245 Discharged diesel fuel oil to Searaven.
1300-1325 Discharged diesel fuel oil to Dentuda.
1335-1402 Discharged diesel fuel oil to Dentuda.
1414 Discharged discharging battery water to Dentuda.
1505 Discharged discharging lubricating oil to Pilotfish.
1600 Discharged discharging battery water to Dentuda.

8 July
1000-1025 Discharged battery water to Tuna.
1046 Completed discharging freshwater to Dentuda.

9 July
0915 Tuna underway from alongside.
0918 Pilotfish underway from alongside.
1333 Target submarine USS Parche (SS-384) moored alongside to port.
1359 Target submarine USS Apogon (SS-309) moored alongside to port, outboard to Parche.

10 July
1117 Target submarine USS Sealeaf (SS-184) moored alongside to port, outboard Apogon.
1119 Apogon underway from alongside.
1438-1508 Pumped battery water to Parche.
1523 Parche underway from alongside.

11 July
1143 Parche moored alongside to port.
1315-1330 Discharged battery water to Parche.
2043 Parche got underway from alongside and anchored off the starboard quarter.

13 July
0828 Target submarine USS Skate (SS-305) moored alongside to port.
1410-1445 Skijack made stationary trim dive.

14 July
1055-1210 Discharged diesel fuel to Skate.

15 July
1023-1226 Discharged battery water to Skate.
USS Fulton (AS-11)

16 July
0915-1050 Discharged freshwater to Skate.
1410 Skate underway from alongside.
1452 Skipjack moored alongside to port.
1653 Skipjack got underway from alongside.

7 Oct (25 July, 0835)

24 July
1629 Underway for area outside of the lagoon, steaming with Dixie.

25-29 July
Remained steaming outside lagoon.

30 July
0735 Anchored in berth 231, Bikini Atoll.

2 August
1100 Radiological safety council members reported on board for radiological detection duties. It is not known when they left.
1508 Underway to shift berths.
1638 Anchored in berth 386.

3-6 August
Anchored in berth 386: engaged in routine activities.

7 August
0902 Underway for berth 231.
1019 Anchored in berth 231.

8-13 August
Anchored in berth 231, routine duties.

11 August
1025 Dentuda stood in and moored alongside to port.

14 August
1302 Dentuda underway from alongside.
1335 Underway for new berth.
1417 Anchored in berth 92.
1500 Dentuda moored alongside to port.

15-20 August
Anchored in berth 92, routine activities.

20 August
1642 Parche got underway from alongside to port and stood out.

21-25 August
Anchored in berth 92, routine activities.

25 August
1635 Departed for Kwajalein Atoll.

26 August
0957 Anchored in berth K-17, Kwajalein.
1312 Dentuda stood in and moored alongside to port.

USS Furse (DD-882)

Crew Size: 293
Bikini Atoll Arrival: Before 25 June 1946
Bikini Atoll Departure: 28 July 1946
Shot ABLE Location: 30 nmi (55 km) N
Shot BAKER Location: 13 nmi (24 km) NW
Decontamination location: Los Angeles
Final Clearance: By 22 November 1946

Task Unit and Function
The destroyer Furse served in Destroyer Division 51 in TG 1.1f (Navy Air Group). Its main function was to provide support for drone and photographic operations.

Shot ABLE (1 July, 0900)

30 June
1756 Underway with USS SaIdor (CVE-117) and USS Newman K. Perry (DD-883) for area north of Bikini Atoll.

1 July
1906 Anchored in berth 321.

No information is available about its role as USS Hanger-La's (CV-38) plane guard during aircraft launches.

2 July
1825 Anchored in berth 54-A, Bikini Atoll.

5 July
0805 Underway for Kwajalein Atoll.

6 July
0920 Anchored at Kwajalein Atoll.

12 July
1700 Underway for Bikini Atoll.

13 July
0630 Arrived at Bikini Atoll. Left Bikini Atoll for air rehearsal operations with SaIdor and Perry.

14 July
1433 Anchored at berth 53A, Bikini Atoll.

Shot BAKER (25 July, 0835)

24 July
0930 Underway for area outside of the lagoon to rendezvous with SaIdor and Perry.

25 July
0845 Changed course to maintain plane guard station #2 during flight operations.

26 July
0344 Proceeding to Bikini Atoll.
0745 SaIdor launched three planes.
0818 Flying to 500 yards (457 meters) from SaIdor.
1120 Underway to plane guard station #1.
1500 SaIdor launched three planes.
1842 On screening station #2, 2,000 yards (1.8 km) from SaIdor.

27 July
0721 On plane guard station #2.
0739-0742 SaIdor launched two F6F aircraft.
0825-0900 Flight operations.

1516 Anchored in berth H, Bikini Atoll. Several men were transferred to Furse for passage to Kwajalein Atoll.

1636 Underway to berth N.

1717 Proceeding to station #1 off SaIdor in area Paige.

330
USS Furse (DD-882)

28 July
1725 Anchored in berth M. Bikini Atoll.
1812 Underway for Kwajalein Atoll.

29 July
Anchored at Kwajalein Atoll and did not return to Bikini before returning to the United States.

USS Gascowne (APA-85)

Crew Size: 105
Bikini Atoll Arrival: Before 31 May 1946
Bikini Atoll Departure: 24 August 1946

Shot Location for Shot ABLE: USS Bexar (APA-237)

Shot Location for Shot BAKER: Bexar

Shot ABLE Location: 2,687 yards (2.5 km)
Crew Size: 28 July
Gasconade (APA-US) Departed Bikini, crew was evacuated to Bexar.

Shot BAKER (25 July, 0835) 22 August

Shot ABLE (1 July, 0900) Before shot ABLE. Gasconade's crew was transferred to Bexar.

1 July
1619 Reported to be Geiger sweet (Reference 6, I-14-A).

2 July
1100 Crew returned to live aboard Gasconade.

Shot BAKER (25 July, 0835) Crew was evacuated to Bexar before the detonation.

29 July
0535 Gasconade had a 30-minute tolerance.
2125 Gasconade still too radioactive to board and remove the test animals (Reference 6, p. 1-36; Reference 5, p. 0-37 B).

30 July
0850-1015 USS Preserver (ARS-8) alongside to wash down Gasconade (Reference 1, Preserver).
1102 Gasconade still too radioactive to board.
1320-1405 USS Conserver (ARS-39) removed the animals and instruments from Gasconade.

2 August
Gasconade thoroughly washed down by USS Sturgeon (ATF-75) (Reference 6, p. 1-71).

A preliminary inspection report on 7 August states that Gasconade was severely damaged (Reference 8). The main deck had a reading of 20 R/24 hours, and where water had accumulated in pockets readings averaged from 6 to 8 R/24 hours; the lowest readings were between 0.2 and 0.5 R/24 hours. The animal compartment in sick bay was 0.8 R/24 hours. Reference 8 also stated that the ship appears too extensively damaged to permit personnel to live aboard even if radioactivity were reduced to safe levels. A 21 August decontamination report disclosed the measures taken to decontaminate Gasconade.

USS Geneva (APA-86)

- Wet sweeping and washdown by firehoses
- Washdown of the upper decks with saltwater
- Pumping contaminated water overboard
- Topsides materials jettisoned.

Deck scrubbing and paint removal was not attempted (Reference 2). Table A.4 lists the average and maximum Geiger readings from 7 to 17 August, which have been extracted from the 20 August Damage Report.

Table A.4 USS Gascowne (APA-85) radiation readings (R/24 hours).

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<th>Below Decks</th>
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<tr>
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<td>0.4</td>
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Sources: References 2 and 7.

13 August: The crew transferred to USS Sylvania (APA-44).
22 August: 1000-1300 Crew returned to Bexar.
26 August: Arrived Kwajalein.
28 August: 1300 Decommissioned.

Gasconade was towed to San Francisco for experimentation and research; it arrived there on 27 January 1947.

USS Geneva (APA-86)

- Crew Size: 115
- Bikini Atoll Arrival: May 1946
- Bikini Atoll Departure: 24 August 1946

Crew Location for Shot ABLE: USS Applin (APA-58)
Crew Location for Shot BAKER: Applin

Shot ABLE Location: 3,063 yards (2.8 km) SW
Shot BAKER Location: 2,800 yards (2.5 km) S

Decontamination Location: San Francisco
Strapped on 2 November 1966.

Task Unit and Function

Geneva, an attack transport, was a target vessel during Crossroads. Its crew was evacuated for each shot. It served in Transportation Division 91 of...
USS Geneva (APA-86)


Shot ABL (1 July 0900)

Geneva's crew boarded Applin before the detonation.

1 July

1552 USS Burleson (APA-67) removed the test animals from Geneva's topside.
1610 Geneva declared radiologically safe (Reference 5, pp. B-12 and B-13).

2 July

1158 The captain and a radiological monitor reboarded.
1220 Teams A and B returned to Geneva.
1330 The radsafe monitor declared Geneva free of all radioactivity.

3-23 July

Anchored in berth 365.

Shot BAKR (25 July, 0835)

24 July

0630 Began closing up ship.
1010 Evacuation of Geneva's crew to Applin complete.

25 July

1218 Geneva declared Geiger sweet.
2312 Radiological clearance was given (Reference 5, pp. D-11 and D-19).

22 July

1618-1636 Test: animals removed by Navy Medical Research Unit on USS Conserver (ARS-39).

29 July

1335 The commanding officer and the Geiger monitor reboarded Geneva.
1350 Team A reboarded.
1410 Team B reboarded.
1420 Geneva declared Geiger sweet.
1530 Team C reboarded.
1600 Geneva returned to normal operation.

4-5 August

A trial run was conducted.

5 August

0731 Jettisoned an aircraft.

24 August

1647 Left Bikini Atoll.

25 August

1208 Arrived at Kwajalein Atoll.

13 October

Departed for Pearl Harbor.

21 October

Arrived at Pearl Harbor.

25 October

Departed for San Francisco.

4 November

Arrived at San Francisco.

USS George Clymer (APA-27)

Shot ABL Location: >21 nmi (39 km) ENW
Shot BAKR Location: >18 nmi (33 km) ENE
Decontamination Location: San Diego
Operational Clearance: By 22 November 1946
Final Clearance: 7 February 1947

Task Unit and Function
Attack transport Clymer was a support ship in Transportation Division 31 of TU 1.3.1 (Transport Unit). Its function was to house target ship crews during and after the two detonations.

Shot ABL (1 July, 0900)

Clymer housed crews from target ships USS Pennsylvania (BB-38) and USS Nevada (BR-36). The crews returned to their ships on 2 and 3 July.

1 July

0519 Underway for area Marmon outside the harbor.
1728 Anchored in berth 300, Bikini Atoll.

2 July

1525 Shifted to berth 244.

7-9 July

Moored next to Nevada to furnish it steam.

9 July

1917 Anchored in berth 268.

Shot BAKR (25 July, 0835)

23-24 July

Personnel from Pennsylvania and Nevada were transferred to Clymer.

25 July

0316 Underway for area Marmon outside the harbor, steaming with TG 1.3.

30 July

0515 Reentered Bikini Lagoon.
0623 Anchored in berth 262, Bikini Atoll.

2 August

1440 Shifted to berth 333.

9 August

1026 A radiological test was conducted on Clymer's evaporators. The test concluded that the evaporators were radiologically safe for personnel.

Radsafe section of JTF 1 conducted a radiological inspection of Clymer and found no radiation hazards.

20 August

0935 Radiological monitors reported on board. Radiological party left and made the following recommendation: "We have examined the passengers, personnel, and material, including evaporators and engine rooms, and find only the stated significant readings which would be no hazard under standard watch conditions. Therefore, we recommend that the ship is radiologically safe." Location of hazards: No. 3 condenser in engine room 0.12 R/24 hours (on surface) and 0.06 R/24 hours at 1-foot (0.3-meter) distance.

1225 Departed for Pearl Harbor.

Crew Size: 270
Bikini Atoll Arrival: 1 June 1946
Bikini Atoll Departure: 20 August 1946
USS Gilliam (APA-57)

**USS GILLIAM (APA-57)**

**Crew Size:** 91

**Bikini Atoll Arrival:** Before 30 June 1946

**Crew location for Shot ABLE:** USS Bottineau (APA-235)

**Crew location for Shot BAKER:** Various task force units

**Shot ABLE Location:** 47 yards (43 meters) NNW

**Shot BAKER Location:** 12 nmi (22 km) NE

**Decontamination Location:** Pearl Harbor/Los Angeles

**Operational Clearance:** 9 January 1947

**Final Clearance:** 10 January 1947

**Task Unit and Function**

Gilliam, an attack transport, was a target vessel during CROSSROADS. Its crew was evacuated before shot ABLE and never returned. It served in Transportation Division 91 of TU 1.2.6 (Merchant Type Unit). Gilliam was equipped with transmitters under the control of the Electronics Group.

**Shot ABLE (1 July, 0900)**

Gilliam's crew was evacuated to Bottineau before the detonation. Gilliam sank as a result of the detonation. Diving operations were conducted later for examination of the ship.

**Shot BAKER (25 July, 0835)**

Gilliam's crew was dispersed to various units of the task force on 8 July.

**GILSS, JAMES M.: see USS JAMES M. GILLS (AGS-13)**

USS Gypsy (ARSD-1)

**USS GYPSY (ARSD-1)**

**Crew Size:** 77

**Bikini Atoll Arrival:** 10 July 1946

**Bikini Atoll Departure:** 5 September 1946

**Shot ABLE Location:** On route from Pearl Harbor to Kwajalein Atoll

**Shot BAKER Location:** 12 nmi (22 km) SE

**Decontamination Location:** Pearl Harbor/Los Angeles

**Operational Clearance:** 9 January 1947

**Final Clearance:** 10 January 1947

**Task Unit and Function**

Gypsy, a salvage lifting ship, served in TU 1.2.7 (Salvage Unit). Its functions included towing, underwater work using divers, and salvaging damaged target vessels.

**Shot ABLE (1 July, 0900)**

10 July

0915 Moored in berth 141, Bikini Atoll.

1542 Underway to USS LST-861.

1522-1636 ...were alongside LST-861 to discharge mail.

1735 Anchored in berth 29.

11 July

1110 Anchored in berth 141.

1725 Anchored in berth 29.

12 July

1716 Anchored off Enew Island.

1230 Loaded anchors and chain.

13 July

1412 Let go port anchor after shifting anchorage off Enew Island to salvage lost anchor.

1620 Completed salvaging two anchors and chain.

1645 Shifted berths.

1705 Anchored off Enew Island.
USS Gypsy (ARSD-1)

14 July
1030-1100 Recovered third anchor.
1105 Underway to USS Fulton (AS-11).
1220 Anchored off Fulton.
1545 Completed transferring anchors to Fulton.
1620 Anchored in berth 29.

16 July
After receiving anchors from USS Mento (APA-45), anchored in unspecified anchorage.

17 July
0722-0810 Alongside USS Rolette (AKA-99) to dispose of anchor chains.
0828-1032 Alongside USS Ottawa (AKA-101) to transfer anchors and chains.
1122-1420 Alongside USS Enoree (AO-69) to take on fuel.
1500 Anchored in berth 69.

18 July
0925-1020 Alongside USS Palmyra (ARS-13-3) to load dynamite.
1250 Anchored off Oroken Island and commenced diving operations.

19 July
0700 Diving party left ship to continue diving operations.

20 July
0907 Moored to USS George Clymer (APA-27).
1620 Underway from Clymer.
1704 Moored portside to target submarine USS Apogon (SS-308).
1912 Underway from Apogon.
1932 Anchored in berth 240.

21 July
0602 Moored alongside Apogon.
0810 Underway from Apogon.
0840-1020 Alongside Clymer.
1032-1205 Alongside Apogon.
1350 Anchored in berth 220.
1610-1748 Moored alongside Clymer.
1800-1921 Moored to target submarine USS Dentuda (SS-335), discharging weights.
1943 Anchored off berth 316.

22 July
0550 Underway for alongside Dentuda to complete hanging weights.
0600 Moored to Dentuda, proceeding to Clymer to receive weights for target submarine USS Tuna (SS-203).
0720-1110 Alongside Clymer.
1130-1345 Alongside Tuna, placed weights aboard.
1417 Anchored in berth 64.
1910 Anchored in berth 29.

23 July
1205 Anchored in berth 119.

24 July
0530 Anchored near berth 23.
1205 Picked up monitor for ship during test BAKER.
1300 Underway for operating area for test BAKER.

Shot BAKER (25 July, 0835)

25 July
1210 Anchored off Eneu Island near berth Sugar.

26-27 July
Anchored as before.

28 July
1058 Underway to the vicinity of Dentuda.
1043 Arrived in vicinity of Dentuda, standing by to assist USS Cougal (ARS-8) if required.
1135 Underway to Palmyra.
1200 Standing to off Palmyra.
1325 Anchored in berth Sugar.
1610 Underway to discharge two anchors for mooring Dentuda.
1655 Operations completed, returning to anchorage.
1838 Anchored in unspecified anchorage.

29 July
1229 Underway: proceeding to target area to recover submarine anchors.
1400 Commenced recovering anchors.
1500 Geiger reading of anchor chain 0.25 R/24 hours.
1520 Recovering anchor in vicinity of Ionchebi Island.
1555 Discharged anchor in lee of Ionchebi Island.
1600 Anchor deposited: underway to recover second anchor.
1830 Anchored in unspecified area.

30 July
0600 Underway.
0705 Laying to off USS Reclaimer (ARB-42).
0749 Underway for target submarine USS Searaven (SS-196).
1220 Moored to Searaven.
1300 Underway from Searaven: Geiger meter reading above tolerance.
0910 Commenced washing submarine.
1091 Secured from washing Searaven, laying to.
1532 Proceeding to assigned anchorage.
1600 Anchored in lee of Eneu Island.

31 July
Remained anchored.

1 August
1 Underway.
0556 Moored to Searaven: commenced recovering anchors.
0640 Underway from alongside Searaven with first anchor.
0725 Discharged anchors to wet storage in lee of Eneu Island, proceeding to Searaven to recover stern anchor.
1020 Moored to Searaven.
1145 Underway from alongside Searaven, proceeding to anchorage.
1540 Anchored off Eneu Island.
1616

2 August
0931 Shifted berths off Eneu Island.
1810 Anchored south of berth 376.

3 August
1055 Underway for salvaging anchors.
USS Gypsy (ARSD-1)

### 3 August

- **1355** Anchored in area of Tuna, sweeping for anchors.
- **1445** Underway to area of Dentuda to anchor and sweep.
- **1455** Anchored.
- **2100** Recovered two anchors and chain.
- **2114** Underway, proceeding to lee of Tonchebi Island to discharge anchor and chain.
- **2215** Laying off north side of Tonchebi Island, discharging anchor and chain.

### 4 August

- **0025** Completed discharging anchor and chain.
- **0114** Anchored south of numbered berths, near berth 376.

### 5 August

- **0855** Underway to Palmyra.
- **1005** Anchored off Eneu Island, commenced recovering submarine anchors.
- **1010** Moored to spring buoy astern of anchorage.
- **1210** Salvaged anchors.
- **1300** Underway for wet storage off Tonchebi Island to dispose of anchors.
- **1645** Anchored off Tonchebi Island.

### 6 August

- **0830-1007** Conducted diving operations in connection with ballooned anchors.
- **1325-1435** Conducted diving operations in connection with ballooned anchors.
- **1600** Underway to Tonchebi Island to dispose of anchors.
- **1840** Anchored.

### 7 August

- **0907** Underway to retrieve anchors.
- **0930** In vicinity of Tonchebi Island to retrieve anchors.
- **1054** Underway to retrieve cable.
- **1115** Cable retrieved.
- **1120** Underway, laying to off Coucal.
- **1320** Underway to anchorage.
- **1355** Anchored in assigned berth.

### 8 August

- **0732** Underway to salvage wire slings from Sea Raven.
- **0805** Moored to Sea Raven, recovering wire slings.
- **1122** Started to clear side of Sea Raven, anchor fouled with Sea Raven anchor chains.
- **1405** Cleared fouled anchor chain; laying to while awaiting orders from CTU 1.2.7.
- **1609** Underway, proceeding to anchorage.
- **1635** Anchored in assigned berth.

### 9 August

- **1435** Moored to spring buoy in berth 54-A.
- **2245** Underway to recover partially sunken LCM.
- **2316** Commenced recovery operations of LCM first line to boat.

### 10 August

- **0335** Completed salvaging LCM, proceeding to vicinity of Rolette.
- **0455** Anchored near Rolette.
- **0755** Released LCM.
- **1125** Moored to spring buoy in berth 54-A.

### 11 August

- **0730** Underway, proceeding to assigned berth, unable to discharge anchor and chain.
- **1108** Moored to spring buoy 54-A.

### 12 August

- **1030** Underway to Dentuda and Tuna to discharge anchor and chain.

### 13 August

- **0900** Discharged anchor.
- **0905** Moored to target submarine USS Skate (SS-305).
- **1205** Underway after transferring anchor and chain to Skate; proceeding to assigned berth.
- **1355** Underway, proceeding to assigned berth.

### 14-18 August

- **19 August** Moored as before.
- **20 August** Moored as before.
- **21 August** Moored alongside target ship USS New York (BB-34).
- **22 August** Discharged winch to LCM.
- **23 August** Underway; proceeding to target ship USS Butte (APA-68) to take anchor and chain on board.

### 14-18 August

- **19 August** Moored as before.
- **20 August** Moored alongside target ship USS New York (BB-34).
- **21 August** Underway.
- **22 August** Underway; proceeding to target ship USS Butte (APA-68) to take anchor and chain on board.
- **23 August** Underway; proceeding to target ship USS Butte (APA-68) to take anchor and chain on board.
- **24 August** Fueled from Enoree.

### 25 August

- **0755** Released LCM.
- **0945-1230** Underway, proceeding to berth of USS LST-388.

### 26 August

- **0800** Underway, proceeding to berth of USS LST-388.
- **1535** Underway from vicinity of LST-388, proceeding to berth 54-A.
USS Gypsy (ARSD-1)

24 August

1555 Anchored in Berth 54-A.

25 August

274 Underway to transfer chains and anchors.

0755-1040 Transferred anchor chain to USS Shaka-maxon (KN-88).

1040 Underway to vicinity of Bikini Island beach to make preparation to clear beach of craft.

1157 Underway from salvage operations.

1402 Moored to beach to salvage target vessel LCT-1237.

26 August

0115 Reveille to start operations for towing LCTs, LCMs, and LCVPs off beach.

0215 Floated all boats clear of beach.

0555 Underway.

0624 Anchored in vicinity of beach at Bikini Island.

1505 Underway, starting operations of clearing Bikini Island beach of LCTs and other craft.

1535 Moored, commenced operations on target vessel LCT-414.

27 August

0930 Continued trying to haul LCT-414 from beach at high tide.

0959 Discontinued use of engines, waiting for high tide.

1436 Commenced backing both engines in operations to free LCT-414 from beach.

1717 LCT-414 free from beach.

1505 Having turned LCT-414 over to demolition team of Palmyra, commenced maneuvering to return to beach area to salvage sunken LCM.

1744 Floated LCM clear of beach.

1822 Anchored off Bikini Island.

29 August

0745 Underway to retrieve mooring anchor.

1014 Recovered mooring anchor, commenced maneuvering and approaching sunken target vessel LCT-1187.

1138 Moored off Bikini Island in vicinity of LCT-1187, making necessary preparations to float LCT-1187.

1500 Pulled LCT-1187 off beach and sank it in 70 feet (21 meters) of water.

1645 Underway for Bikini beach to salvage LCM-5 and LCM-6.

1715 Moored off Bikini beach, preparing to salvage LCMs.

1805 Pulled LCM-5 off beach.

1830 Underway to anchorage.

1850 Anchored off Bikini Atoll.

30 August

1200 Operations continued with target vessel LCT-812.

1300 Wire and all hose run out and secured to LCT-312.

1457 Heaved LCT-812 from beach.

1500 Completed taking ship's moorings, post anchor fouled.

1700 Towed LCT-812 to deep water: LCT-812 sunk.

1715 Anchored off Bikini Island beach.

1810 Hauled LCM-5 from beach.

1904 Proceeding to anchorage off Bikini Island.

1910 Anchored off Bikini Island.

1 September

0750 Underway to haul target vessel LCT-1175 from beach.

1900 Continued operations on LCT-1175.

2 September

1750 Discontinued operations on LCT-1175 and underway.

1907 Mooted close to USS Widgeon (ASR-1) to assist in salvage of target submarine USS Skipjack (SS-184).

3 September

0800 Hauling ship to position to make lift.

0830 Moored ship over bow of submarine.

1155 Submarine surfaced, all clear.

1320 Proceeding to anchorage off Bikini Island.

4 September

1300 Underway to salvage target vessel LCT-1113.

0845 Moored to LCT.

0800 On receiving orders to cancel operations on LCT, heaved around anchors.

1124 Underway to recover buoyed anchors used previously for salvage work.

1135 Anchors recovered, proceeding to vicinity of Widgeon.

1419 Anchored off bow of Widgeon.

2115 Underway to pick up starboard anchor of Skipjack.

2150 Laying to off Widgeon.

5 September

0800 Underway to pick up tow wire from Skipjack.

1307 Anchored off bow of submarine.

1420 Took tow wire off Skipack.

1446 Departed for Kwajalein towing Skipack.

7 September

0840 Anchored in berth D, Kwajalein.

8 September

Cast off Skipack to Widgeon, proceeded to anchorage.

9 September

Towed YF-990 from beach at Kwajalein; cast vessel off to USS Chowanoc (ATF-100).

10-15 September

En route from Kwajalein to Pearl Harbor.

16 September

Arrived at Pearl Harbor.
personnel from radiological hazards and collecting samples of water, food, clothing, drugs, and general storekeeping items that were tested. Radiosafe section was headquartered aboard the ship. [During the period that Haven was engaged in CROSSROADS activities, it carried the hull number APH-112.]

Shot ABLE (1 July, 0900)
30 June
1532 Left the lagoon for area Graham.
1 July
1504 Anchored in berth 131A, Bikini Atoll.
2 July
1123 Shifted to berth 34A.
5 July
1600 Official observers reported aboard.

Shot BAKER (25 July, 0835)
24 July
1538 Underway for area Graham.
25 July
0835 Observed blast in area Chevrolet. Anchored in berth Roger, Bikini Atoll.
28 July
1044 Shifted to berth C.
30 July
1735 Shifted to berth 34A.
2 August
1650 Moved to berth 383.
25 August
1603 Departed for Kwajalein Atoll.
26 August
Arrived at Kwajalein.
10 October
Left Kwajalein for Pearl Harbor.
15 October
Arrived Pearl Harbor.

USS HENRICO (APA-45)

Crew Size: 424
Bikini Atoll Arrival: Before 2 June 1946
Bikini Atoll Departure: 16 August 1946
Shot ABLE Location: >13 nmi (24 km) SE (area federal)
Shot BAKER Location: 8 to 10 nmi (15 to 19 km) SE (area Chalmers)
Decontamination Location: San Francisco
Operational Clearance: 28 January 1947
Final Clearance: 3 February 1947

Task Unit and function
Henrico, an attack transport, served in Transportation Division 3.1 of TU 1.3.1 (Transport Unit). Its functions were to house target vessel crews during and after the detonations and to serve as a mothership for LCPL radiological patrol boats.

Shot ABLE (1 July, 0900)
30 June
1438 Underway for area Mercury, steaming with USS Apling (APA-56) and USS Artemis (AKA-21).

USS Hesperia (AKS-13)

Crew Size: 139
Bikini Atoll Arrival: Before 1 July 1946
Bikini Atoll Departure: 22 August 1946
Shot ABLE Location: Kwajalein Atoll
Shot BAKER Location: 15 nmi (28 km) E
Decontamination Location: Pearl Harbor
Operational Clearance: 28 December 1946
Final Clearance: 4 January 1947

Task Unit and function
Hesperia was a general stores issue ship that served in TU 1.6.1 (Repair and Service Unit). Its function was to provide provisions to other support ships during the operation.

Shot ABLE (1 July, 0900)
30 June
1222 Anchored in berth K-17, Kwajalein.
USS Hesperia (AKS-13)

1 July
1356 Underway for Bikini.

2 July
1222 Anchored in berth 230 Bikini.

3 July
1349 Anchored in berth 145. Bikini.

4-24 July Routine supply-issuing operations.

Shot BAKER (25 July, 0835)

24 July
1500 Underway for area Packard.

25 July
0950 Left formation en route to Rongelap Atoll.
1623 Anchored in berth 35. Rongelap Atoll.

29 July
1830 Underway from Rongelap to Bikini!

30 July
0857 Anchored in berth 145. Bikini.
1147 Anchored in berth 131A. Bikini.

31 July 2 August Routine operations.

2 August
1852 Anchored in berth 369. Bikini Atoll.

5 August
1641-1817 LCT-1377 moored alongside.

7 August
0926 Anchored in berth 131A. Bikini.

8 August
1257-1526 LCT-1420 moored alongside starboard.

14 August
1020 Anchored in berth 191. Bikini.

27 August
0900 Inspected by JTF 1 Radsafe Ship Clearing Board for radioactivity. Cleared of radioactivity except for evaporators.

23 August
1355 Underway for Kwajalein.

24 August

31 August
Underway for Pearl Harbor.

12 September Arrived Pearl Harbor.

USS Hughes (DD-410)

1 July
Crew evacuated to Bayfield.

2 July
1330 Team A under commanding officer reboarded to survey damage.
1400 Team B reboarded; commanding officer inspected holds and lower decks and opened up secured compartments.
1415 Started emergency diesel generator for lighting and power. Inspection disclosed extensive superficial damage and damage to boiler air casings. Damage reported to CFF 1.

5 July
1340-1435 Towed by USS Clamp (ARS-33) from berth 61 to USS Dixie (AD-14) in berth 91 for repair work on boiler air casings.

6 July
1430-1500 YTF-107 removed unstable ammunition.

12 July
0830 Underway from Dixie to assigned berth 163.
1015 Anchored in berth 163. Bikini.

23 July
1710 Team C of reboarding organization left for Bayfield.

24 July
0745 Team B of reboarding organization departed for Bayfield.
1000 Team A left for Bayfield.

Shot BAKER (25 July, 0835)

28 July
Beached off Eneu Island, southeastern part of lagoon, by USS Reclaimer (ARS-42) to prevent possible sinking because of damage sustained during BAKER.

1 August
1300 All Hughes personnel transferred from Bayfield to USS Rockingham (APA-229).

10 August
0845-1000 Commanding officer and nine others in boarding party reboarded Hughes for preliminary decontamination and inspection work. Boarding party departed for Rockingham.

12 August
1400 Ship pumped dry. Retracted from beach by salvage tug and moored to a buoy west of Eneu Island.

13 August
0900-1130 Three-man boarding party aboard ship to assist in salvage operations. Boarding party left ship and returned to Rockingham.

338
14 August
0846-1030 Three officers and boarding party reboarded ship for salvage and inspection work. Boarding party departed.
1440 Four officers and boarding party reboarded for inspection.
1430 Rear admiral boarded ship for inspection of damage.
1600 Rear admiral and party departed.
1615 Ship's boarding party departed for Rockingham.

15 August
0830-1115 Commanding officer and electronics officer with boarding party reboarded ship to continue damage inspections and assist in salvage operations. Boarding party returned to Rockingham.

16 August
0830 Executive officer, first lieutenant, and boarding party boarded ship for inspection and salvage operations.
1130 Boarding party departed for Rockingham.

17 August
0942 Captain and electronics officer with boarding party reboarded ship to continue damage inspections and salvage operations.
1130 Boarding party left ship and returned to Rockingham.

18 August
0832 Commanding officer and first lieutenant reboarded ship with boarding party for inspection purposes; boarding team and executive officer departed.
1230 Ship docked for inspection in ARD-29. Executive officer and party were relieved by first lieutenant and party.
1330 Boarding party departed for Rockingham.

21 August
0800-1115 Commanding officer and others reboarded ship for inspection purposes; boarding team and executive officer departed.
1300-1700 Boarding team reboarded ship to set material condition 7; boarding team departed for Rockingham.

22 August
0840 Commanding officer and others boarded ship to assist in undocking.
0920 Ship undocked and taken in tow by USS Shokanax (AN-88).
1100 Hove to buoy; boarding party departed for Rockingham.

23 August
0940 First lieutenant and boarding party reboarded ship to take aboard an anchor and 96 fathoms (162 meters) of chain.
1150 Boarding party departed for Rockingham.

24 August
1700 All Hughes personnel on Rockingham under way for Kwajalein.

28 August
0900 Transferred entire crew of Hughes to remained target ship USS Niagarta (APA-87). Hughes decommissioned.

16 September
Topside average 0.3 R/24 hours (Reference 7).

Hughes was towed to Puget Sound Naval Shipyard in May 1947, arriving on 31 May, for radiological tests.

HUNTINGTON, ROBERT K.; see USS ROBERT K. HUNTINGTON (DD-410)

US INDEPENDENCE (CVL-22)

Crew Size: 345
Bikini Atoll Arrival: Before 30 June 1946
Bikini Atoll Departure: 25 August 1946
Crew Location for Shot ABLE: USS Rockwall (APA-230)
Crew Location for Shot BAKER: Rockwall
Shot ABLE Location: 650 yards (594 meters) SW Shot BAKER Location: 1,420 yards (1.3 km) W
Decontamination Location: San Francisco
Sunk 26 January 1951 off the southern California coast

Task Unit and Function

Independence, a small aircraft carrier, was a target vessel during CROSSROADS. Its crew was evacuated before both shots. It served in Carrier Division 31 of TU 1.2.2 (Aircraft Carrier Unit).

Ordinance Group and test aircraft on its flight deck.

Shot ABLE (1 July, 0900)

30 June
1017 Evacuated Group II, a total of 8 officers and 103 enlisted men to Rockwall.
1315 Completed evacuation of Group III. 6 officers and 62 enlisted men.

3-33-1042
1412 Inspection team aboard.

1 July
1402 A large fire was reported aboard. Un approachable due to contaminated water surrounding ship (Reference 5, p. B-111).
1757 More fires and explosions reported (Reference 5, p. B-111).

2 July
1200 Towed by APA-186 in western target array.

4 July
By this date, initial boarding team had been aboard (date unknown) and declared the ship safe for reboarding by Teams A and B.

339
USS Independence (CVL-22)

4 July

1341 Captain and his party reboarded the ship.
1353 Team A, consisting of 13 officers and 28 enlisted men, completed reboarding and commenced inspection of the ship with one radiological monitor.
1400-1440 Team B reboarded ship and moved to forward end of the flight deck under the command of the engineering officer.
1547 Party from USS Dulcison (APA-67) came aboard to photograph, inspect, and pick up animals.
1630-1715 Evacuated ship.

5 July

0845 Captain and party reboarded ship.
0905 Team A and selected members of Team B reboarded ship.
1530-1620 Evacuated ship.

6 July

0845 Captain and party reboarded ship.
0910 Team A and selected members of Team B reboarded ship.
0955-1055 Inspection party aboard.
1540-1545 Evacuated ship.

7 July

0850 Captain and party reboarded Independence. Team A and selected members of Team B and the ship's company reboarded.
1545-1705 Evacuated ship: three signalmen left aboard for anchor watch.

8 July

0850 Captain and party reboarded Independence. General working party and designated officers reboarded.
1530-1725 Evacuated ship.

9 July

1030 Moved to new berth.
1045 Embarked in small boats from Rockwall and proceeded to Independence.
1650 Evacuation of ship completed except for engineering and signal watch.

10 July

0750 Embarked in small boats from Rockwall and proceeded to Independence.
1625 Completed evacuating ship.

11 July

0800 Completed boarding ship from Rockwall.
1535 Completed evacuation of ship: one officer and eight enlisted men left aboard as watch standers.

12 July

0830 Reboarded Independence.
1615 Completed evacuation of ship except 37 selected men of B division and other selected divisions.

13 July

0750 Crew aboard ship.
1550 commenced evacuation of ship for Rockwall.
1610 Captain departed ship.

14 July

0745 Embarked from Rockwall in small boats and proceeded to Independence.
1530 Completed evacuation of ship.

15 July

0730 Embarked from Rockwall and proceeded to Independence.
1630 Evacuated personnel returned to Rockwall for the night.

16 July

0930 Salvage barge came alongside with divers to check screws and bottom of ship from frame 108 aft.
1700 Completed evacuation of personnel to Rockwall.

17 July

0755 Party for day's work came aboard Independence.
1037 In newly assigned berth, towed by USS Delver (ARS-23).
1950 Completed mooring operations.

18 July

0745 Commenced receiving men from Rockwall.
1314 Ship completely evacuated for William B. Rehearsal.

19 July

1418 Certain men from the R and E divisions reboarded Independence.

20 July

0755 Commenced receiving men from Rockwall.

21 July

0753 Working parties from Independence crew aboard Rockwall began coming aboard.

22 July

1000 Working parties of Independence crew arrived from Rockwall.

23 July

0755 Completed evacuating personnel to Rockwall.

Shot BAKER (25 July, 0835)

24 July

0800 Captain and party boarded ship.
1145 Commenced evacuating personnel from ship.
1316 Captain and party left the ship. Ship completely evacuated to Rockwall, engineering plant completely secured, all cross-connecting lines secured, and in condition of maximum watertight integrity for shot BAKER.

27 July

1655 Portside very radioactive (Reference 6, p. 1-24-B).

1 August

0915-1330 RadSAFE monitors and 30-man boarding party opened Independence. Inspecting for explosive and toxic gases and lack of oxygen and monitoring radioactivity. A few spaces were intolerable and capable of sustaining life -- all engineering spaces, main deck forward of hangar deck, and a few deck areas. The only damage was the high radioactivity evident on all
USS Independence (CVL-22)
18 August

Surfaces exposed to weather. Boarding party left.
1000 commenced transferring personnel to other units for return to United States.
19 August
0930-1320 Boarding party of 41 men and 2 monitors boarded. Proceeded with inspection of ship, opening of compartments, testing for explosive gases, and radioactivity. Soundings were taken of all voids in engineering and C and R spaces. No unusual soundings indicating hull damage other than slight derangement of loose articles of furniture.
A 19 August report documented the radiation found on Independence as follows: 0.4 R/24 hours in the forward D.C. pump room and trunk and compartments A203-2A, A203-1A, A202-A, C407L, C408L. C202L. CPO mess was 4 R/24 hours starboard side and 1 R/24 hour starboard side: compartment C4147 was 2 R/24 hours. C206L was 7 R/24 hours. C515E (8 inches of water) and C306L were 0.6 R/24 hours, and C306-3A and C310L were 1.5 R/24 hours.
20 August Reboarded Independence. Three redsafe monitors accompanied the 43-man boarding party.
0835-1200 Director of Ship Material aboard to inspect engineering spaces, hull, electrical systems, and armament.
1320 Evacuated ship.
21 August
0900-1300 Forty-man boarding party with one radiological monitor reboarded ship to pump out engineering spaces and close up ship; 1225 Laying to and taking bathythermograph topside average 0.65 R/24 hours (Reference 7). Boarding party returned to Ajax.
22 August Independence decommissioned.
25 August Towed to Kwajalein by USS Munsee (ATF-107).
1 October Topsides average 0.4 R/24 hours (Reference 7).
On 16 June 1947 Independence arrived at San Francisco where it underwent decontamination studies until 1957.

USS INGRAHAM (DD-694)

Shot ABLF (1 July, 0900)
1 July Steaming independently in area near Point Victor.
1823 Stopped all engines: laying to for purpose of taking readings: evidence of slight radioactivity in area.
1900 Underway.
1941 Laying to to take readings.
2241 Laying to to take readings.
2308 Underway in area about 70 nmi (130 km) north of Bikini to collect scientific data in connection with CROSSROADS.
2 July 0100-0501 Laying to to take oceanographic readings.
1254 Entered Bikini Atoll.
1319 Anchored in berth 116.
4-7 July Routine activities.
5 July Anchored in berth 116. After refueling from USS Enoree (AO-6b).
8 July Underway from Bikini Lagoon en route to Point Nan (about 20 nmi (37 km) north of Bikini) for oceanographic survey.
1210 Underway to Point Victor.
1225 Laying to and taking bathythermograph data every 20 minutes.
9 July Laying to adjusting position to take oceanographic data.
10 July Completed bathythermograph readings, underway.
0605 Joined formation with USS Allen M. Sumner (DD-692) and USS Robert K. Huntington (DD-781).
1210 Moored to USS Chikaskia (AO-54).
1222 Anchored in berth 116, Bikini.
11 July Underway for operating Point Victor for BAKER air rehearsal.
1222 Moored to USS Chikaskia (AO-54).
1222 Anchored in berth 116, Bikini.
14 July Underway for operating Point Victor for BAKER air rehearsal.
0525 Moored to USS Chikaskia (AO-54).
1222 Anchored in berth 116, Bikini.
1106 Mobility to USS Chikaskia (AO-54).
1106 Anchored in berth 116, Bikini.
18 July Underway to Point Victor.
1742 Underway to Point Victor.
1025 Laying to off Arikari Island to conduct radiological survey rehearsal (Operation Colgate).
20 July Underway for Bikini.
1418 Anchored in berth 116.
1601 Anchored in berth 116.

341
**USS Ingraham (DD-694)**

22 July
1700 Underway from berth 116N en route to Kwajalein.

23 July
0706 Anchored in Berth A-29, Kwajalein.
1600 Underway for Bikini.

24 July
0550 Standing in Bikini Lagoon being fueled by Enoree.
0827 Anchored in berth 116.
1230 Underway for test BAKER to vicinity of Point Victor, northwest of Bikini.

**Shot BAKER (25 July, 0815)**

25 July
0950 Joined up with Huntington, Leary, and Walke: maneuvered to stay in general vicinity of Bikini Island.
1913 Proceeding independently to position 70 nm (130 km) north of Bikini.
2220 Stopped all engines.
2225 Ship dead in the water; laying to collecting oceanographic data for CROSSROADS.

**USS James M. Gilliss (AGS-13)**

3 August Continued oceanographic survey, stopping at intervals to take soundings.

4 August
0001 Steaming independently northeast of Bikini Atoll conducting oceanographic survey.
0638-0925 Conducted oceanographic survey: made preparations for entering port.
1004 Anchored in berth King North.

7 August
1004 Anchored in berth 189.

9 August
1055-1206 Received fuel from Enoree.
1241 Anchored in berth 189.

10 August
0754 Underway to San Diego, California, via Pearl Harbor with Destroyer Squadron 7.

15 August
Arrived at Pearl Harbor.

**USS JAMES M. GILLISS (AGS-13)**

Crew Size: 40

Bikini Atoll Arrival: 4 July 1946
Bikini Atoll Departure: 20 August 1946
Location for Shot ABL: Wotho Atoll (100 nm [160 km])
Location for Shot BAKER: Wotho Atoll (100 nm [160 km])

Decontamination Location: San Francisco
Operational Clearance: 13 November 1946
Final Clearance: 13 November 1946

Task Unit and functions:

Gilliss was a surveying ship in TU 1.8.5 (Survey Unit). Its functions were surveying the probable effects of the nuclear tests on fish and wildlife and conducting oceanographic surveys to determine the character of the ocean currents in and around Bikini Atoll.

**Shot ABL (1 July, 0900)**

4 July
1410 Arrived at Bikini Atoll.
1700 Anchored in berth 207A.

15 July
0710 Underway for a geophysical survey station off Iroij Island.
0830 Reanchored in Bikini Lagoon.

17 July Conducted a geophysical survey off Ilotech Island.

28 July Conducted an oceanographic survey off Adrikian Island.

19-22 July Conducted oceanographic surveys in Bikini Lagoon.

**Shot BAKER (25 July, 0815)**

24 July
0559 Departed for Wotho Atoll.
1625 Arrived at Wotho Atoll.

26 July Stationed in Hangelop Atoll.
### USS James M. Gilliss (AGS-13)

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<tbody>
<tr>
<td>1-3 August</td>
<td>Conducted oceanographic surveys at Rongelap Atoll.</td>
</tr>
<tr>
<td>4 August</td>
<td>Left for Bikini Atoll.</td>
</tr>
<tr>
<td></td>
<td>Arrived and anchored at Bikini Atoll.</td>
</tr>
<tr>
<td>20 August</td>
<td>Departed for Pearl Harbor.</td>
</tr>
<tr>
<td>1 September</td>
<td>Arrived at Pearl Harbor.</td>
</tr>
</tbody>
</table>

### USS Kenneth Whiting (AV-14)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 August</td>
<td>Conducted an oceanographic survey of the lagoon, then anchored in an unidentified berth.</td>
</tr>
<tr>
<td>5-10 August</td>
<td>Conducted oceanographic surveys of the lagoon.</td>
</tr>
<tr>
<td>12-13 August</td>
<td>Took bottom samples northwest of the lagoon.</td>
</tr>
<tr>
<td>20 August</td>
<td>Departed for Pearl Harbor.</td>
</tr>
</tbody>
</table>

### USS John Blish (AGS-10)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July</td>
<td>Enew personnel came aboard, being evacuated according to ABLE plan.</td>
</tr>
<tr>
<td>1528</td>
<td>Steamed to an area off Burok Island.</td>
</tr>
<tr>
<td>4 July</td>
<td>Departed for Bikini Atoll.</td>
</tr>
<tr>
<td>1524</td>
<td>Anchored at Bikini Atoll.</td>
</tr>
<tr>
<td>6-9 July</td>
<td>Conducted biological surveys.</td>
</tr>
<tr>
<td>11-14 July</td>
<td>Conducted oceanographic surveys.</td>
</tr>
<tr>
<td>17 July</td>
<td>Departed for Rongelap Atoll.</td>
</tr>
<tr>
<td>18 July</td>
<td>Arrived at Rongelap Atoll.</td>
</tr>
<tr>
<td>25 July</td>
<td>Anchored at Rongelap Atoll.</td>
</tr>
<tr>
<td>1034-1540</td>
<td>Steaming off of Burok Island.</td>
</tr>
<tr>
<td>1540</td>
<td>Anchored at Rongelap Atoll.</td>
</tr>
<tr>
<td>20-30 July</td>
<td>Conducted oceanographic surveys at Rongelap Atoll.</td>
</tr>
<tr>
<td>31 July</td>
<td>Conducted a geological survey at Rongelap Atoll.</td>
</tr>
<tr>
<td>0600-1737</td>
<td>Underway for Bikini Atoll.</td>
</tr>
<tr>
<td>1 August</td>
<td>Anchored in an unidentified berth at Bikini Atoll.</td>
</tr>
<tr>
<td>0655</td>
<td>Underway to collect bottom samples of the lagoon.</td>
</tr>
<tr>
<td>0840</td>
<td>Underway to collect bottom samples of the lagoon.</td>
</tr>
<tr>
<td>2 August</td>
<td>Collected bottom samples of the lagoon.</td>
</tr>
<tr>
<td>0921</td>
<td>Left for Bikini Atoll.</td>
</tr>
</tbody>
</table>

### USS Kenneth Whiting (AV-14)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July</td>
<td>Enew personnel came aboard, being evacuated according to ABLE plan.</td>
</tr>
<tr>
<td>0505</td>
<td>Enew personnel came aboard, being evacuated according to ABLE plan.</td>
</tr>
<tr>
<td>0506</td>
<td>Bikini personnel came aboard.</td>
</tr>
<tr>
<td>0525</td>
<td>Underway from berth 55, Bikini, to area Graham.</td>
</tr>
<tr>
<td>0746</td>
<td>Arrived on station in area Graham.</td>
</tr>
<tr>
<td>1553</td>
<td>Anchored in berth 55, Bikini.</td>
</tr>
<tr>
<td>1605</td>
<td>Enew and Bikini parties returned to ship.</td>
</tr>
<tr>
<td>1634</td>
<td>Anchored in berth 46, Bikini.</td>
</tr>
<tr>
<td>1900</td>
<td>Enew and Bikini parties returned to ship.</td>
</tr>
<tr>
<td>2 July</td>
<td>Anchored in berth 55, Bikini.</td>
</tr>
<tr>
<td>1318</td>
<td>Anchored in berth 55, Bikini.</td>
</tr>
<tr>
<td>9 July</td>
<td>No. 2 LCPL returned damaged to ship.</td>
</tr>
<tr>
<td>0927</td>
<td>Routine activities, not involved with target vessels.</td>
</tr>
<tr>
<td>1632</td>
<td>Anchored in berth 46, Bikini.</td>
</tr>
<tr>
<td>25 July</td>
<td>Anchored in berth 55, Bikini.</td>
</tr>
<tr>
<td>0442</td>
<td>Enew island personnel reported on board.</td>
</tr>
<tr>
<td>0507</td>
<td>Enew island personnel reported on board.</td>
</tr>
<tr>
<td>0511</td>
<td>Underway from berth 55, Bikini.</td>
</tr>
<tr>
<td>0724</td>
<td>Arrived on station, 8 nmi (14.8 km) from Point Auto.</td>
</tr>
<tr>
<td>1100</td>
<td>Anchored in berth Obue, Bikini.</td>
</tr>
<tr>
<td>28 July</td>
<td>Anchored in berth 46, Bikini.</td>
</tr>
<tr>
<td>1632</td>
<td>Anchored in berth 381, Bikini.</td>
</tr>
<tr>
<td>29 July</td>
<td>Anchored in berth 381, Bikini.</td>
</tr>
<tr>
<td>0913</td>
<td>Anchored 560 yards (465 meters) due west of berth ABLE, Bikini.</td>
</tr>
<tr>
<td>1007</td>
<td>Anchored in berth 55, Bikini.</td>
</tr>
</tbody>
</table>
USS Kenneth Whiting (AV-14)  

2 August 1612 Anchored in berth 382, Bikini.
7 August 1050 Anchored in berth 55, Bikini.
14 August 0844 Underway from Bikini en route to Pearl Harbor.
19 August 0903 Moored at Pearl Harbor.

USS LAFFEY (DD-724)

Crew Size: 251
Bikini Atoll Arrival: 4 June 1946
Bikini Atoll Departure: 10 August 1946
Shot ABLE Location: 19 nm (35 km) NE (area Hudson)
Shot BAKER Location: 14 nm (26 km) ENE
Decontamination Location: San Francisco
Operational Clearance: 2 November 1946
Final Clearance: 19 December 1946

Task Unit and function
The destroyer Laffey served in Destroyer Squadron 10, TG 1.7 (Surface Patrol). Its functions were to conduct oceanographic surveys and perform radiological monitoring during the operation.

Shot ABLE (1 July, 0900)
30 June

USS LAMSON (DD-367)

Crew Size: 119
Bikini Atoll Arrival: Before 30 June 1946
Crew Location for Shot ABLE: USS Henrico (APA-45)
Shot BAKER Location: Various ships
Shot ABLE Location: 762 yards (693 meters) NNE
Sunk 1 July 1946, Bikini Atoll

Task Unit and function
The destroyer Lanson was a target vessel during CROSSROADS. Its crew was evacuated before shot ABLE and never returned. It served in Destroyer Division 1 of TU 1.2.3 (Destroyer Unit).

Shot ABLE (1 July 1946)

Lanson crew was evacuated to Henrico before the detonation. On 1 July Lanson sank as a result of shot Able. Diving operations were later conducted for examination of the ship.

Shot BAKER (25 July, 0835)
The crew was dispersed among various task force vessels.
LCI-327

Crew Location for Shot ABLE: USS Bayfield (APA-33)
Crew Location for Shot BAKER: Bayfield
Shot ABLE Location: 2,441 yards (2.3 km) E
Shot BAKER Location: 2,443 yards (2.3 km) E
Sunk 30 October 1947 near Kwajalein Atoll

Task Unit and function

LCI-327, a landing craft infantry ship, was a target vessel during CROSSROADS. Its crew was evacuated before shot ABLE and did not return. It served in LCI Group 7 of TU 1.2.5 (Landing Craft Unit).

Shot ABLE (1 July, 0900)
1 July
1532 Test animals were removed from topside. Declared radiologically clear (Reference 5, pp. B-12 and B-13).
1610
2 July
1530 All hands reboarded ship. Commenced inspection of ship to determine damage.

Shot BAKER (25 July, 0835)
27 July
1431 A boarding party returned from LCI-327 (Reference 6, p. I-23-B). Unable to remain aboard because of radioactivity.
1450 Washed down by USS Current (ARS-22) using a high-pressure hose (Reference 5, p. D-31; Reference 6, p. I-32-B).
29 July
0925 Washed down again (Reference 6, p. I-38-B). Unable to reboard because of radioactivity.

Its crew was aboard USS Rockbridge (APA-228) between 27 August and later dispersed to other ships. Its crew was aboard USS Rockbridge (APA-228) between 1 and 28 August and later dispersed to other ships.

1 September
Towed to Kwajalein by ATA-180 and stranded on Bascomb Island until it was sunk.

LCI-329

Crew Size: 16
Bikini Atoll Arrival: Before 30 June 1946
Bikini Atoll Departure: 1 September 1946

Crew Location for Shot ABLE: USS Bayfield (APA-33)
Crew Location for Shot BAKER: Bayfield
Shot ABLE Location: 2,952 yards (2.6 km) E
Shot BAKER Location: 3,266 yards (3.0 km) NE
Sunk 16 March 1948 near Kwajalein Atoll

Task Unit and function

LCI-332, a landing craft infantry ship, was a target vessel during CROSSROADS. Its crew was evacuated before ABLE shot and never returned. It served in LCI Group 7 of TU 1.2.5 (Landing Craft Unit).

Shot ABLE (1 July, 0900)
1 July
1439 USS Ethah (AN 79) reported a small fire aboard LCI-332 (Reference 6, p. I-11-A).
2 July
1550 Team A, two officers, and eight enlisted men reboarded and inspected ship. Requested that remainder of crew return from evacuation transport.

Shot BAKER (25 July, 0835)

Crewmembers went aboard ship for unspecified amounts of time during 1 to 23 August. The crew was later dispersed to various task force units. On 28 August LCI-329 was decommissioned. It was towed to Kwajalein where it was used as part of the ship security detail until 22 February 1947.

LCI-620

Crew Size: 16
Bikini Atoll Arrival: Before 30 June 1946
Crew Location for Shot ABLE: USS Bayfield (APA-33)
Crew Location for Shot BAKER: Bayfield
Shot ABLE Location: Beached, Bikini Island, 3 nm (5.6 km) ENE
Shot BAKER Location: Beached, Bikini Island, 2.75 nm (5.1 km) NE
Sunk 10 August 1946, at sea off Bikini

Task Unit and Function
LCI-620, a landing craft infantry ship, was a target vessel during CROSSROADS. Its crew was evacuated before ABLE and never returned. It served in LCI Group 7 of TU 1,2.5 (Landing Craft Unit).

Shot ABLE (1 July, 0900)

Crew was evacuated to Bayfield before the detonation. LCI-620 was beached at slot 17 on Bikini Island.

Shot BAKER (25 July, 0835)

Crew aboard Bayfield during the detonation. LCI-620 was beached at slot 17, Bikini. The crew was embarked on USS Rockbridge (APA-228) between 4 and 13 August and on reassessed target ship USS Pullmore (APA-83) between 14 and 22 August. Crewmembers went aboard LCI-620 at various times, duration unknown, during the period of 30 June to 3 August.

LCI(L)-549

Crew Size: 22
Bikini Atoll Arrival: 1 June 1946
Bikini Atoll Departure: 24 August 1946
Crew Location for Shot ABLE: USS Bayfield (APA-33)
Crew Location for Shot BAKER: Bayfield
Shot ABLE Location: 4,553 yards (4.2 km) E
Shot BAKER Location: 3,933 yards (3.6 km) ENE
Decontamination Location: San Francisco
Operational Clearance: 4 April 1947
Final Clearance: August 1948
Final Disposition: Sold 19 August 1949, private purchase

Task Unit and Function
LCI(L)-549, a large infantry landing craft, was a target vessel during CROSSROADS. Its crew was evacuated before each shot. It was a member of TU 1,2.5 (Landing Craft Unit), LCI 7. It was loaded with ammunition and mines (Reference 3).

Shot ABLE (1 July, 0900)

10 June Crew evacuated to Bayfield.

1 July 1317 USS Etah (AN-79) (Team 7) ordered its team aboard.
1349 Etah came alongside and the boarding team went aboard.
1355 Declared Geiger sweet by Etah (Reference 6, pp. 7-I-A-9).
1610 Declared free of radiological contamination (Reference 5, p. VI-D-12).

2 July 1630 Boarded ship and inspected for damage. No damage except for a shaken galley smokestack.

Shot BAKER (25 July, 0835)

25 July 1307 USS Clamp (ARS-33) reported a boarding team aboard.
1310 Reported Geiger sweet (Reference 6, pp. 7-I-B-9).
28 July 1952 Reboarded and reported Geiger sweet by the DSM (Reference 5, p. VI-D-34).

LCI(L)-615 suffered no material damage from shot BAKER (Reference 2).

10 August Reboarded.
24 August Left Bikini for Kwajalein.
25 August 1345 Arrived at Kwajalein, where it remained as part of the ship security detail until June 1948.

LCI(L)-615

Crew Size: 16
Bikini Atoll Arrival: 1 June 1946
Bikini Atoll Departure: 4 September 1946
Crew Location for Shot ABLE: USS Bayfield (APA-33)
Crew Location for Shot BAKER: Bayfield
Shot ABLE Location: Slot 14, Bikini Island, 5,500 to 6,000 yards (5 to 5.5 km) NE
Shot BAKER Location: Slot 14, Bikini Island 6,000 yards (5.5 km) NE of center array
Decontamination Location: San Francisco
Operational Clearance: 30 June 1947
Final Clearance: 17 August 1948
Final Disposition: Sold 19 August 1949, private purchase

Task Unit and Function
LCI(L)-615, a large infantry landing craft, was a target vessel for CROSSROADS. Its crew was evacuated before each shot. It was a member of TU 1,2.5 (Landing Craft Unit), LCI 7. It was loaded with ammunition and mines (Reference 3).

Shot ABLE (1 July, 0900)

1 July 1317 Beached in slot N4, Bikini Island. All officers, men, and necessary gear on board Bayfield.
3 July 1516 Commanding officer, executive officer, and six men reboarded LCI(L)-615 with
necessary reboarding gear. Upon reboarding, ship found to have been looted, vandalized, and in very dirty condition. Machinery still in good condition. No direct damage resulted from the Able detonation.

**Commanding officer**

**Executive officer**

**Six men**

**Ship**

**Two men**

5 July

3 July

2 August

8 August

12 August

13 August

14 August

15 August

16 August

17 August

18 August

19 August

20 August

21 August

22 August

23 August

24 August

25 August

26 August

27 August

28 August

29 August

30 August

31 August

3 July

12 July

15 July

17 July

18 July

19 July

22 July

24 July

25 July

26 July

27 July

28 July

29 July

30 July

800 Commanding officer, executive officer, and six men evacuated the ship. Commanding officer reported verbally that the ship had been looted, vandalized, and was in unfit condition to live on. After the reports were made, officers and men returned to Bayfield with necessary gear.


1140 Commanding officer, executive officer, and executive officer boarded USS Rockbridge (APA-228) to receive messages pertaining to operation of LCI(L)-615.

Security guard consisting of four men reboarded LCI(L)-615 with necessary gear by order of the commanding officer.

Executive officer and five men to relieve security watch reported aboard by order of commanding officer.

Executive officer and four men left LCI(L)-615 to reboard Bayfield. Five-man security watch now aboard.

Rebeached ship.

Made second attempt to rebeach ship. Starboard anchor fouled, leaving it inoperative.

Commanding officer and four crewmembers reported aboard.

Attempted to disengage line fouled in starboard screw.

Attempt unsuccessful.

Retracted from beach.

Maneuvering off beach at Bikini.

Making preparations to rebeach.

Beached ship in slot #14.

Commanding officer and four crew members left ship for Bayfield.

Five-man security detail left.

Six-man security detail reboarded ship.

Three men of the six-man security watch evacuated to Bayfield.

Three men security watch with necessary gear evacuated to Bayfield.

Shot Baker (25 July, 0835)

Beached in slot #14, Bikini. All officers, men, and necessary equipment on board Bayfield.

Commanding officer, executive officer, and four men reboarded LCI(L)-615. Ship found in good condition. All lines had parted and ship was floating approximately 200 feet (61 meters) from shore.

Checked ship for damage. Found stern winch radiator pushed back against cooling fan.

Underway to anchor in berth 44.

Arrived in berth 44.

Executive officer, executive officer, and two men left ship to get remaining crewmembers. Two men left aboard. Remaining crewmembers came aboard with all necessary gear. Commanding officer and executive officer boarded USS Rockbridge (APA-228) to receive messages pertaining to operation of LCI(L)-615.

Commanding officer, executive officer, and executive officer boarded.
24 August
0607 Getting underway for salvage operation.
0652 Moored alongside target ship USS Fallon (APA-81).
1200 Underway.
1225 Anchored in berth 108A.

25 August
0830 Underway for salvage operation.
0842 Moored alongside target ship USS Mayrant (DD-602), supplying power to raise anchor.
1504 Underway.
1520 Anchored in berth 108A.

26 August
0826 Underway to perform salvage operations.
0842-1110 Moored to target ship USS Mustin (DD-413) to furnish electrical power.
1110-1126 Underway to perform salvage operation.
1126-1309 Alongside Rhind.
1325 Anchored in berth 108A.
1415 Underway for salvage operation.
1435 Moored to target ship USS Ralph Talbot (DD-390) to haul in anchor.
1535 Underway to anchor.
1704 Anchored in berth 12A.

29 August
1708 Radafsafe monitor aboard.
1714 Underway for salvage operation.
1735-2002 Moored to target vessel LCT-1113 to pump ballast.
2014 Anchored in berth 12A.

30 August
0905 Underway to moor alongside Palmyra.
0922 Moored to Palmyra.
1355 Cast off all lines, underway.
1415 Moored to USS Reclaimer (ARS-42) to take on salvage equipment.
1537 Anchored in berth 12A.

1 September
1516 Underway to perform salvage operations.
1620 Moored alongside target vessel LCT-818 to pump excess water out.
1707 Underway to anchor.
1823 Anchored in berth 88.

2 September
1429 Underway to USS Widgeon (ASR-1) for salvage operation.
1445 Laying to off Widgeon for salvage operation.
1515 Proceeded to anchorage.
1930 Anchored in berth 88.

3 September
1225 Underway to perform salvage operation.
1255 Laying to off Widgeon, ready to give aid in submarine salvage operation.
1430 Underway to Eneu Island.
1510 Laying to off Eneu beach and making preparations to tow target vessel LCT-818 off the beach.
1635 Commenced towing LCT-818 off beach.
1711 Anchored in berth 88.

4 September
1400 Underway to Kwajalein.

5 September
1145 Moored alongside target vessel LCI(L)-549.

LCI(L)-977
Crew Size: 35
Bikini Atoll Arrival: 8 June 1946
Bikini Atoll Departure: 22 August 1946
Shot ABLE Location: Kwajalein
Shot BAKER Location: Kwajalein
Decontamination Location: Guam
Final Clearance: 7 March 1947

Task Unit and function
LCI(L)-977, a large infantry landing craft, was a member of TU 1.8.3 (Dispatch Boat and Boat Pool). Its function as a support ship was to provide dispatch and mail service, interatoll freight, and passenger service.

Shot ABLE (1 July, 0900)
Anchored at Kwajalein.
Shot BAKER (25 July, 0835)
Anchored at Kwajalein.

9 August
0635 Entered Bikini Lagoon.
1125 Anchored in anchorage C.

14 August
0751 Shifted berths and anchored in berth 23A.

22 August
0945 Left Bikini Lagoon for Kwajalein.

LCI(L)-1062
Crew Size: 35
Bikini Atoll Arrival: 7 May 1946
Bikini Atoll Departure: 22 August 1946
Shot ABLE Location: Kwajalein
Shot BAKER Location: In route from Bikini to Rongelap
Decontamination Location: Guam
Final Clearance: By 4 January 1947

Task Unit and function
LCI(L)-1062, a large infantry landing craft, was a member of TU 1.8.3 (Dispatch Boat and Boat Pool). As a support ship, it provided dispatch and mail service, interatoll freight, and passenger service.

Shot ABLE (11 July, 0900)
At Kwajalein.

Shot BAKER (25 July, 0835)

31 July
0945 Entered Bikini Lagoon.
1111 Anchored in berth 61.

2 August
2249 Anchored off Eneu Island.

6 August
0752 Left for Kwajalein.
LCI(L)-1091

18 August 1042 Underway for Bikini.
19 August 0650 Anchored in Bikini Atoll.
22 August 0746 Underway for Kwajalein.
0853 Left Bikini Lagoon for Kwajalein.
23 August 1910 Anchored in berth 29, Kwajalein.

9 September 1522 Underway for Guam.
16 September Moored at Guam.

LCI(L)-1067

Crew Size: 34
Bikini Atoll Arrival: 18 June 1946
Bikini Atoll Departure: 22 August 1946
Shot Able Location: En route Kwajalein from Bikini
Shot Baker Location: Kwajalein
Decontamination Location: Guam
Operational Clearance: 24 February 1947

Task Unit and Function
LCI(L)-1067, a large infantry landing craft, was a member of TU 1.8.3 (Dispatch Boat and Boat Pool). LCI(L)-1067 provided for dispatch and mail service, interatoll freight, and passenger service.

Shot Able (1 July, 0900)

1 July En route to Kwajalein from Bikini at time of shot Able.

Shot Baker (25 July, 0835)

25 July At Kwajalein.

3 August
1215 Entered Bikini Lagoon.
1235 Moored portside to USS LST-861.
1645 Moored to USS Wildcat (AM-2).
1812 Anchored in berth 365.

4 August
1305-1357 Moored to USS Sylvania (AKA-44).
1416 Anchored in berth 365.

7 August
1912 Moored to USS LST-388 to take on cargo.

8 August
0612 Underway for Kwajalein.
0810 Left Bikini Lagoon for Kwajalein.

9 August
1227 Moored at Kwajalein.

12 August
0610 Underway from Kwajalein to Bikini.

13 August
0810 Anchored at Bikini.

16 August
0604 Underway from Bikini to Kwajalein.
0645 Left Bikini Lagoon.

17 August
1125 Moored to N.O.B. pier, Kwajalein.
LCI(L)-1091

USS Lowry (DD-770)

Crew Size: 244
Shot ABE Location: Kwajalein
Shot BAKER Location: Kwajalein

Task Unit and Function

The destroyer Lowry was a member of TG 1.7 (Surface Patrol), attached to Destroyer Division 71. It had been outfitted with special oceanographic and radiological equipment to conduct oceanographic surveys and radiological monitoring. It performed monitoring duties both within and outside Bikini Lagoon.

Shot ABE (1 July, 0935)

In San Francisco during shot ABE.

Shot BAKER (23 July, 0835)

24 July
Underway to area Hudson, Bikini Atoll, from Kwajalein Atoll.

25 July
1428 Underway to area Hudson, Bikini Atoll, from Kwajalein Atoll.
1721 Anchored in Bikini Lagoon.
1835 Underway for night radiological monitoring.
1905 Anchored in southern part of Bikini Lagoon.

26 July
0220 Radiological experts reported the presence of radiation.
0424 Underway to shift anchorages.
0506 Anchored in southern part of Bikini Lagoon.
0954 Shifted anchorages.

27 July
1805 Underway from Bikini to Kwajalein.

28 July
0847 Anchored in berth K-6, Kwajalein Atoll.
1745 Underway from Kwajalein to Bikini.
29 July
0810 Arrived at Bikini and anchored in Bikini Lagoon.
31 July
1316 Anchored at berth 190 South.
2 August
1536 Shifted berths, finally anchoring in berth Love.
7 August
1001 Shifted to anchorage 190 South.
8 August
1017 Anchored in berth 186.
10 August
1631 Underway with ships in Destroyer Squadron 7 for San Diego via Pearl Harbor after a firing run on target ship LCI-620.

LSM-60

Crew Size: 40
Bikini Atoll Arrival: 4 July 1946
Shot ABLE Location: Kwajalein
Shot BAKER Location: Surface zero
Sunk 25 July 1946, Bikini Atoll

Task Unit and Function
Medium landing ship LSM-60 was a member of TU 1645 Underwater unit at desired depth.

Shot ABLE (1 July, 0900)

30 June
Moored to mooring buoy G at Kwajalein.
3 July
0830-0917 YW-94 alongside to deliver water.
1152 Underway from buoy to USS Guinnes Hall (LSD-5) for docking with assistance of USS Munsee (ATF-107) and two PTs.
1228 Commenced entering Gunston Hall.
1229 YTB-469 cast off.
1230 Munsee cast off.
1236 Moored in Gunston Hall.
1245-1315 Entered Gunston Hall.
1345 With Gunston Hall underway to Bikini.

4 July
0831 Entered Bikini Lagoon.
0920 Gunston Hall anchored in assigned berth.
1000-1245 Clear of Gunston Hall.
1330 Anchored in berth 38, Bikini.

5 July
1145 ATA-124 alongside.
14:00 Underway to shift to berth 54A.
1435 Moored to buoy in berth 54A.
1445 ATA-124 underway from starboard side.

8 July
0705 ATA-180 moored to assist in changing berths.
0734 Underway from berth 54A to moor alongside Albemarle.
0805 Moored alongside Albemarle.

12 July
1400 ATA-180 came alongside portside.
1444 Underway from berth 54A to Berth 161.
1530 Commenced mooring.
1600 ATA-180 got underway from alongside.
1610 Completed mooring to four mooring buoys in Berth 161, Bikini.

14 July
1140 Commenced raising detector bell.
1215 Detector bell clear of water.

15 July
0545 Commenced unmooring.
0604 ATA-180 came alongside to assist in shifting berth.
0723 Underway from mooring buoys.
0729 Moored to Albemarle in berth 40.
0810-1130 Stripped ship in preparation for BAKER.
1215 ATA-180 alongside to assist in shifting berth.
1215 Underway from alongside Albemarle.
1310 Moored to mooring buoy in berth 54A.
1345 ATA-180 got underway.

18 July
0515 ATA-180 alongside starboard.
0546 Underway from berth 54A.
0605 Moored to Albemarle in berth 40.
0710 ATA-180 got underway.
1213 ATA-180 alongside starboard side.
1213 Underway from alongside Albemarle en route to assigned mooring buoys with assistance of ATA-160.
1213 Commenced mooring.
1213 ATA-180 got underway from alongside.
1213 Completed mooring to four mooring buoys in Berth 161.
1213 One officer and twenty one enlisted men evacuated to Albemarle.

1700 ATA-180 alongside starboard side to assist in shifting mooring.
1700 Underway from alongside Albemarle en route to berth 54A.
1700 Moored in berth 54A.

10 July
0530 ATA-180 came alongside to assist in shifting berths.
0550 Underway from berth 54A, to four-point mooring in berth 161.
0645 ATA-180 underway from alongside.
0709 Completed mooring to four mooring buoys in Berth 161.
0855 Commenced lowering underwater unit.
1400 Commenced raising underwater unit.
1430 Unit clear of water.
1436 ATA-180 moored alongside out portside to assist in shifting berths.
1436 Underway from four-point mooring in Berth 161.
1436 Moored in berth 54A, Bikini.
1450 ATA-180 underway from alongside.
19 July 1445 Officers and crew returned aboard, resumed normal operations.
1515 Commenced raising detector chamber.
1555 Detector chamber clear of water.

20 July 0807 Underway from berth 161 to berth 54A
0843 Moored in berth 54A.

24 July 0515 ATA-180 came alongside.
0540 Underway to shift berth with assistance of ATA-180.
0605 Moored to Albemarle in berth 40.
0615 ATA-180 underway from alongside.
0715 ATA-180 alongside starboard side.
0730 Underway from Albemarle to assigned mooring buoy.
0830 Commenced mooring.
0855 ATA-180 underway from alongside.
0935 Completed mooring to four mooring buoys in berth 161.
1230 Evacuated one officer and twelve enlisted men to Albemarle.
1600 Commenced lowering detector bell.
1635 Detector bell lowered to desired depth.
1914 Two officers and twenty-three enlisted men evacuated to Albemarle in preparation for BAKER.

25 July 0609 Final evacuation party left the ship with all personnel accounted for. Ship completely abandoned.

Shot BAKER (25 July 0835)

25 July 0835 LSM-60 was completely destroyed by shot BAKER.

Its crew was dispersed to various units of the task force.

**USS LST-125**

1845 Reboarded ship. Restored to normal operation in berth 109. Ship reboarded after orders from DSM.

3-24 July Crew aboard LST-52.

Shot BAKER (25 July, 0835)

24 July 0900 Crew evacuated to Rockwall.

26 July DSM Geiger reading 4.5 R/24 hours from 30 feet (9.1 meters).

8 August 1000 Geiger readings: main deck average 7 R/24 hours, maximum 17 R/24 hours; first platform average 1.5 R/24 hours, maximum 3 R/24 hours.

14 August Inspected by DSM and ship's representatives.

17 August Staff inspections complete; ship made available for towing.

19 August 1000 Crew shifted from Rockwall to USS Dixie (AD-14).

21 August Average topside Geiger reading 3.9 R/24 hours.

26 August Towed to Kwajalein by USS Clamp (ARS-33).

A 26 August letter on the condition of LST-52 on decommissioning stated that it was very radioactive and therefore did not allow long periods of inspection. It later states that the ship was in fair condition.

27 August Anchored at Kwajalein, berth A-20.

28 August Decommissioned.

30 September Average topside Geiger reading 1.14 R/24 hours.

**USS LST-52**

Crew Size: 63
Bikini Atoll Arrival: Before 30 June 1946
Bikini Atoll Departure: 26 August 1946
Crew Location for Shot ABLE: USS Rockwall (APA-230)
Crew Location for Shot BAKER: Rockwall
Shot ABLE Location: 1,550 yards (1.4 km) E
Shot BAKER Location: 1,590 yards (1.5 km) W
Sunk April 1946, near Kwajalein Atoll

Task Unit and Function
LST-52, a tank landing ship, was a target vessel during Operation CROSSROADS. Its crew was evacuated before ABLE and did not return. It served in LST Group 9 of TU 1.2.5 (Landing Craft Unit).

Shot ABLE (1 July, 0900)

30 June 0900 Evacuated ship; crew aboard Rockwall.

2 July 1011 Boarding team reported on board (Reference p. 1-26-A).
1042 USS Fletcher (AN-79) reported LST-52 Geiger sweet.

**USS LST-125**

Crew Size: 5 (only 2 at Bikini for test)
Bikini Atoll Arrival: 13 July 1946
Crew Location for Shot BAKER: USS Rockwall (APA-230)
Shot BAKER Location: En route from Subic Bay to Kwajalein
Sunk 14 August 1946 at sea near Bikini

Task Unit and Function
LST-125, a tank landing ship, was a target vessel during CROSSROADS. Its crew was evacuated for BAKER and did not return. It served in LST Group 9 of TU 1.2.5 (Landing Craft Unit).

Shot BAKER (1 July, 0900)

Not present for ABLE. En route from Subic Bay to Bikini Atoll.

8 July 1435 Anchored in berth 63, Bikini Lagoon.
USS LST-125

10 July Shifted to berth 53, Bikini Lagoon.
13 July Beached on Bikini Island, berth 16. All personnel except for commanding officer and one man were transferred to USS Chil- tun (APA-38) for return to the United States before test BAKER.
14-22 July One-man security watch aboard each night.
Shot BAKER (25 July, 0835)
23 July All personnel departed LST-125 for Rockwall.
31 July Army requested that ramp be lowered to remove gear. Ship reported to be radio logically clear.
August
1 August Commanding officer boarded ship for inspection. Engine rooms completely flooded.
2 August Engine room pumped out.
10 August USS Munsee (ATF-101) and USS Wenatchee (ATF-118) removed ship from beach.
12 August Staff inspections complete.
14 August Towed 5 nmi (9.3 km) southwest of Bikini and sunk by gunfire.

USS LST-133

Crew Size: 78
Bikini Atoll Arrival: 15 April 1946
Bikini Atoll Departure: 29 August 1946
Crew Location for Shot ABLE: USS Rockwall (APA-230)
Crew Location for Shot BAKER: Rockwall
Shot ABLE Location: 5,550 to 6,000 yards (5.0 to 5.5 km) N, beached on Bikini Island
Shot BAKER Location: 675 yards (617 meters) NE
Sunk 11 May 1946 near Kwajalein Atoll
Task Unit and Function
LST-133, a tank landing ship, was a target vessel during CROSSROADS. Its crew was evacuated for each shot. It served in LST Group 9 of TU 1.2.5 (Landing Craft Unit).
Shot ABLE (1 July, 0300)
Immediately after arriving in the area, LST-133 was beached on Bikini Island. Its crew was evacuated to Rockwall on 25 June.
July
1 July
1942
1610
Test animals were removed from topside. Declared free of radioactive contamination (Reference 5, p. B-12).
2 July
1710
Teams A and B returned to LST-133 to put it back in operating condition. An inspection of the ship showed no damage.
3 July
0538
0924
Anchored in berth 10.
1645
Shifted to berth 44.
Team C and remainder of crew returned.

USS LST-220

Crew Size: 59
Bikini Atoll Arrival: 4 April 1946/12 June 1946
Bikini Atoll Departure: 28 August 1946
Crew Location for Shot ABLE: USS Rockwall (APA-230)
Crew Location for Shot BAKER: Rockwall
Shot ABLE Location: 3,272 yards (3 km) N
Shot BAKER Location: 3,466 yards (3.2 km) N
Decommissioned: 28 August 1946
Sunk 12 May 1946 near Kwajalein (8°44'N, 167°25'E)
Task Unit and Function
Tank landing ship USS LST-220 was a member of TU 1.2.5 (Landing Craft Unit). It was a target vessel for shots ABLE and BAKER involved in Army ordnance experiments with poison gases and ammunition.
Shot ABLE (1 July, 0900)
July
1 July
1756
USS Enjio's (AN 79) boarding team decided not to board since it was still smoking fore and aft.
2 July
0938
Ejio reported the boarding team aboard.

353
USS LST-220

2 July

1000 Declared radiologically safe by Etah
1634 Team A boarded. Ship found safe for
beaching.
1705 Team B boarded.

4 July

1308 Team C reboarded. Full crew now aboard.

5-22 July Crew aboard LST-220.

On 8 July, the damage report indicated that there had
been no structural damage. All damage was due to two
small fires (Reference 3).

24 July Evacuated crew to Rockwall.

Shot BAKER (25 July, 0835)

28 July

1706 Boarded by the initial boarding team
from USS Current (ARG-22).
1305 Current boarding team departed.
1952 Reported Geiger sour (contaminated),
averaging 3.0 R/24 hours (Reference 5, p. 6-D-34).

13 August Boarded by team from ship's crew for
inspection.

14 August Inspected by DSM and ship's representa-
tives.

17 August Staff inspections completed.

21 August Average topside reading 0.27 R/24 hours.

28 August Sunk from Bikini to Kwajalein.

LST-220 showed no evidence of physical damage from shot
BAKER (Reference 2).

USS LST-388

Crew Size: 80

Bikini Atoll Arrival: 14 April 1946
Bikini Atoll Departure: 25 August 1946
Shot ABLE Location: 28 nmi (52 km) NE
Shot BAKER Location: 27 nmi (41 km) W
Decontamination Location: San Francisco
Operational Clearance: 6 December 1946
Final Clearance: 13 December 1946

Task Unit and function

LST-388 was a member of TU 1.8.1
(Kepaik and Service Unit). Part of its support
function was as a recreation ship.

Shot ABLE (1 July, 0900)

30 June

1530 Underway to area Papek.

1 July

1926 Reentered Bikini Lagoon and anchored In
berth 45.

2 July

1645 Anchored in berth 45.

USS LST-545

3 July

0543 Beached in the LST beaching area on
Bikini.

Shot BAKER (25 July, 0835)

24 July

1400 Underway.

25 July

1030 Steaming with members of CTG 1.8.
1600 Departed for Rongelap.
1628 Anchored at Rongelap.

30 July

1555 Underway to Bikini.

31 July

0925 Reentered Bikini Lagoon and anchored In
the vicinity of berth 61.

0645-1800 Anchored in the vicinity of berth 61.
0645-1700 Beached on Bikini
Island.
24 July

1705 Anchored in the vicinity of berth 44.

1246 Boarded by the Initial boarding team
from US$ Current (ARS-22).

2 August

1305 Current boarding team departed.
1742 Anchored in the vicinity of berth Roger.

1952 Reported Geiger sour (contaminated),
averaging 3.0 R/24 hours (Reference 5, 25 August
p. 6-D-34),

1137 Left Bikini (or Kwajalein.

13 August

Boarded by team from ship's crew for
inspection.

14 August Inspected by OSM and ship's representa-
tives.

21 August Average topside reading 0.27 R/24 hours.

28 August

1317 Boarded by US$ Etlah (AN-79) Initial
boarding team 7.
1720 Etah reported the boarding team was
aboard.
1745 Reported Geiger sour by Etah (Reference

2 September

1630 Team A reboarded.
1734 Team B and rest of crew reboarded.

There was no damage to the ship as a result of the test
(Reference 3).

Shot BAKER (25 July, 0835)

28 July

1009 AEC Reclalmers (ARR-42) passed close
aboard and saw no apparent damage (Ref-
ence p. 6-D-79).
1109 Boarded by the Initial boarding team
(Reference 5, p. 6-D-79).

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<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1256</td>
<td>USS Current (ARS-22) reported the boarding team aboard (Reference 6, p. 7-1-B-31).</td>
</tr>
<tr>
<td>1952</td>
<td>Reported Geiger sour, average reading 2.0 R/24 hours (Reference 5, p. 6-D-34).</td>
</tr>
<tr>
<td>8 August</td>
<td>IFT-10 reported average maindeck reading 0.7 R/24 hours, inside superstructure 0.35 R/24 hours, and tank deck 0.25 R/24 hours.</td>
</tr>
<tr>
<td>10 August</td>
<td>DSM inspection team aboard.</td>
</tr>
<tr>
<td>15 August</td>
<td>Inspections complete. Made available to CTG 1.2 for towing.</td>
</tr>
<tr>
<td>21 August</td>
<td>Average topside reading 0.096 R/24 hours.</td>
</tr>
<tr>
<td>27 August</td>
<td>Decommissioned.</td>
</tr>
<tr>
<td>28 August</td>
<td>Departed Bikini for Kwajalein.</td>
</tr>
<tr>
<td>30 August</td>
<td>Anchored in Kwajalein.</td>
</tr>
<tr>
<td></td>
<td><strong>USS LST-661</strong></td>
</tr>
<tr>
<td></td>
<td>Crew Size: 63</td>
</tr>
<tr>
<td>3 July</td>
<td>Bikini Atoll Arrival: 1 June 1946</td>
</tr>
<tr>
<td>5 July</td>
<td>Decommissioned.</td>
</tr>
<tr>
<td>10 July</td>
<td>Underway to Kwajalein.</td>
</tr>
</tbody>
</table>

**Task Unit and Function**: LST-661 was a target landing ship and performed various experiments in that role for the Army Ordnance and Engineering units. Poison gases and ammunition were stored on it for shots ABL and BAKER.

**Shot ABL** (1 July, 0900)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1402</td>
<td>The Salvage Unit reported fighting fires aboard LST-661 and others (Reference 5, p. 6-B-11).</td>
</tr>
<tr>
<td>1533</td>
<td>USS Etlah (AN-19) reported the pyrotechnics on LST-661 were exploding because of the fire on board (Reference 6, p. 7-1-A-12).</td>
</tr>
<tr>
<td>1537</td>
<td>DSM directed all ships to stay at least 1,100 yards (1 km) away from LST-661 because of the hazard from the fire and exploding Army ammunition (Reference 5, p. 6-B-12).</td>
</tr>
<tr>
<td>1540</td>
<td>Reported Geiger sour by the DSM.</td>
</tr>
<tr>
<td>1707</td>
<td>Etlah reported that the LST-661 fire was below deck (Reference 6, p. 7-1-A-13 and 7-1-A-16).</td>
</tr>
<tr>
<td>2016</td>
<td>Fires were still active. It was still dangerous to approach due to the possibility of explosions.</td>
</tr>
<tr>
<td>2 July</td>
<td>Etlah reported a boarding team aboard.</td>
</tr>
</tbody>
</table>

**USS LST-817**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0931</td>
<td>Reported Geiger sour by Etlah’s team (Reference 6, pp. 7-1-A-23 and 7-1-A-24).</td>
</tr>
<tr>
<td>1610</td>
<td>Smoldering fire on tank deck extinguished.</td>
</tr>
<tr>
<td>1655</td>
<td>Team B returned to ship.</td>
</tr>
<tr>
<td>5 July</td>
<td>Twenty-seven officers and enlisted men returned to LST-661 from Rockwell.</td>
</tr>
<tr>
<td>24 July</td>
<td>Officers and men evacuated to Rockwell.</td>
</tr>
<tr>
<td>13 August</td>
<td>Commanding officer with Bureau of Ships representative and radsafe team boarded for inspection.</td>
</tr>
<tr>
<td>0900</td>
<td>Eleven officers and enlisted men boarded for inspection.</td>
</tr>
<tr>
<td>0928</td>
<td>Commanding officer returned aboard.</td>
</tr>
<tr>
<td>0930</td>
<td>Inspection party left ship.</td>
</tr>
<tr>
<td>0931</td>
<td>Commanding officer left ship and returned to Rockwell with inspection party.</td>
</tr>
<tr>
<td>25 August</td>
<td>Underway to Kwajalein.</td>
</tr>
<tr>
<td>27 August</td>
<td>Anchored in Kwajalein Atoll.</td>
</tr>
<tr>
<td>28 August</td>
<td>Ship decommissioned.</td>
</tr>
</tbody>
</table>

**Task Unit and Function**: LST-817 was a member of TU 1.3.1 (Transport Unit) as part of Transport Division 31. It and LST-661 were loaded at Pearl Harbor with construction materials. Once the ship arrived at Pearl Harbor, it served as a barracks and storage ship for the Seabees (Reference 5, p. 6-A-20).

**Shot ABL** (1 July, 0900)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June</td>
<td>Underway with TU 1.3.1 for area Mormon.</td>
</tr>
<tr>
<td>1 July</td>
<td>Anchored in berth 39, Bikini.</td>
</tr>
<tr>
<td>3 July</td>
<td>Anchored on Bikini Island.</td>
</tr>
<tr>
<td>5 July</td>
<td>Anchored in berth 39.</td>
</tr>
<tr>
<td>11 July</td>
<td>Anchored in berth 39, Bikini.</td>
</tr>
</tbody>
</table>
USS LST-817

15 July
0809-1235 Took on freshwater from USS Wildcat (AW-2).
1332 Anchored in berth 38.

16 July
1215 Beached at Bikini.

17 July
0410 Anchored in the vicinity of berth 39.
1515 Anchored in Bikini Lagoon.

Shot BAKER (25 July, 0835)
24 July Underway with Division 4 of TG 1.3 for area Marlon.
1715 Observed BAKER explosion.
30 July Underway to Bikini.
31 July Anchored at berth 39, Bikini.

1 August 0714 Anchored at Bikini Island.
10 August 1714 Beached at Bikini Island.
11 August 0940 Anchored in Bikini Lagoon.
12 August 1530 Anchored at berth 39.
15 August 1910 Underway for Kwajalein after taking on potable water from Wildcat.
16 August 1745 Anchored in Kwajalein Lagoon.
20 August 1704 Underway to Bikini.
21 August 1420 Anchored at berth 44, Bikini.
23 August 1726 Underway for Kwajalein.
24 August 1528 Anchored at Kwajalein.
31 August 1224 Underway to United States via Pearl Harbor.

USS LST-871

15 July
0809-1235 Took on freshwater from USS Wildcat (AW-2).
1332 Anchored in berth 38.

16 July
1215 Beached at Bikini.

17 July
0410 Anchored in the vicinity of berth 39.
1515 Anchored in Bikini Lagoon.

Shot BAKER (25 July, 0835)
24 July Underway with Division 4 of TG 1.3 for area Marlon.
1715 Observed BAKER explosion.
30 July Underway to Bikini.
31 July Anchored at Bikini Island.

1 August 0714 Anchored at Bikini Island.
10 August 1714 Beached at Bikini Island.
11 August 0940 Anchored in Bikini Lagoon.
12 August 1530 Anchored at berth 39.
15 August 1910 Underway for Kwajalein after taking on potable water from Wildcat.
16 August 1745 Anchored in Kwajalein Lagoon.
20 August 1704 Underway to Bikini.
21 August 1420 Anchored at berth 44, Bikini.
23 August 1726 Underway for Kwajalein.
24 August 1528 Anchored at Kwajalein.
31 August 1224 Underway to United States via Pearl Harbor.

USS LST-871

Crew Size: 80
Bikini Arrival: 2 April 1946
Bikini Departure: 24 August 1946
Shot ABLE Location: >150 nm (278 km) S
Shot BAKER Location: >186 nm (341 km) S
Decontamination Location: San Francisco

Operational Clearance: 6 December 1946
Final Clearance: 13 December 1946

Task Unit and Function
LST-817, a tank landing ship, served in TU 1.8.1 (Repair and Service Unit). It served as a post office. In addition, it provided provisions or logistic support to other support ships in the operation.

Shot ABLE (1 July, 0900)
30 June 1535 Departed Bikini.
1 July Underway to Kwajalein from Bikini at time of shot ABLE.
2 July 0830 Underway to Bikini.
3 July 0750 Anchored in berth 64, Bikini.
Shot BAKER (25 July, 0835)
24 July 1602 Departed Bikini en route to Kwajalein.
25 July 1550 Arrived at Kwajalein.
27 July 1652 Underway for Bikini.
28 July 1706 Anchored in Bikini Lagoon.
30 July 1200 Anchored in berth 64, Bikini.
31 July 23 August Periodically shifted berths and anchorages.
24 August 1052 Left Bikini Lagoon for Kwajalein.
25 August 1015 Anchored at Kwajalein.
2 September 1453 Departed Kwajalein en route to Pearl Harbor.

USS LST-871

Crew Size: 80
Bikini Arrival: 16 June 1946
Bikini Departure: 25 July 1946
Shot ABLE Location: Rongerik Atoll
Shot BAKER Location: >22 nm (41 km) S
Decontamination Location: San Francisco
Final CI trance: 22 November 1946

Task Unit and Function
LST-871, a tank landing ship, was a member of TU 1.8.1 (Rongerik Evacuation Unit). It was one of the ships used to evacuate the Marshallese from their islands.
USS LST-871

Shot ABLE (1 July, 0900)
1 July Moored off Rongerik Island at the time of shot ABLE as part of the Rongerik
Evacuation Unit.

4 July Underway to Bikini.

5 July Anchored in berth 58, Bikini.

6-24 July Anchored as before.

Shot BAKER (25 July, 0835)

24 July Underway, departing Bikini Lagoon.

25 July Observed shot BAKER 22 nmi (41 km) east
of Bikini Lagoon as unit guide for a
12-ship column.

26 July Arrived Kwajalein.

27 July Departed Kwajalein for Lae Atoll.

28 July Arrived Lae Atoll.

29 July Departed Lae Atoll with 93 natives en
route to Wotho Atoll.

1447 Beached at Wotho Atoll.

1616 Underway en route to Rongelap.

30 July Anchored at Rongelap.

1855 Cleared Rongelap Harbor en route to Kwa-
ja.lein.

31 July Anchored at Kwajalein.

Since it did not enter Bikini Lagoon after BAKER, it
was not contaminated. It departed from Kwajalein for
San Francisco on 9 August 1946.

USS LST-881

Crew Size: 71
Bikini Atoll Arrival: 14 March 1946
Bikini Atoll Departure: 22 August 1946
Shot ABLE Location: 26 nmi (48 km) ENE
Shot BAKER Location: 25 nmi (46 km) l
Decontamination Location: San Francisco
Operational Clearance: 13 December 1946
Final Clearance: 23 December 1946

Task Unit and Function
LST-881, a tank landing ship, was a member of TU
I.3.1 (Transport Unit). It and USS LST-87 were
loaded with construction materials and Seabees at
Pearl Harbor. At Bikini, both ships served as barr-
acks and storage ships for Seabees (Reference 5,

Shot ABLE (1 July, 0900)

30 June Underway for operating area Marmon.

1 July 0900 Observed shot ABLE.

1023 Anchored in berth 41 after entering
Bikini Lagoon.

USS LST-989

Crew Size: 84
Bikini Atoll Arrival: 11 June 1946
Bikini Atoll Departure: 25 July 1946
Shot ABLE Location: Rongerik Atoll
Shot BAKER Location: 22 nmi (41 km) W
Decontamination Location: San Francisco
Operational Clearance: 19 November 1946
Final Clearance: 22 November 1946

Task Unit and Function
LST-989, a tank landing ship, was a member of TU
I.B.7 (Rongerik Evacuation Unit). During shot ABLE
all Rongerik natives were aboard LST-989 as a pre-
cautionary measure in the event the Islands became
contaminated as a result of the CROSSROADS tests.

Shot ABLE (1 July, 0900)

30 June 1430 All Rongerik natives embarked on LST-989
(Reference 5, p. C-B-2).
USS LST-989

1 July
1002 Anchored at Rongerik Atoll.
1002 CTF 1 directed CTU 187 to disembark natives from LST-989 as evacuation was not required (Reference 5, p. 6-D-46).

4 July
Returned to Bikini.

12-15 July
Transferred aircraft from target ship USS Saratoga (CV-3) to other target ships.

Shot BAKER (25 July, 0835)

26 July
1116 Anchored at Kwajalein.

28 July
1045 Underway for Enewetak.

30 July
1737 Anchored at Enewetak Atoll.

31 July
1950 All Enewetak natives were embarked on LST-989 (Reference 5, p. 6-D-46).

7 August
1304 Underway for Kwajalein.

9 August
1153 Anchored at Kwajalein Atoll.
1456 Underway for Pearl Harbor.

Since LST-989 did not enter Bikini Lagoon after test BAKER, it was not radiologically contaminated.

USS Mayrant (DD-402)

1 August
ATA-192 was directed to wash down Mayrant thoroughly with high-pressure hoses (Reference 6, p. 7-1-B-57).

ATA-192 completed washing down Mayrant (Reference 6, p. 7-1-B-67).

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3 August
ATA-192 was again directed to wash down Mayrant using high-pressure streams (Reference 6, p. 7-1-B-77). After completing the washdown, Geiger readings were to be taken at 50 feet (15 meters) from each side (Reference 6, p. 7-1-B-77).

Washed down by ATA-192 (Reference 6, pp. 7-1-B-79 and 7-1-B-80).

1306

14 August
Boarded in the morning by ship's crew. Topside average 4.0 R/24 hours; below decks 0.8 R/24 hours.

14 August
1045-1119 Boarded in the morning by ship's crew. Topside average 4.0 R/24 hours; below decks 0.8 R/24 hours.

15 August
0815-1045 Boarded by five men for salvage operations.
1300-1545 Boarded by 13 men for salvage operations.

16 August
0800-1045 Boarded by a 21-man working party.

25 August
27-28 August Boarded by an unidentified team of at least four men each day. Crew transferred to remaining target ship USS Bleden (APA-63) for transportation to the United States.

15 August
0815-1045 Boarded by five men for salvage operations.
1300-1545 Boarded by 13 men for salvage operations.

16 August
0800-1045 Boarded by a 21-man working party.

27-28 August Boarded by an unidentified team of at least four men each day. Crew transferred to remaining target ship USS Bleden (APA-63) for transportation to the United States.

14 August
0815-1115 Boarded by 13 men for inspection.
1345-1545 Boarded by commanding officer and four men.
USS Mayrant (DD-402)

28 August  Mayrant decommissioned; underway to Kwajalein.

29 August  Arrived at Kwajalein.

USS Mender (ARS-50-2)

Crew Size: 49
Bikini Atoll Arrival: 9 July 1946
Bikini Atoll Departure: 4 September 1946
Shot BAKER Location: In route to Kwajalein from Pearl Harbor
Operational Clearance: 3 January 1947

Shot ABLE (1 July, 0900)
En route to Kwajalein from Pearl Harbor at the time of Shot ABLE.

9 July 0840 Moored to USS Palmyra (ARS(T)-3) at Bikini.
10-23 July Routine activities, Bikini Atoll.
Shot BAKER (25 July, 0835)

24 July 1210 Radsafe monitor reported aboard Mender for shot BAKER.
1259 Underway for area Mercury.

25 July 1155 Anchored in assigned anchorage west of Eneu Island.

29 July 1831 Planted a mooring for a submarine in the vicinity of Ionchebl Island after shifting berths.
1912 Anchored in Bikini Lagoon.

30 July 0900-1220 An inspection party came aboard and reported on the damage sustained to Mender's hull during CROSSROADS.

1 August 1430-1710 Swung the stern of target ship USS Hughes (DD-410) into Bikini Lagoon.
1731 Anchored northward of Eneu Island.

7 August 0740-0846 Retrieved weights from target submarine USS Tuna (SS-203).
1155 Removed a radioactive 1-1/2-inch wire rope.
1606 Anchored in berth 30.

USS Moale (DD-693)

8 August 0912-1505 Shifted a submarine mooring buoy in the vicinity of Ionchebl Island.
1505 Anchored in berth 30.

9 August 1100 Anchored in berth 108A.

10 August 0836-0910 Cleared a fouled anchor on target submarine USS Searaven (SS-196).
0927-1428 Worked alongside target submarine USS Parche (SS-194) to recover the stream anchor. Sustained damage from Parche as a result of the two vessels rolling together.
1428 Anchored in berth 108A.

11-13 August Anchored in berth 108A.

14 August 1420 Mender was put in floating drydock ARD-29.

15 August 1546 Out of floating drydock ARD-29.

18-19 August Anchored in berth 30.

19-22 August Anchored in Bikini Lagoon.

27 August 1602 Moored portside to target ship USS Fallon (APA-81) to put pumps and generators aboard.
1830 Underway from Fallon to anchorage in vicinity of Eneu Island.
1840 Anchored.

24 August 0755-0900 Stowed hose and pumps for sea aboard target ship USS Pensacola (CA-24).
0901 Anchored in berth 108A.

25-27 August The crew prepared LCMs, LCVPs, and four pontoon barges to come off Bikini beach.

31 August 0800 A beach party worked on target vessel LCT-1156 [sic] broadside to the beach about 50 yards (46 meters) off. Divers hooked up air connections to blow the tanks forward. There were excessive holes in the center line and the starboard tanks forward. Anchored in Bikini Lagoon.

4 September 0628 Underway with YW (unnumbered) and target vessel LCT-1078 in tow for Kwajalein, thence to Pearl Harbor.

USS Moale (DD-693)

Crew Size: 247
Bikini Atoll Arrival: 5 June 1946
Bikini Atoll Departure: 10 August 1946
Shot ABLE Location: 20 nmi (37 km) SE
Shot BAKER Location: 18 nmi (33 km) SSE
Operational Clearance: 19 November 1946
Final Clearance: 11 December 1946 (Bremerton)
USS Moale (DD-693)

Task Unit and function
The destroyer Moale was a member of TG 1.7 (Surface Patrol). Destroyer Division 72. It measured radioactivity, took water samples outside the lagoon after each test, and conducted oceanographic surveys.

Shot ABLE (1 July, 0900)
- 0538 Underway from berth 386, Bikini, to Orbit Point Sugar.
- 0830 Commenced circling Orbit Point Sugar.
- 0950 Remained outside of survey danger area as prescribed.
- 1102 Entered the lagoon.
- 1216 Anchored off Eneu Island.
- 1240-1248 Received contaminated water samples from first drone boat.
- 1250-1255 Received contaminated water samples from the second drone boat (total samples aboard, 16). Time elapsed from ABLE detonation until water samples were on board was 3 hours, 55 minutes (Reference 6, p. 7-1-A-38).
- 1305 Underway from Bikini Atoll to Kwajalein.
- 1440 At Gea Island; YTB-537 came alongside for transfer of the water samples.

2 July
- 1047 Returned to Bikini and moored to USS Chikaskia (AO-54) in berth 324, Bikini.
- 1428 Underway to Pearl Harbor.

6 July
- 1320 Moored at Pearl Harbor.
- 1352 Underway for San Francisco.

11 July
- 1325 Moored at San Francisco.

15 July
- 0832 Underway from San Francisco to Pearl Harbor.

18 July
- 0730 Underway from Pearl Harbor.
- 1308 Anchored near Pearl Harbor to Kwajalein.

Shot BAKER (25 July, 0835)
- 0958 Shot BAKER (0835, 25 July, 0835).

24 July
- 0815 Anchored in berth 10A, Kwajalein.
- 1147 Received aboard passenger observers and radiological oceanographic personnel.
- 1347 Underway from Kwajalein to area Mack, Bikini Atoll.

25 July
- 0546 Maneuvered in area Mack.
- 0900 Completed upwind patrol for radiological survey.
- 1902 Anchored at Bikini Atoll.

26 July
- 1034 Underway for a radiological patrol outside the lagoon.
- 1715 Sighted oil slick. Maneuvered on various courses and speeds to determine boundaries of oil slick and maximum radioactivity position.
- 1905 Completed taking water samples.

USS Mount McKinley (AGC-7)

Crew Size: 824
Bikini Atoll Arrival: 10 August 1946
Bikini Atoll Departure: 26 August 1946
Shot ABLE Location: 11 nmi (20 km) 1M
Shot BAKER Location: 8.9 nmi (16.5 km) ESE
Decontamination Location: San Diego
Operational Clearance: 16 June 1946
Final Clearance: 29 January 1947

Function
Mount McKinley, an amphibious force flagship, served as the task force flagship. Several key groups were located aboard the flagship, including JTF, telecommunications, and the staff aerological unit.

Shot ABLE (1 July, 0900)
- 1 July
  - 0911 Underway for ABLE operations. Proceeding to assigned station in area Chevrolet.
  - 1430 Maneuvered to keep in assigned station in area Chevrolet.

30 July-2 August
- 0930 Anchored in berth 330, Bikini Atoll.
- 1300 Anchored in berth 330, Bikini Atoll.

31 July-2 August
- 1630 Anchored in berth 330, Bikini Atoll.
- 1530 Anchored in berth 330, Bikini Atoll.

2 August
- 1700 Anchored in berth 330, Bikini Atoll.
- 1500 Anchored in berth 330, Bikini Atoll.

3-5 August
- 1030 Anchored in berth 330, Bikini Atoll.
- 1500 Anchored in berth 330, Bikini Atoll.

6-7 August
- 1430 Anchored in berth 330, Bikini Atoll.
- 1500 Anchored in berth 330, Bikini Atoll.

7 August
- 1030 Anchored in berth 330, Bikini Atoll.
- 1500 Anchored in berth 330, Bikini Atoll.

10 August
- 1430 Anchored in berth 330, Bikini Atoll.
- 1500 Anchored in berth 330, Bikini Atoll.

USS MOUNT MCKINLEY (AGC-7)
3-5 July  Anchored in berth 112, Bikini.

Shot BAKER (25 July, 0835)

25 July

0518  Underway for BAKER Day exercises.
0600  Steaming to maintain position in area
       Chevrolet.
0835  Bomb exploded beneath target array in
       Bikini Lagoon.
0858  Received verbal orders to close to the
       east of Bikini Atoll.
0925  Began maneuvering to maintain position
       approximately 1 nautical mile (2 km) west of Bikini
       Reef.
1118  Anchored in berth Peter, Bikini.

By 4 July the full crew had
accumulated in the engine bilges (Reference
Shot ABLE

Shot BAKER Day exercises, only.

30 July

0925  Began maneuvering to maintain position
       approximately 1 nautical mile (2 km) west of Bikini
       Reef.
1118  Anchored in berth Peter, Bikini.

28 July

0722  Anchored in anchorage Able, Bikini.

30 July

0842  Anchored in berth 112, Bikini.

10 August

1759  Underway for Pearl Harbor.

USS MUGFORD (DD-389)

Crew Site: 12B

Bikini Atoll Arrival: By 1 June 1946
Bikini Atoll Departure: 19 August 1946

Crew location for Shot ABLE: USS Bottineau (APA-235)
Crew location for Shot BAKER: Bottineau

Shot ABLE Location: 5,890 yards (5.5 km) ESE
Shot BAKER Location: 2,595 yards (2.4 km) NE

Task Unit and Function

The destroyer MUGFORD was a target vessel during CROSSROADS. Its crew was evacuated before each test. It was a member of TU 1.2.3 (Destroyer Unit), Destroyer Division 3.

Shot ABLE (1 July, 0600)

30 June

0930  Teams C and D left the ship.
1150  Captain and Team A left ship.

2 July

1111  USS Oneota (AN-85) reported that a board-ing party was on board MUGFORD.
1132  Reported Geiger counter by USS Shakemakun
       (AN-88) (Reference 6, pp. 7-I-A-27
       through 7-I-A-29). 1134  Captain and Teams A and B
       and last-minute decontamination party returned to ship.
1533  Inspected ship.

8 August  Commanding officer and boarding party
         aboard and reported ship highly radioactive. Pumping operations conducted in the afternoon.

2-7 August  Boarded daily for decontamination. Two- to four-hour shifts used with total time aboard about 9 hours per day.

By 4 July the full crew had returned to MUGFORD.

5-23 July  Crew aboard MUGFORD.

Shot BAKER (25 July, 0835)

24 July

0910  Team C left the ship.
1045  Team B left ship.
1030  Captain and Team A left the ship.

29 July

1307-1311  USS Current (ARS-22) reported that its
          boarding team was aboard MUGFORD.
USS *Mugford* (DD-389)

18 August  Half of *Mugford's* crew transferred to re-manned target ship *USS Bladen* (APA-63).
19 August  Towing and anchor team aboard for 45 minutes. Towed to Kwajalein.
21 August  Anchored at Kwajalein.
27 August  Average topside Geiger reading 0.18 R/24 hours.
28 August 1100 *Mugford* decommissioned.

**USS Munsee** (ATF-107)

**USS Munsee** (ATF-107)

18 August  Engaged in routine activities.
18 July 000-1154 Ballasted target submarine *USS Bearaven* (SS-196).
1145-1247 Ballasted target submarine *USS Apogon* (SS-308).
20 July  Shot BAKER (25 July, 0835).
24 July  Underway from Bikini.
25 July  Anchored in Rongelap Atoll.
30 July  Underway from Rongelap to Bikini.
31 July  Anchored east of berth 168, Bikini.
1 August  Routine activities. Not involved with target ships.
2 August  Proceeded to wash down target ship *USS Ralph Talbot* (DD-390). Anchored.
3-4 August  Routine activities.
5 August  Radiological monitor aboard for unknown period of time.
6-9 August  Routine activities.
10-12 August  Maneuvered target ship USS *LST-125* to various anchorages.
13 August  Anchored with *LST-125* moored alongside.
14 August  Maneuvered *LST-123* to various anchorages.
19 August  Went alongside target ship *Prinz Eugen* to prepare it for towing.
20 August  Underway for Kwajalein with *Prinz Eugen* in tow.
22 August  Arrived at Kwajalein and unhooked tow. En route to Bikini.
23 August  Anchored in Bikini Atoll.
24 August  Pumped target ship USS *Gasconade* (APA-85).
25 August  Departed Bikini Atoll towing target ship *USS Independence* (CVL-22) to Kwajalein.
27 August  Underway to Bikini.
28 August  Anchored in berth 227, Bikini.
USS Munsee (ATF-107)
28 August

1551 Underway for Kwajalein with target ship USS Butte (APA-68) in tow.

30 August
1134 Anchored at Kwajalein.

31 August
0935-1030 Monitoring board came on board to check for radioactivity.

2 September Departed for Pearl Harbor.

USS MUSTIN (DD-413)

Crew Size: 112
Bikini Atoll Arrival: By 1 June 1946
Bikini Atoll Departure: 28 August 1946
Crew Location for Shot ABLE: USS Bottineau (APA-235)
Crew Location for Shot BAKER: Bottineau
Shot ABLE Location: 1,143 yards (1.0.96 km) ESE
Shot BAKER Location: 1,280 yards (1.2 km) NNE
Sunk 28 April 1946 near Kwajalein

Task Unit and Function
The destroyer Mustin was a member of TU 1.2.3 (Destroyer Unit). Destroyer Division 3. Mustin was a target vessel during CROSSROADS. Its crew was removed before both shots.

Shot ABLE (1 July, 0900)

30 June
0924 Commenced evacuating ship.
1100 Captain with final evacuation group departed for Bottineau. Last-minute personnel remained aboard to start diesel generator. Entire ship's company with exception of five men in the last-minute personnel group berthed aboard Bottineau for ABLE.

1 July
Entire ship evacuated.

2 July
1003 USS Shakamaxon (AN-88) reported a boarding team aboard Mustin.
1129 Shakamaxon reported it had completed Mustin.
1615 Commanding officer with Team A of re-boarding party returned aboard with Geiger counter, monitor, and selected ship's personnel.
1625 Team B returned aboard and commenced inspection of ship below decks.
1800 Team C reported aboard.

26 July
1715 USS Preserver (ARS-8) directed to proceed to target ship USS Fallon (APA-81), taking most direct route to Mustin. It was then to proceed with great caution from the vicinity of target ships Mustin and USS Salt Lake City (CA-25) to Fallon.

7 August
1400 Entire crew transferred from Bottineau to USS Rockbridge (APA-228).

8 August
IRT-4 reported Geiger readings: average topside 1.5 R/24 hours; maximum topside 4 R/24 hours; average below decks 0.2 R/24 hours; maximum below decks 0.35 R/24 hours.

9 August
0930-1050 Commanding officer and a selected group of officers and men and a radiological monitor boarded Mustin for a quick inspection of the ship. Inspection completed and party returned to Rockbridge.

12 August
0830-1700 Commanding officer with a selected group of men and a radiological monitor boarded Mustin to conduct salvage operations. All personnel returned to Rockbridge.

14 August
0800-1700 Salvage operation group with radiological monitor boarded Mustin and resumed salvage operation. All personnel returned to Rockbridge.

15 August
0745-1600 Salvage operation group with a radiological monitor boarded Mustin and resumed salvage operations. All personnel returned to Rockbridge.

17-19 August
Transferred 88 men to Rockwall.

28 August
1000 Mustin decommissioned. Towed to Kwajalein.

30 August
Anchored at Kwajalein.

30 September
Average topside reading 0.12 R/24 hours.

USS Nagato

Crew Size: 112
Bikini Atoll Arrival: 28 April 1946
Bikini Atoll Departure: 28 August 1946
Crew Location for Shot ABLE: USS Rockingham (APA-229)
Crew Location for Shot BAKER: Rockingham
Shot ABLE Location: 182 yards (175 meters) SSE
Shot BAKER Location: 145 yards (138 meters) NNW
Sunk 30 July 1946, Bikini Lagoon

Task Unit and Function
The captured Japanese battleship Nagato was member of TU 1.2.1 (Battleship and Cruiser Unit). Battleship Division 7, serving as a target vessel. Its CROSSROADS crew, composed of U.S. personnel, was transferred to Rockingham before shot ABLE and did not return to live aboard. It participated in scientific experiments carrying halocruiser gauges.

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Nagato

Shot ABLE (1 July, 1946)
30 June Crew evacuated to Rockingham.

30 July 0700 Nagato sank in Bikini Lagoon.

Nagato's crew was transferred to other CROSSROADS ships. The majority was dispersed among USS Hall River (CA-131), USS Appling (APA-58), and target ship USS Salt Lake City (CA-257) on 4 August.

USS NEVADA (BB-36)

Crew Size: 403

Bikini Atoll Arrival: 20–29 May 1946
Bikini Atoll Departure: 19 August 1946

Crew Location for Shot ABLE: USS George Clymer (APA-27)
Crew Location for Shot BAKER: Clymer

Task Unit and Function
The battleship Nevada was a member of TU 12.1 (Battleship and Cruiser Unit). Battleship Division 9. It was the target ship for shot ABLE. Its crew was evacuated before each shot. It also housed several experiments including ammunition and poison gases for the Army ammunition experiment, representative items for the Army Signal Unit, food and clothing for the Quartermaster Unit, bell-crusher gauges, linear and logarithmic-axis recorders, and four identification and sixteen diaphragm peak-pressure gauges.

Shot ABLE (1 July, 1946)
30 June Crew evacuated to Clymer.

Shot BAKER (14 July, 1946)

USS Reclaimer (ARS-42) reported Nagato listing starboard and settling by the stern. Nagato had a 1-hour tolerance from about 50 feet (15 meters) (Reference 6, p. 7-I-A-24).

When Reclaimer passed Nagato to the starboard, it was down by the stern with an 80° starboard list. The steady increase in list and settling by the stern indicated progressive flooding. Nagato was highly radioactive, precluding reboarding for pumping or towing (Reference 6, p. 7-I-A-28).

Reclaimer reported Nagato's main deck awash, listing to starboard, and down by the stern (Reference 6, p. 7-I-B-34).

Reclaimer passed Nagato to starboard. Nagato had taken on note list, was down 9 feet (3 meters) forward and 6 feet (1.8 meters) aft, and had a tolerance of 1 to 1-1/2 hours (Reference 6, p. 7-I-B-39).

Reclaimer reported Nagato's main deck awash on the starboard side, the list increasing, and the vessel continuing to settle. There was no change in tolerance (Reference 6, p. 7-I-B-46).

28 July
1256 USS Preserver (ARS-8) put a boarding party on Nevada.
1308 Fires extinguished.
1537 USS Clamp (ARS-33) reported a fire on Nevada's No. 4 turret.
1541 Clamp moored alongside, sent boarding team aboard.
1545 Fire party aboard.
1635 Clamp reported the fire on Nevada extinguished and fire party returned to Clamp (Reference 6, p. 7-I-A-33).
1647 Boarding party returned from Nevada.

3 July
1335 The captain with reboarding party A returned to ship to inspect damage.
1410-1420 Member of Bureau of Ordnance with inspection party of eight men came aboard.
USS Nevada (BB-36)
3 July

1430-1650 Party of nineteen aboard.
1515 Reboarding party B boarded to inspect lower decks and engineering plants.
1730 Gunnery officer and party of ten gunners returned to ship to inspect all magazines.
1830 Captain with reboarding party A returned to Clymer.
1925 Party of eight men came aboard to retest men returned to Nevada to remove special radioactivity of ship.
2040 Radioactivity inspection party left ship: 1425 Team of 93 men departed.

With the exception of a 20-man security watch, Nevada remained evacuated. After several days of radiological monitoring and repair work performed by various boarding teams. Nevada was found safe for reboarding by its crew on 8 July.

Shot BAKER (25 July, 0835)

24 July Crew evacuated to Clymer.
30 July 1116 ATA-180 reported recovering instruments from Nevada (Reference 6, p. 7-1-B-51).
1 August 1049 Inspection by USS Deliver (ARS-23) was completed and revealed Nevada to be very radioactive. Deliver's boarding team came back on board (Reference 6, p. 7-1-B-66).
2 August Deliver worked for 1-1/2 hours on Nevada using high-pressure water hoses (Reference 6, p. 7-1-B-74).
7 August 1000-1015 Three-man team boarded for inspection.
9 August 0745 Commanding officer and 27 men boarded.
1135 Sixteen men returned to Clymer.
1145 Teams A and B boarded.
1645 Commanding officer and Teams A and B de-boarded; Geiger readings on quarterdeck 1.9 R/24 hours, forecastle 1.5 R/24 hours.

9-10 August The entire ship was not opened up but completely inspected due to lack of time, other work requiring immediate action, and the still relatively high radioactivity. There were no items of major damage apparent that appeared to have been caused by BAKER. However, the ship was still highly radioactive topside and in some spaces below deck (Reference 2).

10 August 0745 Commanding officer and 91 men boarded.
1015 Team of 23 men boarded.
1130 A group of 104 men returned to Clymer.
1115 A group of 80 men boarded.

USS Newman K. Perry (DD-883)

1630 Commanding officer and 90 men returned to Clymer.

12. 14-16 August Small groups of non-Nevada crewmembers boarded each day. Probably ship inspection teams.

13 August 0930-1100 A radiological monitor and five enlisted men returned to Nevada to remove special equipment.

17 August 0745 Nine men boarded.
2015 Commanding officer and 103 men boarded.
1215 Team of 88 men boarded.
1425 Commanding officer and the remainder of those aboard departed.

18 August Nevada's crew transferred to remanned target ship USS Cortland (APA-75) for transportation to Kwajalein.

19 August Towed to Kwajalein by Preserver. Seven man anchor team aboard Preserver from Nevada.

22 August Arrived at Kwajalein.
27 August Average topside reading 0.6 R/24 hours.
1 October Average topside reading 0.4 R/24 hours.

Nevada was towed to Pearl Harbor for radiological inspection, arriving 5 May 1947.

USS NEWMAN K. PERRY (DD-883)

Crew Size: 280
Bikini Atoll Arrival: 5 June 1946
Bikini Atoll Departure: 4 August 1946
Shot ABLE Location: 30 nm (56 km) NW
Shot BAKER Location: 10 nm (19 km) NE
Decontamination Location: San Diego
Operational Clearance: 13 January 1947
Final Clearance: 25 January 1947

Task Unit and Function
The destroyer Perry was a member of TG 1.6 (Navy Air Group), Destroyer Division 51. Its primary mission was to serve as a plane guard for the aircraft carrier USS Sailsor (CVE-117).

Shot ABLT (1 July, 0900)

30 June 1351 Underway from Bikini.
1 July 1900 Anchored in berth 304, Bikini.
2 July 1535 Anchored in berth 55-A.
4 July 1613 Underway en route to Kwajalein.
5 July 1006 Anchored in berth 13, Kwajalein.
1249 Underway for Rol Island.

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USS Newman K. Perry (DD-883)

5 July

1621 Anchored in berth A-3. Port.
1736 Underway for Bikini.

6 July
0737 Anchored portside to USS Enoree (AO-69), Bikini.
1013 Anchored in berth 55A.
1645 Underway to Hot Island, Kwajalein.

7 July
0810 Anchored at Kwajalein in berth A-6.

12 July
1730 Underway from Kwajalein to Bikini.

13 July
0809 Moored starboard side to Enoree, Bikini.
1040 Anchored in berth 56.

Shot BAKER (25 July, 0835)

24 July
0918 Underway for plane guard station.

25 July
0850 Maneuvering to take plane guard station No. 1.

27 July
1223 Entered Bikini Channel to transfer photographic supplies and a civilian technician to USS Mount McKinley (AGC-7).
1327 Rejoined formation.
1427 Commenced laying to 4 nml (7.4 km) east of Bikini Channel entrance.
1650 Proceeded to screening station 2330 on Reclaimer.

29 July
1443 Anchored in berth Mike, Bikini Atoll.

30 July
0958 Anchored in berth 55A, Bikini Atoll.

1 August
0912 Moored to Enoree.
1119 Anchored in berth 55-A.

2 August
1402 Anchored in berth F, Bikini Atoll.

4 August
1330 Underway for Pearl Harbor from Bikini Atoll.

9 August
1320 Moored Pearl Harbor.

USS NEW YORK (BB-34)

USS NEW YORK (BB-34)

Crew Size: 536
Bikini Atoll Arrival: 15 June 1946
Bikini Atoll Departure: 22 August 1946
Crew Location for Shot ABL: USS Rockbridge (APA-228)
Crew Location for Shot BAKER: Rockbridge
Shot ABL Location: 1,541 yards (1.4 km) ESE
Shot BAKER Location: 570 yards (550 meters) ESE
Battleship Division

Task Unit and Function
The battleship New York was a member of TU 1.2.1 (Battleship and Cruiser Unit). Battleship Division

7. serving as a target vessel for CROSSROADS. Its crew was evacuated before each shot. Among the experimental equipment on board were food and clothing (provided by the Quartermaster Unit) and free-piston recording gauges.

Shot BAKER (25 July, 0835)

30 June
1425 Crew evacuated to Rockbridge.

1 July
1420 USS Reclaimer (ARS-42) noted a smoldering fire amidships on New York (Reference 6, p. 7-I-A-10).


1615-1625 Crew reported the ready service ammunition on New York had overheated (Reference 6, p. 7-I-A-17).

1730 USS Clamp (AGS-33) sent a boarding team aboard.

Boarding team returned to Clamp.

Clamp reported New York Geiger meter reading 20 minutes earlier.


2 July
1150 Commanding officer and boarding team A returned aboard ship. No radiation detected except telephone radium marker buttons, which were not test-related.

1400 Team H returned aboard and commenced opening up the ship.

1630 Team C returned aboard.

1820 Team D returned aboard.

3 July
1130 Team E returned from Rockbridge.

4-23 July
Crew aboard ship.

Shot BAKER (25 July, 0835)

24 July
1125 Crew evacuated to Rockbridge.

25 July
1000-1200 Damage reported (down by stern).

Reclaimer passed close to New York's portside. New York was very radioactive (Reference 6, p. 7-I-B-14).

28 July
0003 Reclaimer again passed New York, which was down slightly by the stern (Reference 6, p. 7-I-B-28).

CJEF 1 reported to Commander Rear Echelon (COMREARECH): "Further Inspection of New York indicates about 1,800 tons increase in displacement with the center of gravity of additional water at Frame 165, resulting in trim by stern of about 4 feet. Situation believed stabilized and ship in no danger (Reference 5, p. 6-0-33).

A radiological monitor boarded and obtained a reading showing 29 minutes tolerance on deck (Reference 6, p. 7-I-B-40).
29 July

1212-1415 Washed down by ATR-40 (Reference 6, p. 7-1-B-42).

1634 A radiological monitor reboarded to take Geiger readings (Reference 6, p. 7-1-B-48). Tolerance time had increased to 40 minutes.

30 July

Washed down by ATR-40 with a high-pressure stream for 4 hours (Reference 6, p. 7-1-B-48).

1 August

1025 USS Deliver (ARS-23) completed its inspection of New York (Reference 6, p. 7-1-B-48).

3 August

Washed down thoroughly by USS Preserver (ARS-8) using high-pressure streams. Preserver used and were relieved every 2 hours and after washing (Reference 6, p. 7-1-B-48).

5 August

1000-1500 The initial boarding team boarded the ship for decontamination operations. Maximum radiation encountered aboard New York was 0.625 R/hr; average reading at the time of the last survey was 0.16 R/hr.

6 August

Washing procedure completed by tug. Captain boarded ship with initial boarding team for inspection of ship.

7 August

0800-1500 The first decontamination teams from the ship's company boarded. Four teams were used and were relieved every 2 hours and returned to Rockbridge. The day was spent gathering and collecting data. One group spent the day scouting for boiler compound, lye, cornstarch, scrubbers, gloves, boots, etc. Freshwater was provided by Rockbridge. By early afternoon water was obtained from the forecastle and the topside was washed down with particular attention being paid to the forecastle.

8 August

0800-1545 Four teams were aboard for 2 hours each. Necessary working materials were now assembled and decontamination on the forecastle began in earnest. Solutions of boiler compound and lye were used, and the forecastle was washed down several times. Sand was obtained and hollystoning began. Cleaning up of the second deck was also started and numerous pools of water removed. Gear cleaned up, and hose gear straightened up.

9 August

0800-1545 Four teams were aboard for 2 hours each. The forecastle was again washed down and hollystoned with boiler compound, lye, and sand. Freshwater still had to be hauled from Rockbridge in cans. Approximately 100 men worked on the second deck and considerable progress was made in cleaning up the second and third decks and the officers' quarters.

10 August

0800-1545 Four teams were aboard for 2 hours each. The forecastle was again hollystoned with boiler compound, lye, and sand. Aircastle and boat decks were washed down with boiler compound and lye: the main deck aft was washed down with saltwater (Reference 4).

Table A.5 shows the results obtained in reducing the forecastle's radioactivity by hollystoning with boiler compound, lye, and sand.

Table A.5. Decontamination results on USS New York (BB-34) forecastle.

<table>
<thead>
<tr>
<th>Frame No.</th>
<th>7 Aug</th>
<th>8 Aug</th>
<th>9 Aug</th>
<th>10 Aug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bow</td>
<td>1.8</td>
<td>0.7</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>10P</td>
<td>1.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.45</td>
</tr>
<tr>
<td>10F</td>
<td>1.6</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>205</td>
<td>1.3</td>
<td>0.9</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>305</td>
<td>1.5</td>
<td>1.2</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>405</td>
<td>2.0</td>
<td>1.1</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>60P</td>
<td>2.0</td>
<td>1.6</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Source: Reference 4.

The reduction in radioactivity on the topside main deck aft from one washing with saltwater is reported in Table A.5.

14 August

0800-1600 Four teams aboard for 2 hours each.

16 August

0800 Engineering party aboard to make connections to receive power from Reclamer.

0930 POM inspection parties and ship inspection parties left ship to collect data.

1115 All parties left ship except an engineer and pumping detail.

1645 All hands clear of ship.

17 August

0830-2000 Two teams aboard 2 hours each.

18 August

Two teams aboard 2 hours each.

0800-1115 Pumping detail aboard ship.

0930-1100 Pumping detail aboard ship.

1100-1500 Pumping detail aboard ship.

19 August

Four teams aboard 2 hours each.

0800-1100 Pumping detail aboard ship.

0930-1500 Pumping detail aboard ship.

20 August

Two teams aboard 2 hours each.

0800-1110 Pumping detail aboard ship.

0930-1300 Pumping detail aboard ship.
21 August

Our teams aboard for 2 hours each.
0100 USS Niagara (AN-85) alongside to starboard to assist in hoisting starboard anchor. Ordnance Inspection team aboard.
0832 Anchor detail aboard.
0833 Reclamite came alongside to port to furnish electric power. Target vessel LCI(L)-6151 alongside to starboard to furnish power.
1230 Ordnance detail left ship.
1410 Starboard anchor was housed.
1536 Widgeon cast off.
1545 Anchor detail left ship. Average topside readings 0.6 1/4 to 7/4 hours.

Final Clearance. 10 November 1946
Scrapped in 1950

Task Unit and function
USS Niagara, an attack transport, served in TU 1.2.6 (Mechanic Type Unit). Transport Division 93, as a target vessel. Its crew was evacuated before each shot. The Quartermaster Unit had placed food and clothing aboard it for experimental purposes.

Final Clearance. 9 November 1946
Scrapped in 1950

Target Unit and function
USS Niagara, an attack transport, served in TU 1.2.6 (Mechanic Type Unit). Transport Division 93, as a target vessel. Its crew was evacuated before each shot. The Quartermaster Unit had placed food and clothing aboard it for experimental purposes.

Shot ABLE (1 July, 0900)

0805 Commenced evacuation of Niagara crew to Bayfield.
1528 Bayfield, with all personnel aboard, underway to operating area about 18 nm (33 km) east of Bikini Atoll.

1 July

1207 USS Oneota (AN-85) sent a team aboard Niagara.

1335-1358 ATA-192 fought a fire on Niagara without boarding it (Reference 6, p. 7-1-A).1355

1524 Oneota Team 9 reported Niagara Geiger string.
1610 Niagara declared free of radiological contamination.

2 July

1205 The captain and Team A (six officers, nineteen enlisted men, and one radiological monitor) came aboard to inspect and open Niagara.
1435 Team B (four officers and twenty-four enlisted men) came aboard to light off the boilers.
1530 The radiological monitor returned to USS Haven (AV-12).1515

3 July

Team C (cust remaining men and gear) came aboard.

USS Niagara's crew lived aboard ship until 24 July.

Shot BAKER (25 July, 0815)

24 July

1026 Commanding officer and the last evacuation group were received on board Bayfield.

25 July

1129 CIU 1.7.1 reported Niagara radiologically clear for boarding (Reference 5, p. 6-10).

1212-1219 USS Preserver (AK-58) boarding team on Niagara (Reference 6, pp. 7-1-A and 7-1-A-8).

1230 Radiosonde reported Niagara Geiger string and recommended all teams be reloaded aboard. Instrumentation Team H went aboard Niagara (Reference 5, p. 6-10).

27 July

1927-1134 An instrumentation team boarded Niagara (Reference 6, p. 7-1-A) and 7-1-A-8.

29 July

1136 Another instrument team was placed on Niagara.

30 July

The commanding officer and Team A left Bayfield to reboard Niagara.
The commanding officer and reboarding Team A and B reboarded the ship and commenced inspection of it; no apparent damage was noted.

1535 Underway to shift berths in the lagoon.

1600 Anchored in berth 381.

1615 The remainder of the crew returned on board with baggage and gear.

Inspections conducted for evidence of radioactivity adjacent to the ship's sides revealed about 0.4 R/24 hours, which decreased in intensity on board to a point 5 feet (1.5 meters) from the sides to about 0.1 R/24 hours. The average reading of compartments below the waterline was 0.05 R/24 hours (Reference 2).

30 July All decks and bulkheads in compartments above the waterline were washed down with soap and water. The sides of the ship were also scraped to a distance of about 5 feet (1.5 meters) below the waterline to remove marine growth.

1 August Afternoon Underway and put to sea to wash the ship's sides. This reduced the Geiger readings approximately 40 percent.

2 August Speed increased to 15 knots (28 km/hr); however, this did not reduce the radioactivity further. Upon entry into Bikini, hogging lines with scrapers attached were led around the ship and the bottom scraped in an attempt to remove some of the marine growth.

3 August Monitor made inspection, finding the ship below 0.10 R/24 hours throughout. Maximum radioactivity on a portion of the ship's hull adjacent to gangway reading there was 0.095 R/24 hours, about 0.05 R/24 hours higher than the rest of the ship. Safe distance from Niagara's hull reduced from 5 feet (1.5 meters) to 1 foot 0.3 meter).

4 August Continued to scrape hull. During this time the entire bottom and waterline area were scraped.

5 August Niagara was again inspected. At this time the monitors declared the ship radiologically safe on all parts and gave it the ready clearance required to depart from Bikini.

Due to the location of Niagara's anchorage, materials from decontaminated ships were washed against it. To prevent these materials from clinging to its sides the waterline was washed down with fire hoses each day for a week, and the bottom was periodically scraped. At the end of a week, another Geiger inspection showed a maximum of 0.08 R/24 hours of 1 January 64. The rest of the ship was below 0.05 R/24 hours (Reference 6). The results of one inspection showed the following (Reference 6):

<table>
<thead>
<tr>
<th>Frame No.</th>
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<th>Starboard</th>
</tr>
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<tbody>
<tr>
<td>57</td>
<td>0.017</td>
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<td>122</td>
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<td>0.048</td>
</tr>
<tr>
<td>135</td>
<td>0.036</td>
<td>0.012</td>
</tr>
</tbody>
</table>

USS Niagara (APA-87)

USS O'Brien (DD-725)

Crew Size: 217

Bikini Atoll Arrival: 15 June 1946

Bikini Atoll Departure: 6 August 1946

Shot ABLF Location: 43 nm (80 km) SW

Shot BAKER Location: 12.5 nm (23 km) W

Decontamination Location: San Francisco

Operational Clearance: 6 November 1946

Final Clearance: 13 December 1946

Task Unit and Function

The destroyer O'Brien (DD-725) served in TG 1.7 (Surface Patrol). Destroyer Division 71. Before its arrival at Bikini, O'Brien had special oceanographic and radiological equipment installed aboard. It conducted radiological patrols, including monitoring the area just inside the lagoon entrance.

Shot ABLF (1 July, 0900)

1 July Steering on course in accordance with JTF 1 Op Plan 4-46.

1414 Commenced radiological patrol.

1815 Stopped all engines to obtain radiological data.

2018 Laying to to collect radiological data.

2 July 0620 Arrived on station; commenced patrolling station.

3 July At 0030, 0217, 0347, 1006, 1245, 1541, and 2134, lying to and obtaining radiological data on station.

4 July At 0151, 0421, 1121, 1321, 1446, 1835, 2014, and 2145 obtained radiological data on station.

5 July 0000 Took radiological data on station.

0645 Entered Bikini lagoon.

0647 Mustered personnel to USS O'Brien (AU-64), berth 30.

0920 Underway to anchorage.

1600 Anchored in berth 190 North Bikini.

6 July 1100 Underway to depart lagoon.

6 July Took hydrographic data.

11 July 1415 Reentered Bikini lagoon.

1615 Anchored in berth 190 Bikini.

14 July Collected radiological and hydrographic data off Bikini and surrounding waters.
USS O'Brien (DD-725)

Shot BAKER (25 July, 0835)

24 July
1212 Underway for area Hudson for shot BAKER.

25 July
0935-1129 Conducted radiological patrol of Eneu Channel entrance.
1515 Commenced patrolling area Studenaker.
1923 Commenced downwind radiological patrol.
2150 Commenced radiological survey.

26 July
0402-0505 Conducted radiological survey.
1225 Anchored in berth 316, Bikini.
1317 Anchored in berth 257, obtaining radiological data.

27 July
1357 Shifted to berth 370.

28 July
1619 Anchored in berth U, obtaining radiological data.

30 July
0800 Relieved USS Pal River (CA-131) as Harbor Entrance Control Vessel (HECV).
0937 Anchored 600 yards (549 meters) northwest of berth 386.
1114 Relieved as HECV.
1152 Moored in berth 305.
1355 Relieved USS Laffey (DD-724) as HECV.
1406 Anchored in berth 386.

2 August
1313 Relieved of duties as HECV.
0900 Anchored in berth 1165.
1516 Anchored in berth H-North.

5 August
0742 Departed Bikini Lagoon to conduct firing exercises.
1738 Anchored in berth H-North.

8 August
1218 Departed Bikini: underway on oceanographic cruise en route to Pearl Harbor.

USS ONEOTA (AN-85)

Shot ABLE (25 July, 0635)

24 July
1222 Entered Bikini Lagoon.

24 July
1320 Joined formation leading the lagoon.

1442 Reported fires on USS Bladen (APA-63) and USS Bracken (APA-64) (Reference 6, p. VII-1-9-A).
1452 Placed boarding team on USS Niagara (APA-87).
1524 Reported Niagara Geiger sweet (Reference 6, p. VII-1-11-A and VII-1-12-A).
1537 Placed boarding team on Bladen.
1542 Reported a small fire on the afterdeck house of Bracken (Reference 6, p. VII-1-13-A).
1635 Placed boarding team on target ship USS Fillmore (APA-83).
1725 Placed boarding team on target ship USS Weymurt (DD-902).
1737 Placed boarding team on Bladen.
1855 Anchored in lee of Eneu Island, Bikini.

2 July
0708 Underway to pick up boarding party.
0730 Underway from anchorage.
0815 Moored to the starboard side of Bracken.
0815 Placed boarding team on Bracken.
0854 Underway to target submarine USS Bracken (SS-394).
1040 Underway.
0925 Moored to the starboard side of Bracken.

5 July
1338 Underway from anchorage.
1445 Proceeding to target area.
1550 Moored to anchorage.
1147 Underway.
1216 Moored next to USS Roiette (APA-99) to receive clamp and chain for mooring buoy.
1602 Underway.
1612 Anchored 800 yards (720 meters) astern target ship USS LST-661.

6 July
1304 Underway from lST-661.
1320 Laying off near Palmyra.
1345 Proceeding to target area.
1320 Moored to anchorage.
1227 Underway.
1216 Moored next to USS Roiette (APA-99) to receive clamp and chain for mooring buoy.
1617 Underway from LST-661.
1602 Anchored in berth H-North, Bikini.

18 July
0056 Departed Bikini Lagoon.

19 July
1602 Underway.
1617 Anchored in berth I43A, Bikini.
1725 Placed boarding team on target ship USS Weymurt (DD-902).
1737 Placed boarding team on Bladen.
1855 Anchored in lee of Eneu Island, Bikini.

18 July
0935-1129 Conducted radiological patrol of Eneu Island.
1225 Anchored in berth 316, Bikini.
1317 Anchored in berth 257, obtaining radiological data.

2 July
0937 Anchored 600 yards (549 meters) northwest of berth 386.
1114 Relieved as HECV.
1152 Moored in berth 305.
1355 Relieved USS Laffey (DD-724) as HECV.
1406 Anchored in berth 386.

2 August
0900 Anchored in berth 1165.
1122 Underway.
1551 Anchored in lee of Eneu Island.

5 August
1334 Underway from anchorage.
1455 Proceeding to target area.
1602 Underway.
1612 Anchored 800 yards (720 meters) astern target ship USS LST-661.

6 July
1617 Underway from lST-661.
1617 Laying off near Palmyra.
1617 Proceeding to target area.
1617 Moored to anchorage.
1617 Underway.
1617 Moored next to USS Roiette (APA-99) to receive clamp and chain for mooring buoy.
1617 Underway from LST-661.
1617 Anchored in berth H-North, Bikini.

8 August
1617 Departed Bikini: underway on oceanographic cruise en route to Pearl Harbor.
25 July
1129 Directed to proceed to the vicinity of USS Kenneth Whiting (AV-14) to embark a special instrumentation team (Reference 6, p. VII-1-6-B).
1810 Anchored in lee of Eneu Island.
26-27 July Anchored in lee of Eneu Island.
28 July
1555 Underway to change berths.
1635 Anchored in unidentified berth in Bikini.
29 July
0805 Underway
0945 Moored to raft of outermost instrumentation gear station.
0947 Hauled gear aboard.
1017 Underway to assigned anchorage.
1155 Anchored in berth 295, Bikini.
31 July
0745-1415 Underway to instrumentation stations. Reported that it would take one more day to complete the recovery of the vertical stations. Oneota also reported that its radionuclide monitor had been ordered removed from the ship.
1120 CTR 1.2.7 reported to Radsafe that removal of the monitor from Oneota without prior notice made it impossible to operate the ship.
1300 Radsafe reported that it had not ordered the removal of the monitor.
1421 Anchored in berth 54, Bikini.
1426 Oneota was directed to discontinue operations for the day because the monitor had been removed (Reference 6, pp. VII-1-60-B and VII-1-66-B).
1 August
0745 Directed to recover vertical stations as requested by the Technical Director. Upon completion, it was directed to CTR 1.8.1 for repairs to auxiliary generator (Reference 6, p. VII-1-65-B).
0750-1530 Underway, picking up instrumentation stations.
1530 Ceased operations for the day and proceeded to anchorage.
1547 Anchored in berth 54, Bikini.
1620 Reported having recovered three vertical stations and that there were probably nine more to pick up. However, one was fouled and two were on the bottom. The radioactivity of the instruments had slowed up operations. The estimate of total radioactivity received was 0.1 R (Reference 6, p. VII-1-70-B).
2 August
0745 Underway to target array to collect gauges.
0815 Began collecting gauges.
1055 All gauges aboard. Secured operations for the day.
1345 Anchored in lee of Eneu Island after receiving water from USS Wildcat (AV-2).
1744 Underway to shift berths.
1810 Anchored off Eneu Island.
3 & August Anchored off Eneu Island.
7 August
1745 Underway to shift berths.
1845 Anchored in berth 88, Bikini.
8 August
1812 Anchored in berth 31, Bikini.
9 August Anchored in berth 31, Bikini.
10 August Underway to shift berths.
0745 0807 Moored portside of ATA-185 to portside of USS Fulton (AS-11) in order to have repairs made on the #2 auxiliary generator.
11-12 August Moored to portside of ATA-185 to portside of Fulton, awaiting repairs.
13 August
0738 Underway to shift berth with ATA-185 in tow on starboard side.
0950 Anchored in berth 58, Bikini.
14 August
1252 Underway to moor alongside Wildcat to take on freshwater.
1635 Anchored in berth 58, Bikini.
15-18 August Anchored in berth 58.
19 August
0728 Underway to pick up anchor.
0749 Anchored in berth 95.
1015 Underway to locate anchor in wet storage in vicinity of Ionchebi Island, Bikini.
1148 Anchored in lee of Ionchebi Island.
1235 Underway to shift berths.
1420 Moored to portside of LCT-1184 to portside of Palmyra.
1703 Underway to shift berths.
1718 Anchored in berth 33, Bikini.
20 August
0800 Underway to go alongside target ship USS Carreret (APA-70) to supply power to hoist its anchor.
0837-1035 Moored to Carreret to supply power to hoist motor.
1040 Underway from Carreret to assigned anchorage.
1102 Anchored in berth 33, Bikini.
21 August
1512 Underway to Lee of Ionchebi Island to place anchor in wet storage.
1628 Anchored in unidentified berth in Bikini.
22 August
1300 Underway to go alongside target ship USS LST-133 to assist in hoisting its anchor.
1402-1705 Alongside LST-133 to furnish power for hoisting its anchor.
1750 Moored next to USS Severn (AO-61) to take on freshwater.
23 August
0840 Underway from alongside Severn to assigned anchorage.
0950 Anchored in unidentified berth in Bikini.
24 August
1045  Underway to change anchorage.
1155  Anchored in berth 116, Bikini.
1322  Underway to moor alongside Fulton.
1335  Moored portside to Fulton.

25 August
0914  Underway from Fulton.
0924-1203 Moored to LST-661 to furnish power for hoisting anchor.
1205  Underway to assigned anchorage.
1223  Anchored in berth 116, Bikini.
1618  Underway to alongside target ship USS LST-52 to assist in hoisting its anchor.
1635  Tied up alongside LST-52 port to port.
1747  Began supplying power to LST-52.
1755  Underway from alongside LST-52.
1814  Anchored in berth 116 in Bikini Lagoon.

26 August
0851  Underway to furnish power and aid in hoisting anchor of LST-52.
0907-1020 Moored to LST-52 to furnish power for hoisting anchor.
1029  Underway from LST-52.
1032  Moored to USS Orca (AVP-49) (AN-79).
1045  Underway to go alongside target ship USS Ralph Talbot (DD-390) to take it in tow.
1327  Moored to Talbot to take it in tow.
1832  Underway from Bikini with Talbot in tow for Kwajalein.

27-28 August
En route to Kwajalein.

29 August
1030  Anchored Talbot.
1040  Proceeding to USS Enoree (AO-69) to take on fuel.
1108  Moored to starboard side of Enoree.
1412  Underway to assigned anchorage.
1425  Moored in berth 29 at Kwajalein.

30 August-5 September
Operated in Kwajalein performing routine buoy-laying duties. Not involved with target vessels during this period.

6 September
1949  Underway for Guam.

7-12 September
En route Kwajalein to Guam.
13 September Arrived at Guam.

USS Orca (AVP-49)

Crew Size: 213
Bikini Atoll Arrival: 7 May 1946
Bikini Atoll Departure: 12 August 1946
Shot ABL location: 22°16' 41'° N
Shot BACK location: 22°16' 41'° N
Decontamination location: Pearl Harbor
Operational Clearance: 11 December 1946
Final Clearance: 11 December 1946

Last Used for: The small seaplane tender ORCA served in the 14th Naval Air Group, as a tender for the seaplane shore between Kwajalein and Bikini Islands. ORCA was also prepared to provide air sea rescue in an emergency. It provided maintenance and towing service to the VHP-3. A one-man aerial rescue unit was aboard to obtain surface weather reports when any of the ships were absent from the Bikini area (Reference 6, p. VII-1-13-R). Finally, within the constraints of its limited communications facilities, ORCA assisted in local air traffic control (Reference 6, p. VII-1-9-P).

Shot ABL (1 July, 0900)
30 June
1648  Underway from Bikini to Point Nan for shot ASLE.

1 July
0727  On station at Point Nan.
1530  Assumed station astern of USS Major (CVE-117).
1921  Anchored in berth 285, Bikini.

2 July
1042  Anchored in berth 22.

Shot BAKER (25 July, 0835)
24 July
1615  Underway from Bikini Atoll in accordance with CJTF I Op Plan 1-46.

25 July
0008  Commenced circling counterclockwise using 8° left rudder in accordance with instructions contained in CJTF I Op Plan 1-46.
0843  Departed from Point Nan.

26 July
1410  Anchored in berth A, Bikini Atoll.

Following BAKER, many seaplanes landed near ORCA.

29 July
0945  Anchored in berth B, Bikini.

30 July
0845  Anchored in berth 22.

2 August
1805  Anchored in berth 304.

3 August
0900  Anchored in berth 22.
1235  Shifted fuel to port for purpose of scraping waterline.
1717  Anchored in berth 304.

4 August
0806  Anchored in berth 22.
1631  Anchored in berth 304.

5 August
0805  Anchored in berth 22.
1647  Anchored in berth 304.

6 August
0936  Anchored in berth 22.
1646  Anchored in berth 304.

7 August
0756  Anchored in berth 22.

12 August
1449  Underway from Bikini to Kwajalein.
USS Ottawa (AKA-101)

Crew Size: 67
Bikini Atoll Arrival: 20 March 1946
Bikini Atoll Departure: 2 August 1946
Shot ABLE Location: 35 m (80 km) ENE
Shot BAKER Location: 25 nmi (46 km) ESE
Decontamination Location: Pearl Harbor
Final Clearance: 13 September 1946

Task Unit and Function
Ottawa, an attack cargo ship, was a member of TU 1.2.1 (Transport Unit). Ottawa and USS Rolette (AKA-99) were loaded with 200 Seabees and construction material at Port Hueneme before sailing for Bikini. At Bikini, they served as barracks and material stores ships for the Seabees.

Shot ABLE (1 July, 0900)
30 June
1249 Underway in accordance with CJTF 1 Op Plan 1-46 for operation area Marmon.

1 July
1007 Anchored in berth 35, Bikini.

2 July
1551 Anchored in berth 35, Bikini.

Shot BAKER (25 July, 0835)

24 July
1646 Underway from Bikini Atoll in accordance with CJTF 1 Op Plan 1-46.

25 July
1749 Anchored in berth 32, Rongelap Atoll.

28 July
0952 Underway for Bikini Atoll.
1638 Anchored in berth 35, Bikini.
1937 Underway from Bikini to Rongelap.

29 July
0831 Anchored in berth 32, Rongelap Atoll.

30 July
1753 Underway for Bikini.

31 July
0739 Anchored in berth 35, Bikini.

2 August
1606 Underway from Bikini to Port Hueneme, California.

USS Palmyra (ARS[T]-3)

Crew Size: 299
Bikini Atoll Arrival: By 1 June 1946
Bikini Atoll Departure: 5 September 1946
Shot ABLE Location: 20 nmi (37 km) NE
Shot BAKER Location: 12 nmi (22 km) SE
Decontamination Location: San Francisco
Operational Clearance: By 22 November 1946
Final Clearance: By 4 January 1947

Task Unit and Function
Palmyra, a salvage craft tender, was the flagship of TU 1.2.1 (Salvage Unit). The duties of this unit included selecting beaching areas, facilitating salvage of damaged ships, performing all underwater work involving divers both before and after the tests, buoy placement, firefighting, and general salvage work. As a floating salvage base, Palmyra carried assorted salvage equipment and housed salvage personnel.

Shot ABLE (1 July, 0900)
30 June
1500 Joined formation, took aboard personnel and engaged in last-minute work off Ionchebi and Eneu.

1 July
0850 In preparation for the flash from atomic bomb ABLE, all hands covered their eyes to prevent blindness.

Explosions were observed in Bikini Lagoon. Fires were evident in target vessels.

0905 Received dispatch from CTU 1.2.7 to remain in reentry area Able.

1207 Ordered to send a boat to transfer boarding team from USS Anchorage (ARS-42) to USS Reclaimer (ARS-42) (Reference 6, p. VII-1-8-A).

1326 Anchored in berth Able, Bikini.

One officer with a 2-man working party left the ship in boat #4 with two burning outfits (to cut anchor chains) for target vessel YO-160.

1435 Boat #6 sent to Reclaimer for assignment to boarding team by Order 1-46.

1520 Boat #5 left the ship to inspect boat pool moorings.

Boat #5 returned.

1540 Was requested to move LCT-1420 100 yards (91 meters) offshore to prevent beaching (Reference 6, p. VII-1-16-A).

1606 Boat #4 returned.

2000 Boat #6 returned.

2 July
1226 LCM #1 left to assist in beaching target submarine USS Skate (SS-305) on Eneu island.

1430 LCM #2 left to assist beaching Skate.

1600 Individual sent to Reclaimer for examination after being exposed to radiological contamination.

24 July
1247 Radiological monitor came aboard.

1249 Underway from Bikini in accordance with CTU 1.2 Op Order 1-46.

25 July
1130 Anchored in Bikini Lagoon.
25 July

**USS Palmyra (ARS[T]-3)**

1200 Directed to have two boats made ready with cutting equipment and to report to Recliner for instructions (Reference 6, p. VII-I-5-B). One cutting boat (LCPR) was returned to Palmyra before entering the target array.

1255 An officer with 5-man working party left the ship for the target area.

1335 Working party returned to ship.

26 July

0852 Freshwater tank and intake tested for radioactivity and found to be clear.

1602 Directed to stand clear until Recliner passed through anchorage area with target ship USS Hughes (DD-410).

1837 Anchored at berth 344, Bikini.

27 July

1012 Directed to send an LCM to pick up an obstruction buoy and replant it on 4-1/2 fathom (8.2-meter) shoal off north end of Eneuf (Reference 6, p. VII-I-11-B).

1336 Directed to send an LCM to beaching area to assist in beaching target ship USS Dentuda (APA-65) (Reference 6, p. VII-I-23-B).

1450 Directed to have an LCM plant anchors for Dentuda (Reference 6, p. VII-I-24-B).

28 July

1154 Directed to have two LCMs ready to assist in berthing target submarine USS Dentuda (SS-335) (Reference 6, p. VII-I-30-B).

1435 LCM #2 left ship.

1440 LCM #3 left ship.

1618 Anchored 450 yards (411 meters) south of berth 380.

1710 LCM #3 returned.

1830 LCM #2 returned.

29 July

0755 Directed to have boat take a series of soundings around Dentuda and Palmyra (Reference 6, p. VII-I-36-B).

0935 Directed to place obstruction buoy in area of sunken target ship USS Batonga (CV-3) to mark mast and afterend of Island (Reference 6, p. VII-I-38-B).

1017 Directed to have an LCM prepared and at high tide to swing stern of Dentuda clear of Eneuf (Reference 6, p. VII-I-39-B).

1125 Some Palmyra personnel were directed to report to USS Mender (ARS[T]-3) with instructions on planting submarine mooring buoy.

30 July

0920 LCM #2 left Palmyra.

1200 LCM #2 returned: crew was contaminated by radioactivity and ordered to change and wash clothes and shoes and to take showers.

1448 Anchored in berth Mike.

1529 Dispatched an LCM with a dynamiting party to capsized target vessel LCT 1114.

2330 LCM and dynamiting party returned.

31 July

1620 LCM #1 with 14 men left to haul Hughes stern off of Dentuda.

1720 LCM #1 returned.

**USS Panamint (AGC-13)**

2 August

1250 LCM #2 departed with 30 cases of dynamite for blasting on Eneuf Island.

1305 LCM #3 departed with a salvage party.

1320 Moored in berth Q.

1330 LCM #3 and salvage party returned.

1850 Moored 500 yards (457 meters) south of berth 380.

3 August

0932 Anchored in anchorage M.

13 August

0940 RadSafe section representative came aboard for temporary duty.

20 August

0855 Target vessel LCI(L)-615 moored to starboard.

21 August

0815 LCI(L)-615 underway.

25 August

1405 Sank radioactive sprung buoy by rifle fire.

30 August

0920 LCI(L)-615 came alongside.

1355 LCI(L)-615 underway.

5 September

1815 Underway to Kwajalein.

6 September

Arrived at Kwajalein.

7 September

1450 Radsafe Radiological Clearance Board reported aboard and commenced examination of ship and personnel.

**USS Panamint (AGC-13)**

**Crew Size:** 591

**Bikini Atoll Arrival:** 29 June 1946

**Bikini Atoll Departure:** 27 July 1946

**Shot ABLE Location:** 13 nmi (33 km) NNE

**Shot BAKER Location:** 9 nmi (17 km) ESE

**Decontamination Location:** Los Angeles, California

**Operational Clearance:** 22 November 1946

**Final Clearance:** By 22 November 1946

**Task Unit and Function**

Panamint, an amphibious force flagship, was a member of TU 1.1.3.3 (Observers Unit). Panamint carried aboard it United Nations representatives, civilian scientists, Congressional representatives, and special press representatives. Because of the press observers, television transmitters and receivers were placed aboard the ship. It also had special equipment for reflectivity measurements.

**Shot ABLE (1 July, 0900)**

29 June

0930 Arrived at Bikini.

Nonparticipating observers boarded and inspected target ships Nagato, USS Nevada (BB-36), and USS Independence (CVL-22).

30 June

1700 Put to sea to take up its station for shot ABLE.
USS Panamint (AGC-13)

1 July
1541 Anchored in berth 250. Observers from Panamint inspected the entire target area in small boats and were permitted to board target ships Nevada, USS Arkansas (BB-33), and German cruiser Prinz Eugen (Reference 6, p. VII-Q-9).

2 July
0954 Underway.
1040 Target ship Japanese cruiser Sakawa sighted sinking by the stern.
1145 Anchored in berth 20.

5 July
1700 Left Bikini Atoll.

6 July
0925 Anchored at Kwajalein.
1500 Began the Pacific cruise that had been planned to occupy the interim period between ABLE and BAKER (Reference 6, p. VII-Q-9).

Shot BAKER (25 July, 0835)

24 July
1145 Sailed from Kwajalein.

25 July
Panamint returned to the Bikini area before the BAKER detonation.
1735 Anchored in berth 382, Bikini Lagoon, just inside Enew Island. Radioactivity in the water around the target area prevented Panamint from going into the lagoon for inspection. The observers were allowed to examine a target ship, USS Hughes (DD-410), beached on Enew Island to prevent it from sinking. The observers viewed Hughes at close range from small boats (Reference 6, p. VII-Q-10).

27 July
1820 Left Bikini for Kwajalein (Reference 6, p. VII-Q-10).

USS Parche (SS-384)

Crew Size: 61
Bikini Atoll Arrival: 22 May 1946
Bikini Atoll Departure: 22 August 1946

Crew Location for Shot ABLE: USS Bullfinch (APA-23)
Crew Location for Shot BAKER: Bottlenose
Shot ABLE Location: 1,366 yards (1.3 km) SSW
Shot BAKER Location: 1,580 yards (1.4 km) SW

Decontamination Location: San Francisco
Scrapped July 1947

Task Unit and Function
The submarine Parche was a member of TU 1.2.4 (Submarine Unit), Submarine Division 112, serving as a target vessel. Its crew was evacuated before each shot. The Electronics Group had installed equipment for electronic experiments aboard it. The group monitored 15 separate pieces of radio and radar equipment aboard the boat.

Shot ABLE (1 July, 0900):

2 July
0935 Parche reported Geiger meter (Reference 6, p. VII-Q-10).
1155 Teams A and B reboarded.

Table A.7. Number of men decontaminating USS Parche (SS-384) between 6 and 21 August and their lengths of time aboard.

<table>
<thead>
<tr>
<th>Date</th>
<th>On Board</th>
<th>Departed</th>
<th>Number of men</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 August</td>
<td>1300</td>
<td>1500</td>
<td>12</td>
</tr>
<tr>
<td>7 August</td>
<td>0900</td>
<td>1100</td>
<td>10</td>
</tr>
<tr>
<td>8 August</td>
<td>0900</td>
<td>1100</td>
<td>20</td>
</tr>
<tr>
<td>9 August</td>
<td>1300</td>
<td>1600</td>
<td>20</td>
</tr>
<tr>
<td>10 August</td>
<td>0830</td>
<td>1100</td>
<td>30</td>
</tr>
<tr>
<td>11 August</td>
<td>0900</td>
<td>1200</td>
<td>8</td>
</tr>
<tr>
<td>12 August</td>
<td>0830</td>
<td>1100</td>
<td>20</td>
</tr>
<tr>
<td>13 August</td>
<td>1300</td>
<td>1530</td>
<td>20</td>
</tr>
<tr>
<td>14 August</td>
<td>0830</td>
<td>1300</td>
<td>30</td>
</tr>
<tr>
<td>15 August</td>
<td>1100</td>
<td>1530</td>
<td>20</td>
</tr>
<tr>
<td>16 August</td>
<td>0900</td>
<td>1400</td>
<td>--</td>
</tr>
<tr>
<td>17 August</td>
<td>0830</td>
<td>1530</td>
<td>40</td>
</tr>
<tr>
<td>18 August</td>
<td>0900</td>
<td>1500</td>
<td>20</td>
</tr>
<tr>
<td>19 August</td>
<td>0900</td>
<td>1730</td>
<td>--</td>
</tr>
<tr>
<td>20 August</td>
<td>0900</td>
<td>1600</td>
<td>--</td>
</tr>
<tr>
<td>21 August</td>
<td>0900</td>
<td>1500</td>
<td>--</td>
</tr>
</tbody>
</table>

Note: -- Indicates "no value given."

Source: Reference 1.

Table A.8. Topside shipboard contamination (R/24 hours) aboard USS Parche (SS-384).

<table>
<thead>
<tr>
<th>Date</th>
<th>Bow</th>
<th>Amidships</th>
<th>Stern</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 July</td>
<td></td>
<td></td>
<td></td>
<td>5.2</td>
</tr>
<tr>
<td>1 August</td>
<td>5.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 August</td>
<td>4.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 August</td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 August</td>
<td>3.5</td>
<td>0.35</td>
<td>0.6</td>
<td>1.6</td>
</tr>
<tr>
<td>7 August</td>
<td>0.6</td>
<td>3.0</td>
<td>0.35</td>
<td>0.86</td>
</tr>
<tr>
<td>8 August</td>
<td>0.4</td>
<td>2.5</td>
<td>0.5</td>
<td>0.71</td>
</tr>
<tr>
<td>9 August</td>
<td>0.1</td>
<td>2.0</td>
<td>0.7</td>
<td>0.50</td>
</tr>
<tr>
<td>10 August</td>
<td>0.2</td>
<td>3.6</td>
<td>0.2</td>
<td>0.80</td>
</tr>
<tr>
<td>12 August</td>
<td>0.2</td>
<td>0.8</td>
<td>0.2</td>
<td>0.40</td>
</tr>
<tr>
<td>14 August</td>
<td>0.12</td>
<td>0.6</td>
<td>0.2</td>
<td>0.27</td>
</tr>
<tr>
<td>15 August</td>
<td>0.2</td>
<td>0.51</td>
<td>0.1</td>
<td>0.322</td>
</tr>
<tr>
<td>17 August</td>
<td>0.15</td>
<td>0.5</td>
<td>0.05</td>
<td>0.211</td>
</tr>
<tr>
<td>18 August</td>
<td>0.08</td>
<td>0.5</td>
<td>0.1</td>
<td>0.230</td>
</tr>
<tr>
<td>20 August</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
*Below decks reported radiologically safe when opened 6 August except for the conning tower (0.5 R/24 hours) and main induction pipe (2.0 R/24 hours)."

Source: Reference 4.
USS Parcke (SS-384)

- 120-1510 Opening up boat.
- 2-24 July Crew aboard.
- Shot BAKER 25 July (Battleship and Cruiser Unit).

USS Pennsylvania (BB-38)

- Crew Location for Shot BAKER: Clymer; Rockbridge
- Shot ABLE Location: 1,541 yards (1.4 km) SE
- Shot BAKER Location: 1,140 yards (1.0 km) S
- Sunk 10 February 1948 near Kwajalein

Task Unit and function

The battleship Pennsylvania served in TU 1.2.1 (Battleship and Cruiser Unit). Battle-Ship Division 9, as a target ship for CROSSROADS. Its crew left the ship for each shot. Different kinds of materials were placed aboard the ship for experimental reasons. The materials included food and clothing, ammunition, and radio, radar, and electronic equipment.

Shot ABLE 1 July, 0900

Most Pennsylvania crew members were evacuated to Clymer and Rockbridge on 29 and 30 July.

- 1 July 0335 The last-minute evacuation group left for Rockbridge, leaving no persons aboard.
- 1314 Explosions amidship noted (Reference 6, p. VII-I-8-A).
- 1330 A fire flared up on Pennsylvania and burned continuously until about 1330 when it was extinguished by the USN salvage parties.
- 1445 Pennsylvania was reported Geiger sour (Reference 6, p. VII-I-11-A).
- 1700 Crew concluded on Clymer.
- 1905 DSM declared Pennsylvania clear for boarding by Teams A and B; to be hoarded on the following day.

2 July 013 The commanding officer and a portion of Boarding Team A departed from Clymer for USNS Haven (AH-12) to pick up the radiological monitor.

- 1130 The radiological monitor was taken aboard the ship and on to Pennsylvania.
- 1155 The ship's initial boarding team immediately commenced a radiological clearance of the topside.
- 1215 The topside and the forecastle main mast were found to be radiologically clear, and the inspection was continued below decks.
- 1457 The engine rooms, fire rooms, and auxiliary spaces were found to be radiologically clear.
- 1435 The remainder of Team A and Team B was received aboard.
- 1455 The radiological officer and commanding officer satisfied themselves that Pennsylvania was radiologically clear and safe.
- 1507 The radiological monitor collected water samples and returned to Haven.
- 2005 Clearance to turn on freshwater was obtained.
USS Pennsylvania (BB-38)

3 July
1600 Remainder of crew returned aboard.

5 July
1700 Jettisoned two test OS2U aircraft.

6 July
1026-1440 Conducted diving operations to check the underwater condition of the ship.

Shot BAKER (25 July, 0835)

25 July
0357 The last-minute evacuation group was evacuated to Rockbridge.
1408 CJTF I told DSM to avoid Pennsylvania as radioactivity on board was sharp with high intensity (Reference 6, p. VII-11-A).

27 July
1030 Pennsylvania cleared for the initial boarding team.
1400 Pennsylvania last-minute crewmembers aboard Rockbridge were transferred to Clymer.
1608 USS Reclaimer (ARS-42) passed Pennsylvania, which had a 25-minute tolerance.

28 July
Pennsylvania was reported to be slightly down by the stern with a slight starboard list.

31 July
1406 The after section of Pennsylvania was washed down with foamite by salvage vessels.

1 August
0831 USS Deliver (ARS-23) reported having completed covering Pennsylvania with foam (Reference 6, p. VII-I-66-A).

3 August
Deliver was instructed to wash down Pennsylvania thoroughly using high-pressure streams and afterwards take Geiger readings from 30 feet (15 meters) on each side (Reference 6, p. VII-I-77).

8 August
0930 The first Pennsylvania boarding team, along with the radiological monitors from Haven, commenced a preliminary inspection. The radiological survey showed a 45-minute to 2-hour tolerance on the weather decks. Geiger readings are presented in Table A.9. Pumping and radiological decontamination was carried on until 1700, at which time the ship was closed up and the boarding team returned to Clymer.

9 August
0843-1630 Boarding team worked on radiological decontamination and pumping of the after compartments. Canvas, manille, and cork floats were removed from the topside, and the starboard side of the quarterdeck was scrubbed in decontamination efforts. The boarding team returned to Clymer.

10 August
0840 The boarding team boarded Pennsylvania and commenced salvage and decontamination work: continued decontamination work on the weather decks with assistance from working parties from target ships USS Independence (CVL-22), USS Pensacola (CA-24), USS Mogford (DO-388), and USS Ralph Talbot (DD-390).

11 August
All decontamination work on Pennsylvania was halted.

14 August
Radiological monitors tested men who had been on Pennsylvania.

16 August
The air in the ice room on Pennsylvania was found radiologically unsafe. The crew returned to remanned target ship USS Nilegna (APA-87), where Pennsylvania personnel had been transferred for berthing and messing.

17-21 August Working parties boarded Pennsylvania to inspect and prepare it for towing.

21 August
1400 Pennsylvania underway in tow by USS Chus'nac (ATF-100) for Kwajalein. Topsides average 0.7 R/24 hours (Reference 7).

24 August
1100 Pennsylvania arrived at Kwajalein.

29 August
Decommissioned at Kwajalein.

20 September
Topsides average 0.39 R/24 hours (Reference 7).

Pennsylvania underwent radiological and structural studies until 10 February 1948, when it was sunk.

Table A.9. Geiger readings aboard USS Pennsylvania (BB-38) by ship's company the first day of reboarding (8 August 1946).

<table>
<thead>
<tr>
<th>Location</th>
<th>Range</th>
<th>Maximum</th>
<th>Location of</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starboard, main deck aft</td>
<td>2.0 - 4.0</td>
<td>10.0</td>
<td>Waterline, scuppers</td>
<td></td>
</tr>
<tr>
<td>Port, main deck aft</td>
<td>2.0 - 4.0</td>
<td>15.0</td>
<td>Plane</td>
<td></td>
</tr>
<tr>
<td>Port, starboard side of forecastle</td>
<td>1.5 - 3.0</td>
<td>18.0</td>
<td>Scupper (waterways) generally had hot spots</td>
<td></td>
</tr>
<tr>
<td>Superstructure deck</td>
<td>2.0 - 4.0</td>
<td>18.0</td>
<td>Vegetable locker, water</td>
<td></td>
</tr>
<tr>
<td>Main mast</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foremast</td>
<td>Slightly</td>
<td>&gt;1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Reference 3.
Crew Size: 354
Bikini Atoll Arrival: 28-29 May 1946
Bikini Atoll Departure: 24 August 1946
Crew Location for Shot ABLE: USS George Clymer
Shot ABLE Location: 710 yards (649 meters) W
Crew Location for Shot BAKER: USS Rockingham
Shot BAKER Location: 640 yards (585 meters) W
Decontamination Locations: Kwajalein; Bremerton
Shot BAKER Location: USS Rockingham
Shot ABLE Location: USS Pensacola
Crew Size: 354

1-10 July
1349 No Pensacola crewmembers regularly boarded aboard, but continued living on Rockingham. The crew worked on Pensacola from 3 to 10 July and returned to Rockingham each night except for a small security detail.
1430 Task force medical officer on board for inspection.
1035 Crew returned to quarters aboard. Anchored in berth 161.

1 July
0340 Completed evacuation of Pensacola to Rockingham. Last-minute security detail evacuated to Clymer.
1630 Clymer and Rockingham reentered the laagoon and proceeded to anchor for the night. Later in the night, Pensacola personnel aboard Clymer disembarked and joined Pensacola crew aboard Rockingham.
1702 Fire noted burning on fantail (Reference 6, p. VII-I-16-A).

2 July
1630 Although Pensacola had not yet been cleared radiologically, the commanding officer made a survey of Pensacola from a small boat but did not board.

3 July
0800 Pensacola cleared radiologically.
0915 The commanding officer, Team A, and radiological monitor came aboard.
0925 Joint Chiefs of Staff and members of the President's Evaluation Board, who had boarded prior to the commanding officer, left the ship.
1040-1200 Conducted radiological inspections of the topside structures. Topside was cleared radiologically with some exceptions.
1300-1700 Team B on board to open below deck spaces and continue with radiological survey below. Pensacola declared radiologically clear with minor exceptions. A security watch of 3 officers and 23 enlisted men remained aboard.
1120-1430 Task force medical officer on board for inspection.
1200 Repair parties boarded Reclaimer (ARS-42).
1430 Reclaimer went alongside Pensacola. Reboarding groups boarded Pensacola to adjust hoses and to continue preliminary damage inspection.

5 August
1430 Reclaimer came aboard to adjust pump hoses and inspect damage. In accordance with advice from radiological monitor, four men were sent to USS Haven (AH-12) for examination because their hands had been contaminated while working on Pensacola.

10 August
0315 Last-minute personnel left ship for Clymer.
25 July
0345 The detonation caused extensive damage to Pensacola and it was radiologically unsafe for habitation.
27 July
Pensacola crewmembers aboard Clymer apparently transferred to Rockingham.
30 July
ATR-87 washed down Pensacola for 4 hours with high-pressure hoses (Reference 6, p. VII-I-49-B). The ship had tolerances of 6 and 14 minutes.
31 July
ATR-87 washed down Pensacola with foamite (Reference 6, p. VII-I-57-B).
1 August
Work parties from Pensacola boarded USS Preserver (ARS-8) to go alongside Pensacola.
1420 Preserver washed down decks and superstructures with saltwater to reduce high radioactivity after a boarding party from Pensacola found it unsafe.
1500-1623 Repair teams aboard to lay out hoses and pump out flooded compartments. Repair crews left Pensacola and the Pensacola boarding party returned to Rockingham. Radioactivity was too high to permit an accurate assessment of damage.
2 August
0830 Repair parties boarded USS Reclaimer (ARS-42).
1002 Repair parties boarded Pensacola and completed laying our hoses and connected portable pump in preparation for pumping out flooded compartments.
1805-1810 Reclaimer moored alongside to refuel pump.
1028 Reclaimer stood clear from alongside Pensacola due to heavy radioactivity, which prevented it from remaining.
1415-1528 Reclaimer alongside Pensacola to complete connecting pump and hoses. High radioactivity prevented reboarding except for short periods of time.

7 August
1430 Reboarding party from Reclaimer adjusted hoses.
8 August
1510-1610 Reclaimer alongside Pensacola with reboarding party to adjust hoses.
10 August
1030-1130 A small boarding party from Reclaimer came aboard to adjust pump hoses and inspect damage. In accordance with advice from radiological monitor, four men were sent to USS Haven (AH-12) for examination because their hands had been contaminated while working on Pensacola.

11 July
1035 Crew returned to quarters aboard.
1035 Anchored in berth 161.
USS Pensacola (CA-24)

10 August

1300 The men were examined and returned to duty.

11-24 August High radioactivity continued to prevent reboarding of the ship except for short periods of time.

14 August 0830 Radiologists came aboard Rockingham to check all Pensacola personnel who had been on board Pensacola. Results were satisfactory. Pensacola continued to be unsafe for habitation.

17, 19 August About 200 Pensacola crewmembers were transferred to Clymer.

26 August Arrived at Kwajalein: the

22 August Topside average 1.0 R/24 hours (Reference 7).


22 August Six men were transferred to Preserve for temporary additional duty in connection with towing and anchoring Pensacola.

0830 A small party reboarded Pensacola to prepare it for towing.

1050 Taken in tow to Kwajalein: crewmembers departed aboard Rockingham.

26 August Arrived at Kwajalein: the 6-man towing detail returned to Rockingham from Preserve.

28 August Decommissioned.

1 October Topside average 0.8 R/24 hours (Reference 7).

Pensacola was towed to Puget Sound Naval Shipyard by USS Mitchel (ATF-103) and USS Takesha (ATF-113) for radiological research on 21 April 1947.

1 July Underway after evacuation party from Aomen reported aboard.

0445 Underway after evacuation party from Aomen reported aboard.

0650 Rendezvoused with PGM-24, PGM-25, PGM-29, PGM-31, and PGM-32.

1130 Received clearance into lagoon from radiological safety section. Commenced making oceanographic and radiological survey of sector Brazil with radiological patrol boats (LCPL-A-1, A-2, A-3, and B-19).

2 July Conducted radiological and oceanographic surveys.

0708-1452 Conducted radiological and oceanographic surveys.

1452 Anchored in berth 40.

3 July Underway in accordance with safety plan of CJTF 1 Op Plan 1-46.

0653 Underway in accordance with safety plan of CJTF 1 Op Plan 1-46.

1201 Anchored at Bikini.

1345 Underway.

1818 Moored alongside USS Baton (L2-72).

1911 Anchored in berth 21.

4 July Shifted anchorage, bearings Beacon "B" 112.5°T, Beacon "C" 76°T. Beacon "E" 31.5°T.

0910 Evacuation party from Aomen departed.

5 July Underway from anchorage, proceeding to make radiological surveys of Lokuj, Bokonejien, Nam. Aomen, Iroij, Odrik, and Lomillik islands.

1850 Underway from anchorage, proceeding to make radiological surveys of Lokuj, Bokonejien, Nam. Aomen, Iroij, Odrik, and Lomillik islands.

Anchored in berth 3A.

6-23 July No contact with target vessels.

Smoke BAKER (25 July, 0835)

24 July Radiological section party aboard, commenced operation of BAKER D-1.

0950 Radiological section party aboard, commenced operation of BAKER D-1.

1235 Evacuation of Iroij Island completed.

1605 Underway to drop seismographic and wave measurement buoys.

25 July Evacuation party from Aomen Island aboard.

0508 Evacuation party from Aomen Island aboard.

0612 Departed for area Franklin as assigned in CJTF 1 Op Plan 1-46.


1835 Underway, proceeding to make radiological reconnaissance of lagoon in accordance with CJTF 1 Op Plan 1-46.

26 July Underway, proceeding to make radiological reconnaissance of lagoon in accordance with CJTF 1 Op Plan 1-46.

0743 Underway, proceeding to make radiological reconnaissance of lagoon in accordance with CJTF 1 Op Plan 1-46.

1657 All monitors and oceanographers departed.

1702 Anchored 700 yards (640 meters) from temporary berth Roger.

30 June A radiosafe party reported aboard to participate in the operation. Evacuated personnel from Iroij and Nam before anchoring off Aomen Island.

27 July Proceeded to carry out radiological survey.

0614 Proceeded to carry out radiological survey.

1158 Anchored off USS Appling (APA 58).
2 July

Rad-safe section ordered all crewmembers except 5 men to depart ship. Remaining crew left ship for Appling. A new monitor reported aboard.

28 July

Two officers boarded as skeleton crew. Four men reported aboard as skeleton crew. Ten men reported aboard. All crewmembers except 11 men and officers evacuated to Appling.

29 July

Crew returned from Appling. Radiological monitors aboard, proceeding on radiological survey of lagoon. Anchored in temporary berth 1, Bikini.

30 July

Conducted radiological survey. Anchored in berth 34A.

31 July

Carried out radiological patrol. Anchored 49 yards (14 meters) east of berth 25A. Shifted to berth 34A.

1 August


2 August

Proceeding on decontamination run outside the lagoon. Anchored 1,600 yards (1.5 km) from berth 370. Proceeding on decontamination trip outside the lagoon. Anchored in berth 384. Shifted anchorage to berth 361.

3 August

Underway for decontamination run. steaming on various courses and speeds inside lagoon. Passed lagoon entrance and proceeded on various courses on 6-hour decontamination run outside lagoon. Anchored in Bikini Lagoon in berth 353.

10 August

Representatives from USS Bowditch (AGS-4) came aboard for scientific work. Underway at various courses and speeds making survey of lagoon, stopping every 1,000 to 2,000 yards (0.9 to 1.8 km) to take water samples. Anchored 300 yards (214 meters) southwest of berth 14.

11-15 August

Routine activities.

15 August

Towed two target LCMs west of the target array for sinking and sank them. Anchored 400 yards (366 meters) north of berth 38.

16 August

Removal of a reel placed aboard by the radiological department.

19 August

Photographed target ships. Anchored 400 yards (366 meters) north of berth 38.

20 August

Underway on photographic assignment. Steaming on patrol assignment.

21 August

On patrol assignment.

22 August

Radsafe officer removed radiological gear.

23 August

Petrolled target area.

24 August

Petrolled target area.

25 August

Underway for Kwajalein.

26 August

Anchored in Kwajalein. Checked and declared radiologically safe by Radsafe Section. Radsafe recommended another check for radioactivity be made if the ship were drydocked or major machinery overhauled.

27 August

Underway to carry out patrol of target ship area. Anchored in Kwajalein Lagoon in berth 20.

28 August

Anchored in Kwajalein 2019. Underway to take on fuel and water. Moored starboard side to USS Severn (AO-61).

30 August


1 September

Underway to patrol target ship area. Anchored in berth 22-King, Kwajalein.

2 September

Underway on nightly patrol of target ship area. Anchored in berth 22-King.

3 September

Anchored in berth 22-King.

31 August

Underway to patrol target area. Anchored in berth 22-King.

1 September

Underway on nightly patrol of target ship area. Anchored in berth 22-King.

2 September

Anchored alongside 121-1105, which was moored alongside USS Limestone (IX-158). Anchored in berth 22-King. Underway in Kwajalein area.

3 September

Made preparations for getting underway.
3 September

2218 Secured from special seal detail, orders to patrol area of target vessels having been cancelled by CVV-138.

4 September

0930-1012 Moored alongside USS Tombigbee (AGD-11) to take on water.

1023 Anchored in berth King-17.

1322 Anchored in berth K-9.

1506 Underway.

1525 Moored to starboard side of PGM-24.

1904 Underway.

1907 Anchored in unspecified anchorage, Kwajalein.

5 September

0135 Proceeding to N.O.B., Guam.

0920 Received orders to proceed back to Kwajalein.

6 September

0610 Anchored in berth K-21, Kwajalein.

1537 Moored to portside of PGM-24.

7 September

1312 Anchored in berth K-16.

8 September

1325 Shifted anchorage in berth K-16.

1925 Shifted anchorage to unspecified point in Kwajalein Lagoon.

9 September

Departed for Pearl Harbor.

10 September

Arrived at Pearl Harbor. An inspection for radioactivity was conducted.

PGM-24

Crew Size: 48

Bikini Atoll Arrival: 14 May 1946

Bikini Atoll Departure: 25 August 1946

Shot ABLE Location: 20 miles SE of Bikini

Shot BAKER Location: 30 miles SE of Bikini

Disinfection Location: Pearl Harbor

Operational Clearance: 13 February 1947

Final Clearance: 12 March 1947

Task Unit and Function

PGM-24, a patrol motor gunboat, was a member of 701.8.2 (Dispatch Boat and Boat Pool Unit). It was assigned to perform lagoon radiological patrols. These were conducted in the first few days following each shot. The ship then performed boat pool duties.

Shot ABLE (1 July, 0900):

10 June

Proceeding to area Franklin.

1 July

0900-0955 Proceeding to area Catterpiller.

1020 Arrived at lagoon entrance.

1145-1216 Proceeding to patrol sector Chile in company with radiological patrol boats B-6, B-7, and H-8.

1530 Laying to and changing position in accordance with radiological readings.

1603 Anchored in sector Chile.

2 July

0755 Underway to make radiological patrol of northern part of area in vicinity of target vessels.

1130 LCCL alongside to pick up water samples and record sheets.

1143 Anchored close astern target ship USS Nevada (BB-36).

1147 Underway and laid to waiting for tugs to tow target ship USS Independence (CVL-22) clear of area.

1240 Anchored close astern to Nevada.

1340 LCPL-B-12 took some oceanographic equipment from PGM-24 aboard.

1430 Underway to western edge of lagoon to take radiological samples.

Arrived on station.

Proceeding to specified sectors, taking samples on arrival.

Arrived in last sector near USS Haven (AH-12).

1504 Received a radiological group aboard from Haven; disembarked group that was aboard.

Anchored at Bikini.

3 July

0906 Underway resuming radiological patrol.

Laying to.

1245 Underway for next station to obtain water samples for radiological section.

1802 Anchored in vicinity of Haven.

4 July

1020 Underway to resume radiological patrol of western part of lagoon.

1035 Moored alongside PGM-23.

1125 Underway from PGM-23, steaming to first station, carrying out radiological patrols.

1730 Anchored off Haven.

5 July

1116 Underway for Bokdrolul, Bokaoetoktok, Adirkan, Calea, and Loko islands to conduct radiological tests.

Arrived at Bokdrolul Island, laying to awaiting radiologists to clear island.

1515 Underway for Broken and Adrikan islands.

1533 Arrived at passage between Broken and Adrikan islands.

1816 Anchored in vicinity of Haven.

6-24 July

Engaged in routine activities.

Shot BAKER (25 July, 0835):

24 July

1709 Arrived in area Franklin, joining PGM-25, PGM-24, and PGM-32. Proceeded in column to patrol sector.

25 July

0001 Steaming in area Franklin.

0430 Proceeded to area Catterpillar.

0440 Proceeded to lagoon entrance.

1425 Entered the lagoon and proceeded via safest route with Bikini landing, petty following in UMP-1A-6.

1645 Arrived in new station accompanied by UMP-1A-6 and U-9, laying to await further directions.

1730 Proceeding to Bikini via safest route.

381
1 July

1645 1100 Underway to new berth by orders of Radiological Survey.
       1155 Anchored in berth 34A.
       1205 Underway to approach starting position of a new set of radiological surveys.
1700 1800 Made radiological surveys.
       1825 Anchored in night station.

2 July

0040 0120 Underway to carry out radiological patrol.
0150 0200 Evacuated officers and crew returned.
0640 0510 Underway on radiological patrol.
0910 0930 Underway on radiological patrol.
1615 1620 Underway on radiological patrol.
1850 1920 Anchored at Bikini.

3 July

0900 0920 Underway to make radiological survey in target area.
           0925 Anchored.

4 July

0900 0920 Underway on radiological patrol.
           0930 Anchored.

5 July

1000 1020 Underway on radiological patrol.
1030 1050 Anchored at Bikini.
1420 1420 Underway on radiological patrol.
1520 1520 Anchored at Bikini.

6 July

1000 1020 Underway on radiological patrol.
1030 1050 Anchored at Bikini.
1530 1530 Underway on radiological patrol.

7 July

0845 1850 Underway to make decontamination run at Waven.
           1900 Shipped berths.
           2200 Shipped berths.

8 July

0640 0740 Underway to new berth by orders of Radiological Survey.
           0745 Anchored in berth 34A.
           0800 Underway to make radiological survey in target area.
           1420 Anchored in vicinity of Haven.

9 July

0940 1020 Underway to target anchorage to take radiological readings near sunken targets.
           1025 Anchored near target ship USS Nevada (BB-36).
           1350 Underway to anchorage.
           1420 Anchored in berth 69.

10 July

0040 Underway for Guam via Kwajalein.
11 August
0952 Anchored at Kwajalein.

12 August
Underway from Kwajalein to Guam.

17 August
Arrived at Guam.

PGM-29

Crew Size: 48

Bikini Atoll Arrival: 14 May 1946

Bikini Atoll Departure: 10 August 1946

Shot ABLE Location: 70 nmi (33 km) EN

Shot BAKER Location: 80 nmi (45 km) S

Decontamination Location: New Orleans

Final Clearance: 28 May 1947

Task Unit and Function

PGM-29, a patrol motor gunboat, was a member of
TU 138 (Dispatch Boat and Boat Pool). It was
assigned to perform Decontamination duties in
area Bikini during the first few days following each shot,
after which it was to perform boat pool duties.

Shot ABLE (1 July, 0000)

0900 Proceeding to harbor entrance.

0919 Laying to in area Caterpillar.

1150 Entered the lagoon.


1820 Anchored in Bikini Atoll.

2 July
0725-1732 Underway conducting radioactivity survey.

1732 Anchored.

3 July
0800 Two photographers and two radiological

men came aboard.

0900 Photographers left ship.

0935 Steaming while carrying out radioactivity

survey.

1330-1532 Anchored off Nan.

1820 Anchored in berth 40, Bikini Atoll.

4 July
0917 Underway in Bikini Lagoon while taking

water samples.

1616 Anchored in berth 40, Bikini.

4 July
Routine activities.

Shot BAKER (25 July, 0835)

24 July
1015 Radiological party from USS Haven (AM 12) come

aboard for BAKER.

1258 Proceeded out of harbor.

1440 Patrolled area Franklin.

25 July
0835 Proceeding to area Caterpillar.

0900 Laying to in area Caterpillar.

1140 Entered lagoon.

In target area carrying out BAKER day
operations in sector England (east to
southeast of surface zero). In company
with LCPL B-12, B-13, and B-14.

Radiological and photographic parties
left ship.

Anchored in berth 320, Bikini.

Shifted anchorages.

Due to excessive radioactivity accumu-
lated while carrying out BAKER day activ-
ities, all of the crew was evacuated to
USS Apple (APA-58) with the exception
of the captain, executive officer, and
six crew members.

26 July
0812 1230

Crew returned to PGM-29.

Underway to sector Holland (west of sur-
face zero) to take water samples.

Observers aboard.

In vicinity of target vessels.

Observers departed.

Anchored in Bikini Lagoon.

27 July
0722

Underway in sector England (south to
southeast of surface zero). Taking
samples of radioactive water.

Entered sector Argentina (north to
northwest of surface zero).

Anchored in area 92, Bikini.

28 July
0845 1728

Monitors came aboard.

Steaming while taking samples of radio-
active water in the lagoon.

Anchored in Bikini Lagoon (11°31'10"N,
165°30'30"E).

1307-1310

Monitors arrived.

Anchored in area Franklin.

1820

Anchored in Bikini Lagoon.

29 July
0900 1030

Monitors boarded.

Steaming in Bikini Lagoon for radiolog-
ical survey work.

Monitors left ship.

Anchored in position 11°30'45"N, 165°
30'20"E.

30 July
0930 1515

Underway in Bikini Lagoon taking water
samples.

Anchored in berth 25.

1 August
1830 1538

Underway.

Proceeded on decontamination run inside
lagoon.

Anchored in berth 14, Bikini.

2 August
0930

Monitors logged.

Proceeded to take water samples for ra-
diological survey.

Anchored in berth 14.

3 August
0945

Steaming in Bikini Lagoon on a decontam-
ination run.

Anchored in berth 14.

7 August
Anchored in berth 16, Bikini.

1130

In target area carrying out BAKER day
operations in sector England (east to
southeast of surface zero). In company
with LCPL B-12, B-13, and B-14.
5 August
1300 Oceanographic party boarded and removed all oceanographic equipment.

9 August
0600 Oceanography party boarded.
0800 Streaming St. Barths-Leopard by samples of water.
1000 Water sampling devices leak.
1116 Oceanography party departed for USS New Hampshire (AGS 4).
1144 Anchored in 3,000 fathoms.

13 August
0800 Oceanography party on board to prepare a microbiochemical survey of the PGM-29.
1300 Underway en route to St. Barths-Leopard.
1400 Arrived at St. Barths-Leopard.
1700 Underway for New Hampshire.
1800 Arrived at New Hampshire.

31 July
0045 Underway for water samples for oceanographic survey.
0655 Anchored in 60 fathoms.

5 July
1300 144' Underway with oceanographic survey party for water samples.
1444 Oceanographic survey party used a motorboat to visit Leopard-Atlantic.
1444 Leopard-Atlantic aboard, Leopard-Africa did not return.
1506 Anchored in 9,000 fathoms.

8 July
0600 144' Underway, 144' inches or westward end of PGM-29.
1500 Anchored in 60 fathoms.

16 July
0045 Underway, with oceanographic survey party for water samples.
1644 Anchored off St. Barths.
1726 Oceanographic survey party to St. Barths-Leopard.
1726 Underway, not in St. Barths-Leopard.
1800 Anchored.

19 July
1300 Underway, 144' north and anchored.
1345 Anchored.

21 July
0245 Underway, 144' north, 6,000 fathoms.
0745 Anchored.

24 July
0800 Underway, 144' north, 6,000 fathoms.
0945 Anchored.

28 July
0800 Underway, 144' north, 6,000 fathoms.
1145 Anchored.

29 July
1345 Underway, 144' north, 6,000 fathoms.
1345 Anchored.

30 July
26 July

Depleted unit returned to Bikini Atoll on 16 July 1946 and remained for three days to conduct final decontamination and liquid waste disposal operations. The unit then proceeded to the Marshall Islands for a short period of time. On 19 July, the unit left for Pearl Harbor, where it remained until 22 July, when it was transferred to the United States for decommissioning.

Note: The unit was not involved in any weapons testing operations.

PGM-31

26 July

Depleted unit returned to Bikini Atoll on 16 July 1946 and remained for three days to conduct final decontamination and liquid waste disposal operations. The unit then proceeded to the Marshall Islands for a short period of time. On 19 July, the unit left for Pearl Harbor, where it remained until 22 July, when it was transferred to the United States for decommissioning.

Note: The unit was not involved in any weapons testing operations.

PGM-32
26 July
0941 1720 Collected scientific data in accordance with Shot BAKER (17) operations.
0728 Anchored in vicinity of Hoven.
1030 Evacuated personnel to USS Aplom (APA-50) due to radioactivity.

21 July
0755 Crew returned to PGM 31.
0845-1615 In target array area to gather scientific data.
1002 Anchored in vicinity of Kueh Channel entrance.

28 July
1940 Underway from anchorage in vicinity of Hoven to new anchorage due to radioactivity in area.
1640 Anchored in vicinity of Aplom.

29 July
0800 Underway within Bikini Lagoon collecting scientific data on radioactivity.

30 July
0841 1920 Underway from anchorage to vicinity of target area to gather scientific and radiological data.
1830 Anchored in berth 34.

21 July
1546 Underway to receive fresh supplies and water.
1852 Anchored in berth 52.

1 August
1221-1740 Outside of Bikini Lagoon.

2 August
10 Routine activities.

10 August
1840 Left Bikini for Guam via Kwajalein.

11 August
1010 Arrived at Kwajalein.

12 August
1400 Departed Kwajalein.

17 August
1400 Arrived at Guam.

USS PHAON (ARB-3)

Crew Size: 140
Bikini Atoll Arrival: 2 May 1946
Bikini Atoll Departure: 23 August 1946
Shot ABLI Location: Anchored at Kwajalein, 210 nmi (390 km) S
Shot BAKER Location: Anchored at Kwajalein, 210 nmi (390 km) NE
Decontamination Location: Los Angeles
Operational Clearance: 26 December 1946
Final Clearance: 3 January 1947

Task Unit 32.8.1

The only repair ship, USS Phaon (ARB-3) was a member of Task Unit 32.8.1 (Repair and Service Unit). The duties of this unit included repairing, towing, and refueling ships and supplying provisions. This unit also provided a Fleet Post Office, a motion picture exchange, as well as recreation, welfare, and legal facilities.

Shot ABLI (1 July, 0900)

1 July
Anchored in berth 21, King anchorage, Kwajalein at time of detonation.

2 July
0825 Underway for Bikini.

3 July
0800 Anchored in berth 115, Bikini.

5 July
1400 Moored to target ship USS Arkansas (BB-33).

9 July
1510 Underway from Arkansas.
1535 Anchored in berth 115, Bikini.

10-23 July
Routine activities.

Shot BAKER (25 July, 0835)

24 July
1430 Underway from berth 115 to area Packard in accordance with CTU 1.8.7.

25 July
0895
1720 Proceeding independently to Rongelap.

30 July
0758 Underway from berth 115 to area Packard.

1 August
1615 Underway within Bikini Lagoon collecting scientific data on radioactivity.

2 August
0310 Target vessel LC(L)-615 moored alongside for repairs.

3 August
1050 Anchored in berth 115 to area Packard.

5 August
LC(L)-615 underway from alongside.

7 August
Shifted berths.

9 August
LC(L)-615 underway from alongside.

9 August
1015 LC(L)-615 underway from alongside.

14 August
Shifted berths.

14-18 August
Alongside target ship LC(L)-239.

22 August
0943-1020 Ready Safe Ships Clearance Board aboard to inspect the ship and made the following recommendations: "The ship is safe for operation from a radiological standpoint with the exception of the evaporators, which will be checked by the evaporator board.

23 August
0949 Underway for Kwajalein.

24 August
0927 Arrived at Kwajalein.
28 August 1200 Radsafe Ships Clearance Board inspected evaporators. Evaporators radiologically clear for sailing but were not to be opened without presence of a monitor.

3 September Left Kwajalein for Pearl Harbor.

12 September Arrived at Pearl Harbor.

**USS PILOTISH (SS-386)**

Crew Size: 50
Bikini Atoll Arrival: 22 May 1946
Crew Location for Shot ABLE: USS Hotline (APA-235)
Crew Location for Shot BAKER: Bottlenose
Shot ABLE Location: 2,505 yards (2.3 km) NW
Shot BAKER Location: 250 yards (236 meters) NW
Sun 25 July 1946, Bikini Lagoon

**Task Unit and Function**

The submarine Pilotfish was a member of TU 1.2.4 (Submarine Unit). Submarine Division 112. It was a target vessel during CROSCROADS. Its crew was evacuated before each shot. Pressure-time recorders and radiation intensity films were placed aboard the boat.

Shot ABLE (1 July, 0900)

30 June 0945 Crew evacuated.

1 July 1546 USS Fillmore (APA-79) placed a boarding team on Pilotfish.


1730 IGM declared Pilotfish radiologically clear for boarding (Reference 6, p. VII-13-B).

2 July

1105 Damage control parties boarded.

1140 Material inspection completed.

There was no damage of consequence to Pilotfish from ABLE (Reference 2). It appears the crew returned to Pilotfish at 7 July.

3 July 1415 Shifted berths. moored alongside USS Pollux (AK-11).

Shot BAKER (25 July, 0835)

24 July 0645 Crew evacuated. 0900 Pilotfish was submerged.

25 July 0645 USS Couga (AN 8) reported able to find only two turns from Pilotfish. (Reference 6, p. VII-13-A).

Pressure-time recorders and radiation intensity films were recovered from Pilotfish (Reference 6, p. VII-13-B). Efforts to raise boat unsuccessful.

**USS Pollux (AKS-4)**

Crew Size: 144
Bikini Atoll Arrival: 20 May 1946
Bikini Atoll Departure: 19 August 1946
Shot ABLE Location: 22 nmi (41 km) ST
Shot BAKER Location: 11 nmi (20 km) ST
Decommission Location: Puget Sound
Operational Clearance: 29 November 1946
Final Clearance: 25 January 1947

**Task Unit and Function**

Pollux, a stores issue ship, was a member of TU 1.8.1 (Repair and Service Unit).

Shot ABLE (1 July, 0900)

1 July 1500 Entered Bikini Lagoon.

1825 Anchored in berth 273.

2 July 1043 Underway to shift berths.

1124 Anchored in berth 131A.

20 July 1102 Target vessel ICT 1181 moored alongside.

1300 ICT-118 was departed.

Shot BAKER (25 July, 0635)

25 July 0833 Observed shot BAKER and proceeded to Kwajalein.

26 July 0833 Anchored at Kwajalein.

4 August 1537 En route to Bikini.
USS Pollux (AKS-4)

5 August
0834 Entered Bikini Lagoon.
0740 Anchored in berth Q.

19 August
1449 Underway to Kwajalein.

20 August
0820 Arrived at Kwajalein.
1649 Underway to Pearl Harbor.

29 August
Arrived at Pearl Harbor.

USS Preserver (ARS-8)

5 August
0836 Underway to pick up instrument party from USS Kenneth Whiting (AV-14).
0915 Proceeding to pick up instruments and buoys.
0935 Commenced salvage operations.
1225 Proceeded to target ship Nagato to investigate reported fires; made inspection, no fires found to exist.
1240 Resumed salvage operations.
1625 Completed salvage operations, and proceeded to Whiting to discharge passengers, instruments, and buoys.
1751 Anchored in berth 85.

Crew Size: 85
Bikini Atoll Arrival: 28 May 1946
Bikini Atoll Departure: 28 August 1946
Shot ABLE Location: 27 nmi (50 km)
6 ,uly
Shot BAKER Location: 12 nmi (22 km)
NE
12:30-13:00 Underwater to Kwajalein.

13 August
14:00 Anchored in berth Q.

19 August
1449 Underway to Kwajalein.

20 August
0820 Arrived at Kwajalein.
1649 Underway to Pearl Harbor.

29 August
Arrived at Pearl Harbor.

USS Preserver (ARS-8)

5 July
1640-1720 Loaded instrument buoys and air tanks on LCM.

6 July
0631-0915 Towed Brule to new berth.
1130-1143 Engaged in diving operations to retrieve necessary instrument. Sent diver down to recover instrument. Instrument recovered, diver on board.
1255 Anchored in berth 85.

8 July
1620-1900 Towed YOG-83 to new berth.

10 July
1157-1217 Underway to take No. 2 motor launch in tow.
1329 Took motor launch in tow.
1332 Anchored in berth 85.

11 July
0055 Underway with YO-160 in tow to area west of target array.
0750 Proceeding to beaching area west of Eneu Island.
1525 Cast off tow, standing by.
1530 YO-160 beached on reef northwest of Eneu Island.
1725 Anchored YO-160.
1737 Anchored northwest of Eneu Island.

12 July
0800 Commenced salvage operations on YO-160.
1243 Underway, preparing to tow YO-160.
1415 Commenced towing YO-160 from beach.
1500 Tow cable parted, maneuvered to secure new tow.
1605 Secured tow wire to YO-160, commenced steady pull.
1710 Anchored north of Eneu Island.
12 July

1745-1800 Sent divers down with shallow-water gear to inspect damage on YO-160.

13 July

0800 Commenced salvage operations on YO-160.
1112 Commenced steady pull on YO-160 to keep it from broaching.
1325 Towed YO-160 to beach.
1335 Towed YO-160 to lee of Eneu Island.
1432 Anchored near berth 370.
1500 Commenced counterflooding starboard tanks of YO-160.
1625 Got underway to tow YO-160 to shallow water in beaching area off north end of Eneu Island.
1710 Anchored northwest of Eneu Island. YO-160 In tow.

14 July

0800 Commenced salvage operations on YO-160.
1418 Underway to tow YO-160 to temporary mooring in berth 239.
1424 Took YO-160 in tow alongside and proceeded to berth.
1508 Moored YO-160 to mooring buoy in berth 239.
1625 Got underway to assist USS Recluse (ARS-42) in mooring Nagato.
1725 Moored to buoy in berth 143.

15 July

1245 Underway on deck: diver has been underwater unspecified period of time.
1355-1540 Second diver down.
1602-1614 Third diver down.
1814 Secured operations for the day.

17 July

0925 Completed diving operations to secure wire to Nagato anchor.
0930 Diver secured wire to anchor.
1215 Commenced hauling up Nagato anchor.
1408 Dropped Nagato anchor in assigned spot.
1525 Anchored in berth 65. Bikini.

18 July

0625 Participated in BAKER rehearsal.
1142 Underway to go alongside target ship USS Nagato (APA 8).
1208 Entered Eneu Channel.
1253 Circled Nagato to simulate boarding.
1313 Circled target ship USS Pennsylvania (BB-38) to simulate boarding.
1350 Anchored in berth 85.

20 July

0623 Underway to tow and anchor YO 160 to an anchorage In target array.
0820 Underway with YO-160 In tow.
0830 YO-160 anchored in assigned berth.
1043 Underway from YO-160 to refuel.
1437 Anchored in berth 85.

21 July

1120 Underway to tow target ship USS Trippe (AVP 403) to new berth.
1134 Anchored alongside Trippe.
1204 Underway with Trippe.
1448 Trippe anchored In berth 17W.
1530 Anchored in berth 85.

23 July

1223 Underway to bring Nagato to desired heading.
1245 Moored to Nagato.
1340 Took strain on stern cable wire, brought Nagato heading to OBO.
1545 After taking anchors on board from USS Henrico (APA 45) to anchor target submarine USS Tuna (SS-201). Underway to Tuna.

Shot BAKER (25 July, 0835)

24 July

0105 Completed transferring anchors to Etah to moor Tuna.
0720 Anchored in berth 85. Bikini.
1221 Boarding Team No. 1 came aboard for BAKER day operations.
1256 Underway from Bikini to anchor target ships and make radiological survey of water in area.

25 July

1101 Entered Eneu Channel.
1128 Anchored in berth 85.
1147 Underway to place boarding team on Niagara.
1208-1211 Boarding team on Niagara.
1257-1259 Team boarded target vessel LCT-115.
1358 Anchored in berth 85.

26 July

1424 Underway to survey target vessels and make radiological survey of water in area.
1516 Tow wire secured to anchor chain of target ship USS Fallon (APA 81). Due to radioactivity, cast off tow wire and proceeded out of area to anchorage.
1814 Anchored in berth 344.

27 July

0805-1350 Engaged in Fallon towing operations.
1453 Anchored west of anchoring area near Fallon to assist in putting on bow and stern anchors.

28 July

1400-1407 Underway with observers to tow target array.
1710 Anchored 675 yards (611 meters) south of berth 379.

29 July

0910 Underway to vicinity of Fallon to take Geiger readings.
1847 Moored alongside USS Chickakaw (ATF 83).

30 July

0811 Underway to wash down target ship USS Geacoonage (APA 85).
0850-1015 Washed down Geacoonage, concluding with Geiger readings.
1048 Proceeded to beaching area at Eneu to secure anchor to target submarine USS Dendura (SS 335).
1115 Anchored off Eneu.
30 July

1450-1708 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1730 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0901-1010 Washed down Conyngham with saltwater and moored alongside to send a team aboard with Geiger meters to take readings.
1401 Underway to target ship USS Carteret (APA-70) to take Geiger readings and spray with foam.
1137 Completed taking Geiger readings, commenced spray down with powdered chemical foam.
1255 Completed spraying Carteret and proceeded to LCT-705.
1327 After taking Geiger readings, commenced spray LCT-705 with foam.
1340 Completed spraying LCT-705 and proceeded to LCT-1013.
1358 1405 Sprayed LCT-1013 with foam: used a total of 142.5 gallon cans of powdered foam on both target vessels.
1401 Preceded to USS Palmyra (ARS[40];3) to renew supply of chemical foam.
1100 Upon receipt of message that no foamite was available, got underway to anchorage.
1210 Washed down with powdered foam. Anchored In special berth C.

1 August

0745 Underway to wash down Carteret with two 5-inch water monitors.
1017 1027 Monitor team aboard Carteret to take Geiger readings.
1117 Washed down Carteret, Procedure to wash down target ship USS Pensacola (LCX 24) with saltwater.
1415 MOON and party came aboard to direct operations, in placing submersible pumps aboard Pensacola.
1425 Party In LCVP boarded Pensacola and found it radiologically unsafe for reboarding.
1440 1527 Washed down Pensacola with two 5-inch monitors from close aboard.
1545 Moored to Pensacola and placed submersible pump aboard.
1550 Boarding team boarded Pensacola to take Geiger readings.
1615 Transferred equipment to deck of Pensacola.
1620 Underway from Pensacola to anchorage east of berth 145.

2 August

1834 Underway to wash down target ship USS New York (BQ-24) with saltwater and take Geiger readings.
0810 1110 Washed down New York.
1117 Completed taking readings on New York and proceeded to anchorage.
1215 Anchored south of berth 379.

3 August

0714 Underway to wash down target ship USS New York (BQ-24) with saltwater and take Geiger readings.
0816 1110 Washed down New York.
1117 Completed taking readings on New York and proceeded to anchorage.
1215 Anchored south of berth 379.

6 August

0540-0947 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
0550 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0901-1010 Washed down Conyngham with saltwater and moored alongside to send a team aboard with Geiger meters to take readings.
1401 Underway to target ship USS Carteret (APA-70) to take Geiger readings and spray with foam.
1137 Completed taking Geiger readings, commenced spray down with powdered chemical foam.
1255 Completed spraying Carteret and proceeded to LCT-705.
1327 After taking Geiger readings, commenced spray LCT-705 with foam.
1340 Completed spraying LCT-705 and proceeded to LCT-1013.
1358 1405 Sprayed LCT-1013 with foam: used a total of 142.5 gallon cans of powdered foam on both target vessels.
1401 Preceded to USS Palmyra (ARS[40];3) to renew supply of chemical foam.
1100 Upon receipt of message that no foamite was available, got underway to anchorage.
1210 Washed down with powdered foam. Anchored In special berth C.

7 August

0722-1135 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1155-1440 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1506 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0901-1010 Washed down Conyngham with saltwater and moored alongside to send a team aboard with Geiger meters to take readings.
1401 Underway to target ship USS Carteret (APA-70) to take Geiger readings and spray with foam.
1137 Completed taking Geiger readings, commenced spray down with powdered chemical foam.
1255 Completed spraying Carteret and proceeded to LCT-705.
1327 After taking Geiger readings, commenced spray LCT-705 with foam.
1340 Completed spraying LCT-705 and proceeded to LCT-1013.
1358 1405 Sprayed LCT-1013 with foam: used a total of 142.5 gallon cans of powdered foam on both target vessels.
1401 Preceded to USS Palmyra (ARS[40];3) to renew supply of chemical foam.
1100 Upon receipt of message that no foamite was available, got underway to anchorage.
1210 Washed down with powdered foam. Anchored In special berth C.

9 August

0730 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0755 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0815 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0915 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0945 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
1115-1530 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored In special berth C.
1600-1625 Washed down Navy's bunks and superstructure with saltwater.

10 August

0745 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
0756-0921 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
0951 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1118-1523 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1649 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.

12 August

0725 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
0915 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1110-1320 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1145 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1204-1439 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1451 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1505-1647 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1706 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.

13 August

1114 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1145 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1204-1439 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1451 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1505-1647 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.
1706 Engaged in operations to pull stern of Dentuda away from the stern of Hughes. Anchored in special berth C.

14 August

0730 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
0820 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
1159 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.

15 August

0915 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
1159 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.

16 August

0915 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
1159 Underway to wash down target ship USS Conyngham (DD-371) with saltwater and target vessels LCT-705 and LCT-1013 with powdered foam.
1247-1700 Engaged in dragging instrument cable; failed to locate instruments.
1910 Monitors left the ship.

15 August
0905-1008 Continued dragging operations for recovery of gamma meters.
1031 Worked alongside Reclaimer to receive equipment that had been placed on Pensacola on 1 August.
1158 Underway to continue dragging operations.
1621 Anchored in berth 107.

16 August
0736 Got underway to conduct diving operations on sunken target ship USS Saratoga (CV-3) to recover instruments and conduct general examination.
0955 Anchored in berth 187.
1052 Sent survey party to determine condition of Saratoga and take soundings.

19 August
1245 Proceeding to Nevada to take it in tow.
1257 Anchored alongside Nevada.
1347 Disembarked anchor detail to Nevada.
1415 Underway for Kwajalein with Nevada in tow.
1424 Anchor detail returned.

22 August
0125 Anchored Nevada in berth A-11, Kwajalein.
1233 Underway to Bikini.

23 August
0411 Anchored in berth 90, Bikini.

24 August
0115 Anchored near Pensacola to take it in tow.
1015 Underway to Kwajalein with Pensacola in tow.

26 August
0825 Anchored Pensacola in berth A-4, Kwajalein.
1253 Underway to Bikini.

27 August
0734 Anchored in berth 107 Bikini.

28 August
0945 Moor alongside target ship USS LST-220 to take in tow.
1122 Underway to Kwajalein with LST-220 in tow.

30 August
0920 Anchored LST-220 in berth A-4, Kwajalein.

31 August
0941-0920 Radiological Safety Officer aboard to inspect the ship for radioactivity.
1 September
Underway from Kwajalein to Pearl Harbor.

USS Preserver (ARS-8)

14 August

Decommissioning Location: Los Angeles
Operational Clearance: 17 December 1946
Final Clearance: 21 December 1946

Task Unit and Function
The self-propelled barracks ship Presque Isle was a member of TU 103 (Dispatch Boat and Reclaim Group) and provided such services as inter-atoll freight and passenger service and also functioned as a barracks ship.

Shot Able (1 July, 0900)

1 July
0900 Observed shot ABLE from approximately 30 nm (56 km) southwest of the lagoon.
1900 Entered Bikini Lagoon.
1921 Passed buoy 4 abreast to starboard.
1940 Anchored in berth 159.

3 July
1257 Underway to shift berths.
1258 Anchored in berth 95.

4-24 July Routine activities.

Shot Baker (25 July, 0835)

26 July
Departed Bikini Lagoon.

29 July
0855 En route from Bikini to Rongelap.
1710 Anchored at Rongelap.

30 July
0953 Underway to Bikini.
1829 Entered Bikini Lagoon.
1900 Anchored in berth 185.

31 July
0827 Underway to shift berths.
0925 Anchored in berth 95.

7 August
1530 Underway to new anchorage.
1655 Anchored east of berth 95.

7 August
0927 Anchored in berth 95.

12 August
0919 Anchored in berth 116.

13 August
1128 Anchored in berth 95.

19 August
1736 Departed Bikini Lagoon en route to Kwajalein.

20 August
0800 Anchored Kwajalein.

2 September
1603 Underway to Pearl Harbor.

12 September
Arrived at Pearl Harbor.

USS Prinz Eugen (AVP-44)

Prinz Eugen

Decommissioning Location: Los Angeles
Operational Clearance: 12 December 1946
Final Clearance: 21 December 1946

Task Unit and Function
The self-propelled barracks ship Prinz Eugen was a member of TU 103 (Dispatch Boat and Reclaim Group) and provided such services as inter-atoll freight and passenger service and also functioned as a barracks ship.

Shot Able (1 July, 0900)

1 July
0900 Observed shot ABLE from approximately 30 nm (56 km) southeast of the lagoon.
1900 Entered Bikini Lagoon.
1921 Passed buoy 4 abreast to starboard.
1940 Anchored in berth 159.

3 July
1257 Underway to shift berths.
1258 Anchored in berth 95.

4-24 July Routine activities.

Shot Baker (25 July, 0835)

26 July
Departed Bikini Lagoon.

29 July
0855 En route from Bikini to Rongelap.
1710 Anchored at Rongelap.

30 July
0953 Underway to Bikini.
1829 Entered Bikini Lagoon.
1900 Anchored in berth 185.

31 July
0827 Underway to shift berths.
0925 Anchored in berth 95.

7 August
1530 Underway to new anchorage.
1655 Anchored east of berth 95.

7 August
0927 Anchored in berth 95.

12 August
0919 Anchored in berth 116.

13 August
1128 Anchored in berth 95.

19 August
1736 Departed Bikini Lagoon en route to Kwajalein.

20 August
0800 Anchored Kwajalein.

2 September
1603 Underway to Pearl Harbor.

12 September
Arrived at Pearl Harbor.

Prinz Eugen

Crew Size: 94
Bikini Atoll Arrival: 20 May 1946
Bikini Atoll Departure: 14 August 1946
Shot ABLE Location: 30 nm (56 km) NE
Shot BAKER Location: About 20 nm (37 km) NE

Crew Size: 144
Bikini Atoll Arrival: 11 June 1946
Bikini Atoll Departure: 26 August 1946

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Prinz Eugen

Crew Location for Shot Able: USS Rockingham (APA-29)
Crew Location for Shot BAKK: Rockingham
Shot Able Location: 3,960 yards (3,602 m) NWW
Shot BAKK Location: 1,980 yards (1,809 m) NWW
Sun 27 December 1944, Kwajalein

Attack Unit and Function
The captured German cruiser Prinz Eugen was a mem-
ber of the 18.6.1 (Battleship and Cruiser) Unit. Cruizer Divi-
sion 3. It was a target vessel during CROSSROADS tests and contained representa-
tive items from the Army Signal Unit. Its CROSSROADS
crew, composed of U.S. personnel, was removed from
the ship before each test. Prinz Eugen was ac-
tually commissioned during its ferrying to Bikini
island and was given the hull number of IX-60.

Shot Able (1 July, 0830)
1 July
1830 USS Reclaimer (ARS-A7) completed inspect-
ing Prinz Eugen (Reference 6, p. VII-194 A7).

2 July
1730 USS Conserver (ARS-33) was directed to
place a boarding team on board Prinz Eugen (Reference
6, p. VII-194 A7).
1736 Conserver reported Prinz Eugen October
Sweat (Reference 6, p. VII-194 A7). Overall
condition was good with no major damage.
1240 Concentrated Team A from Rockingham to
Prinz Eugen.
3 July
Crew returned aboard to live.

21 July
1730 Crew evacuated to Rockingham.

Shot BAKK (25 July, 0835)
1 August
0906 USS Clamp (ARS-33) was directed to place
a boarding team on board Prinz Eugen (Reference
6, p. VII-140 B7).

2 August
1137 USS Deliver (ARS-23) was directed to
proceed to the vicinity of USS Washington
(AP-17) to pick up a boarding team, pro-
ceed to Prinz Eugen to wash it down with
high pressure streams and place boarding
team aboard if radiological tolerance
permitted (Reference 6, p. VII-140 B7).
1157 Clamp reported completing a 4 hour wash
down of Prinz Eugen and placed boarding
team on board.
1214 Deliver inspection of Prinz Eugen com-
pletes, the boarding team returned aboard
their respective ships (Reference 6, p. VII-140 B7).

3 August
1136 1700 Prinz Eugen boarded by initial landing
1400 1636 Team A. The after engine room was thrust 1
with 3,000 liters of water. All compa-
parts were pumped dry. CTS 1.2 or
deeded to 1.4 was sent to the wing-shear side
of Bikini for the next test. To begin at 0900 to
scrub down Prinz Eugen (Reference 6).

4 July
Hosted daily in decontamination by four
pumps of CROSSROADS radiological duty / 7
hours. Teams consisted of 17 men of the
beginning of this period and increased to
33 mV as the radiation level decreased.
Near the end of this period, as below
decks spaces were radiologically cleared.
3/4 engineers boarded each day to make
the propulsion system operational.

Radiation readings aboard Prinz Eugen between 4 August
and 1 October are listed in Table A-10.

15 August
0835 Prinz Eugen personnel transferred to re-
manned target ship USS Bladen (APA-63).

20 August
Fueled to Kwajalein by USS Munsee (ATF-
167).

Prinz Eugen was later beached on Carlson Island, Kwa-
jailein, and sunk in December 1946.

Table A-10. Radiation readings (R/24 hours)
aboard Prinz Eugen main deck.

<table>
<thead>
<tr>
<th>Date</th>
<th>Minimum</th>
<th>Average</th>
<th>High</th>
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<tr>
<td>4 August</td>
<td>1.0</td>
<td>3.7</td>
<td>4.6</td>
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<tr>
<td>5 August</td>
<td>0.9</td>
<td>2.0</td>
<td>3.1</td>
</tr>
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<td>6 August</td>
<td>0.54</td>
<td>1.5</td>
<td>3.5</td>
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<td>7 August</td>
<td>0.8</td>
<td>1.4</td>
<td>1.5</td>
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<tr>
<td>8 August</td>
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<td>1.5</td>
<td>8.0</td>
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<tr>
<td>9 August</td>
<td>0.7</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>10 August</td>
<td>0.6</td>
<td>1.2</td>
<td>0.45</td>
</tr>
<tr>
<td>14 August</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1 October</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note.
No decontamination required below
armor deck.

USS Quartz (IX-150)

Crew Size: 50
Bikini Atoll Arrival: 6 April 1946
Bikini Atoll Departure: 27 August 1946
Shot ABK Location: Anchored at Kwajalein
Shot ABK Location: Langley Atoll
Decontamination Location: Pelagian Island
Operational Clearance: 13 December 1946
Final Clearance: 23 December 1946

Attack Unit and Function
Concrete barge Quartz was a member of 18.6.1
repair and salvage ships. Above ship stored
dry provisions from this barge.

Shot ABK: 1 July, 0830.
1 July
Anchored in berth 19A, Kwajalein Atoll.

3 July
1430 Underway in convoy 152, 1/2, condition:
Quartz.

4 July
1430 Anchored at berth 19A Kwajalein Atoll.

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USS Quartz (IX-150)

5 July 1400 Anchored in berth 146, Bikini.
18 July 1610 Underway for Rongelap Atoll towed by Mungose.
19 July 1145 Anchored in berth 22, Rongelap Atoll.
21 July BAKK (25 July, 0835)
25 July Anchored in berth 22, Rongelap Harbor.
26 July 1615 Underway to tow by Mungose for Bikini.
31 July 0935 Anchored in berth 108, Bikini.
2 August 0945 Shifted to berth east of berth B.
3 August 1000 Anchored at a berth between 145 and 146, Bikini.
14 August 1400 Anchored in berth 19(A), Bikini.
21 August 1800 Anchored near entrance to Bikini Harbor.
22 August 0945 Underway to Kwajalein towed by USS Sioux (AVP-75).
23 August 1300 Anchored in berth south of King 4, Kwajalein.
31 August 1055 Target vessel LC11(L)-349 alongside.
1755 LC11(L)-349 underway.
3 September 1115 Underway to Pearl Harbor towed Sioux.
15 September Arrived at Pearl Harbor.

USS Reclaimer (ARS-42)

2 July 1500 Reboarded and commenced inspection of all spaces.
24 July 1100 Completed the evaucation of personnel to Henrico.
8 August 0940 Talbot Geiger sour. Average readings on main deck. 1.5 R/24 hours; forecastle, 0.8 R/24 hours; maximum reading - paint chips and rust scales, 4.0 R/24 hours; living space, 0.4 R/24 hours; bridge deck, 2.0 R/24 hours; inside turrets and deckhouses average, 0.7 R/24 hours.
9 August 0830 The captain, department officers, and NBM representatives reboarded and commenced hull and material inspection. Inspection completed. Inspecting parties evacuated the ship.

USS RALPH TALBOT (DD-390)

Crew Size: 132
Bikini Atoll Arrival: 1 June 1946
Bikini Atoll Departure: 26 August 1946
Crew location for Shot BAKK: USS Henrico (APA 45)
Crew location for Shot BAKK: Henrico
Shot ABK Location: 1,363 yards (2.3 km) / 1,000 yards (1.8 km) MSW
Shot ABK Location: 1,815 yards (3.3 km) MSW
Sink March 1948 near Kwajalein

Task Unit and Function
The destroyer Talbot was a member of TU 12.3 (destroyer Unit), Destroyer Division 1. It was a target vessel during CROG-SCRAM'S. It's crew was evacuated before each shot. It carried aboard it special electronic equipment that the Electronic Group monitored.

Shot ABK (1 July, 0000)
30 June 1430: All personnel evacuated to Henrico.

Crew Size: 77
Bikini Atoll Arrival: 1 June 1946

394
USS Reclaimer (ARS-42)

Bikini Atoll Departure: 1 September 1946
Shot ABilt Location: 24 nm (45 km) E
Shot BAKLW Location: 11 nm (20 km) S1
Decontamination Location: Los Angeles
Operational Clearance: 24 December 1946
Final Clearance: 4 January 1947

Task Unit and Function
The salvage ship Reclaimer served in TM 1.2.7. Salvage Unit. Reclaimer’s function involved salvaging damaged target vessels after the tests, performing emergency repairs, and fighting fires. In addition, the TDU was embarked aboard Reclaimer to coordinate all salvage operations. The TDU aboard Reclaimer made the final inspection of the target area.

Shot ABilt (1 July, 0900)

1 July
Streamed in area Mercury in accordance with CTRP 1 Operation Plan 146, with TDU and CTU 1.2.7 embarked.
1116
In accordance with CTRP 1 Operation Plan 146, with TDU and CTU 1.2.7 embarked.
1130
Steam ahead of TU 1.2.7 to take position as an auxiliary vessel.
1200
Entered Ingnion with TU 1.2.7 went astern and an area off the detached unit passed in closer. Projected in safety zone of target area with safety radius (Reference 6, p. XVI 2 0 A.) operating in water having a radiocative level between 0.1 and 1.4 P/24 hours.
1515
Proceeded on various courses and speeds to go along port side of target ship USS PanayRacing 1115 to extinguish fires.
1532-1555
Hydrod oxygen ship USS New York (1115-1555) oxygen filled.
1600
Projecting point cleared.
1615
Fouled lines on target ship USS New York (1115-1555).
1627
New York cleared.
1733-1747
Fouled fire on target ship USS Nevada (HH 341).
1747
Cleared Nevada.
1839
Anchored in berth 64, Bikini.

2 July
0815
Steam through target area on various courses and speed with TDU and CTU 1.2.7 directed salvage operations.
1111 1115
Fouled stream of water from the forward monitor on Nevada to extinguish fires.
1133 1115
Fouled steam of water on target ship USS Independence (VI 22) from forward monitor to extinguish fires on target deck aft.
1848
Anchored in berth 64, Bikini.

3 July
0717
Underway through target area.
1000 1010
Sailing south of target vessel and put absorbing team ashord.
1041 1110
Anchored to Nevada and put absorbing team ashord.
1220 1110
Mooed alongside target ship USS Atlantic (HH 333) absorbing team ashord.
1330
Proceeded to salvage unit.
1500 1510
Mooed to target vessel YO 106.
1530 1556
Mooed to target ship USS Reliance (AI 127) absorbing team ashord.
1645
Anchored in berth 64, off Point Pribilof.

5 July
1200 1230
Laid mooring line to target vessel.
1345
Anchored to target vessel and put absorbing team ashord.
1154 1440
Towed ship 60 to opposite target vessel.
1700
Anchored to target vessel.

6 July
0744
Anchored to target vessel.
0944
Underway from berth (14).
1116
Anchored to target vessel.
1145
Underway from berth 14 for vicinity of USS Reliance (AI 127) to take up safety men.
1700
Anchored to target vessel.
1800-2045
Prepared for diving operations.
1800
Reangled off-ship left the ship.

7 July
0800
Reangled off-ship left the ship.
0844
Anchored to target vessel.
1116
Anchored to target vessel.
1145
Underway from vicinity of target vessel to pool of USS Reliance (AI 127) to take up safety men.
0944
Anchored to target vessel.
0944
Anchored to target vessel.

9 July
1425 1444
Anchored to target vessel.
1600
Anchored to target vessel.

10 July
0814
Anchored to target vessel.
1116
Anchored to target vessel.
1145
Underway from vicinity of target vessel to pool of USS Reliance (AI 127) to take up safety men.
1600
Anchored to target vessel.
1600
Anchored to target vessel.

11 July
0814
Anchored to target vessel.
1116
Anchored to target vessel.
1145
Anchored to target vessel.
1600
Anchored to target vessel.
1600
Anchored to target vessel.

12 July
0814
Anchored to target vessel.
1116
Anchored to target vessel.
1145
Anchored to target vessel.
1600
Anchored to target vessel.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 July</td>
<td>USS Reclaimer (ARS-42) anchored at berth 357.</td>
</tr>
<tr>
<td>28 July</td>
<td>Underway from berth 37 to target array.</td>
</tr>
<tr>
<td>29 July</td>
<td>Anchored off Ponce Island, berth 370.</td>
</tr>
<tr>
<td>30 July</td>
<td>Walking the target submarine in the target area off Ponce Island.</td>
</tr>
<tr>
<td>31 July</td>
<td>Anchored in vicinity of berth 370.</td>
</tr>
<tr>
<td>1 August</td>
<td>Underway from berth 370 to target array.</td>
</tr>
<tr>
<td>2 August</td>
<td>Plotted target array.</td>
</tr>
<tr>
<td>3 August</td>
<td>Anchored off Ponce Island, berth 370.</td>
</tr>
<tr>
<td>4 August</td>
<td>Walking the target submarine in the target area off Ponce Island.</td>
</tr>
<tr>
<td>5 August</td>
<td>Anchored in vicinity of Pensa cola.</td>
</tr>
<tr>
<td>6 August</td>
<td>Underway from berth 375 to wash down Pensacola with high-pressure seawater.</td>
</tr>
<tr>
<td>7 August</td>
<td>Anchored in berth 375, Bikini.</td>
</tr>
<tr>
<td>8 August</td>
<td>Underway from berth 375 to go alongside Pensacola.</td>
</tr>
<tr>
<td>9 August</td>
<td>In vicinity of Pensacola.</td>
</tr>
<tr>
<td>10 August</td>
<td>Anchored in berth 375.</td>
</tr>
<tr>
<td>11 August</td>
<td>Underway in vicinity of Pensacola.</td>
</tr>
<tr>
<td>12 August</td>
<td>Moored to Pensacola, placed boarding team aboard.</td>
</tr>
<tr>
<td>13 August</td>
<td>Washed down Pensacola.</td>
</tr>
<tr>
<td>14 August</td>
<td>Underway from berth, proceeding to vicinity of Pensacola.</td>
</tr>
<tr>
<td>15 August</td>
<td>Anchored in berth 375.</td>
</tr>
<tr>
<td>16 August</td>
<td>Underway to Mayrant.</td>
</tr>
<tr>
<td>17 August</td>
<td>Hoisted alongside Mayrant.</td>
</tr>
<tr>
<td>18 August</td>
<td>Placed two pumps aboard Mayrant.</td>
</tr>
<tr>
<td>19 August</td>
<td>Pumped out engine rooms of Mayrant.</td>
</tr>
<tr>
<td>20 August</td>
<td>Anchored in berth 141.</td>
</tr>
<tr>
<td>21 August</td>
<td>Underway from berth 141.</td>
</tr>
<tr>
<td>22 August</td>
<td>Washed down Pensacola.</td>
</tr>
<tr>
<td>23 August</td>
<td>Underway from berth 375 to go alongside Pensacola.</td>
</tr>
<tr>
<td>24 August</td>
<td>In vicinity of Pensacola.</td>
</tr>
<tr>
<td>25 August</td>
<td>Anchored in berth 375.</td>
</tr>
<tr>
<td>26 August</td>
<td>Underway from berth 375 to wash down Pensacola with high-pressure seawater.</td>
</tr>
<tr>
<td>27 August</td>
<td>Anchored in berth 375, Bikini.</td>
</tr>
<tr>
<td>28 August</td>
<td>Underway from berth 375 to go alongside Pensacola.</td>
</tr>
<tr>
<td>29 August</td>
<td>In vicinity of Pensacola.</td>
</tr>
<tr>
<td>30 August</td>
<td>Anchored in berth 375.</td>
</tr>
<tr>
<td>31 August</td>
<td>Underway in vicinity of Pensacola.</td>
</tr>
</tbody>
</table>
USS Reclaimer (ARS-42)
14 August

1705   Anchored in berth 109.
15 August
0740   Party left ship to service pumps on board Mayrant and Pensacola.
1225   Working party left to service pump on Preserver.
1323   Target vessel LCi(L)-615 alongside.
1350   LCi(L)-615 departed.
1610   Working party off to service pump on Pensacola.

16 August
0725   Underway to New York.
0819   Moored alongside New York.
1539   Underway from alongside New York.
1615   Anchored in berth 109.

17 August
0610   Moored alongside Nevada; furnished power to it for 6 hours.
1430  1435   Working party serviced pump on Pensacola.
1600   Underway from alongside Nevada; proceeding to Pensacola to check draft readings and inspect pumps.
1635   Returned to anchorage.

18 August
Routine activities.
19 August
0835   Moored alongside Pennsylvania.
0940   Commenced furnishing power to Pennsylvania.
0950   Pump detail departed for Pensacola.
1135   Pump detail returned.
1555   Computed furnishing power to Pennsylvania.
1622   Underway from alongside Pennsylvania, proceeding to anchorage.
1650   Pumping detail departed for Pensacola.
1710   Pumping detail returned from Pensacola.

20 August
0851   Moored alongside Pennsylvania.
1810   Started towing (swinging) Pennsylvania in order to get the turns out of its anchor chain.
2005   Completed swinging Pennsylvania.
2027   Returned to anchorage.

21 August
0820   Moored alongside New York. Supplied electrical power to New York for about 3-1/2 hours.
1345   Moored alongside Pennsylvania and removed hawser from winch.
1417   Underway from Pennsylvania, proceeded to anchorage.
1650   Underway to assist in clearing Pennsylvania in towing that vessel. No assistance was required.
1940   Returned to anchorage.

22 August
1425  1505   Moored alongside Mayrant in order to remove salvage equipment from that vessel.
23 August
Routine activities.
24 August
0817   Anchored ahead of Crittenden.

USS Rhind (DD-404)

14 August

1035   Underway with Crittenden in tow, en route to Kwajalein.

25 August
En route from Bikini to Kwajalein with Crittenden in tow.

26 August
Anchored Crittenden at Kwajalein.

27 August
Moored alongside Crittenden.

28 August
Commenced moving Crittenden to come alongside target ship USS Dewey (APA-79).

29 August
Underway from alongside Crittenden.

30 August
Departed Kwajalein on route to Bikini.

31 August

1150   Moored alongside Fallon.

2 September
Sustained working parties on hourly basis to service pumps on Fallon. Hourly dispatches continued throughout the day and evening hours.

3 September
Continued servicing salvage pumps on Fallon.

4 September
Moored alongside Fallon; loaded anchor chain and anchors for Bikini on board Fallon.

6 September
Underway: proceeded to anchorage.

9 September
Routine activities.

11 September
0955   Anchored Fallon in Kwajalein harbor, proceeded to anchorage.

14 September
0900   Underway with Fallon in tow, en route from Bikini to Kwajalein.

15 September
En route from Bikini to Kwajalein with Fallon in tow.

27 September
Arrived at Pearl Harbor.

USS Rhind (DD-404)
USS Rhind (DD-404)

Task Unit and Function
The destructor Rhind was a member of TU 12.3 (Destroyer Unit 12.3, Destroyer Division 1). It was a target vessel for COMSHAVE. Its crew was evacuated before each shot. It carried instruments, including radio transmitters.

Shot Abt (1 July, 0800)

20 June 0800 1125 Evacuated ship a crew to Bayfield.
1 July 0418 Request for final evacuation. Team Q departed ship.

2 July 1049 Commanding officer and radiological monitor boarded.
1050 Special boarding Team A and B boarded the ship and began inspection.
1045 (1045) Radiologically safe with no explosive or toxic gases or other hazardous materials present aboard. However, considerable damage had occurred and deckkeeping ability was reduced.

3 July 0814 Remainder of crew reassembled.

9 July 0414 Shifted anchorages to berth 1/3.

Shot BMK (9 July, 0815)

24 July 09101113 Evacuated Rhind crew to Bayfield except for Team R.

25 July 0610 Team R left; Rhind secured for Team M.

1 August 1000 Mined personal and equipment transferred to USS Richard (APA 22).

3 August 1742 1714 USS Courageous (ASD 4/0) manned down Rhind using high pressure stream (Reference 6, p. VII 1 BI).
1814 1517 USS Custer (AK 22) placed a boarding team on Rhind (Reference 6, p. VII 1 BI) to name 1/2 to 6 h/24 hours.

10 August 0911 The commanding officer, two officers, nine enlisted men, and two boarding party boarded Rhind to determine the effects of the mine damage found. Significant damage was discovered. Topside average 1.7 h/24 hours, high 2.5 h/24 hours, low 0.5 h/24 hours. Deck average 1.7 h/24 hours, high 2.5 h/24 hours, low 0.5 h/24 hours. A special boarding party cleared the ship.

17 August Topside average 1.7 h/24 hours (reference 7).

23 August 0910 Three men aboard to pick up shore-maintained and special radiological film.

USS Robert K. Huntington (DD-761)

Task Unit and Function
The destroyer Huntington was a member of TU 3.7 (Surface Unit 3.7). It had special radiological equipment installed before the participation in the test series. It took water samples and radiological readings outside the target.

Shot Abt (1 July, 0800)

20 June 1040 Members of the radiological monitoring party reported aboard for temporary duty.

1 July 0645 Breakfast for all ships personnel of surface unit.
0700 Left demobilization danger area.
0745 Changed course and speed to clear danger area.
1200 Stopped all engines to combat water problems.

2 July 0415 0415 Stopped all engines and took bathythermograph and radiological readings.
0515 0510 All engines stopped to take water samples.
0540 0540 All engines stopped to take water samples.

1245 Compressed maneuvering to take station off African coast to combat problems.
1300 Stopped all engines and took station off African coast.
1315 Compressed maneuvering in VTC.
1345 Took VTC in low.
2140 Maneuvered to take position off African coast.
2240 Rove to near African coast, conducting radiological survey.

3 July Took radiological readings in vicinity of African island.
**USS Robert K. Huntington (DD-781)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 July</td>
<td>1000</td>
</tr>
<tr>
<td>8 July</td>
<td>GB76</td>
</tr>
<tr>
<td>11 July</td>
<td>1741</td>
</tr>
<tr>
<td>11 July</td>
<td>1741</td>
</tr>
<tr>
<td>11 July</td>
<td>1741</td>
</tr>
<tr>
<td>16 July</td>
<td>1000</td>
</tr>
</tbody>
</table>

**USS Rockbridge (APA-228)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 August</td>
<td>0350</td>
</tr>
</tbody>
</table>

**USS Rockbridge (APA-228)**

**Crew Size:** 700

**Bikini Atoll Arrival:** 4 Jul 1946

**Bikini Atoll Departure:** 23 August 1945

**First Call Location:** 70 nm (130 km) NW

**Second Call Location:** 10 nm (19 km) NE

**Detachment Location:** San Francisco

**Operational Clearance:** 6 December 1945

**Final Clearance:** 13 December 1946

**Task Unit and Function:**

The attack transport Rockbridge was a member of Task Unit 31.3.4 (Transport Units). Transport Divisions 31.3.4 were the United States Marine Transport Command (USMC) units that served in the Pacific Theater of Operations during World War II. They were primarily engaged in the support of amphibious operations, providing logistic support and evacuation of wounded personnel. The Rockbridge was one of the first transports to arrive at Bikini Atoll, and its mission was to support the operation by providing logistic support and evacuation of wounded personnel as needed.

**Navy Brief (17 July, 1946)**

**17 July**

**0430** | Evacuated crew of target ships USS Andrew J. C. Newman (APA-111), USS New York (APA-24), and USS Salt Lake City (APA-22) at anchor in preparation for drop of BL-28.

**1 July**

**0410** | Began evacuation of last minute personnel from target vessels.

**0515** | Underway from berth 277, Bikini, for operating area.

**0700** | Began, maneuvering to enter Bikini area from operating area, awaiting signal to enter.

**1045** | Anchored in berth 276, discharging personnel to various transports.

**2 July**

**1400** | Started anchorage at berth 277.

**2/7 July** | Routine activities.

**Navy Brief (25 July, 1946)**

**25 July**

**0630** | Evacuated personnel, Andrew J. C. Newman, New York, and Salt Lake City personnel.

**27 July**

**0000** | Evacuated last minute personnel from target ships.

**27 August** | Underway F - berth 277.

**27 August** | Joined to F - berth area Marine.

**28 August** | Continued detachment, continued steaming into Marine.

**27 July**

**1500** | Evacuated last minute personnel of target ships, U.S. Pennsylvania (BB-38), USS Indianna (BB-33), USS North Carolina (BB-55), USS Utah (BB-31), and USS Arizona (BB-39) to reduce their crew to other transports.
USS Rockbridge (APA-228)

27 July

1444 Maneuvered in vicinity of Bikini Atoll.

29 July

0830 Anchored in berth Dog, Bikini.
1056 Got underway from berth Dog to rendezvous with TG 1.3.
1156 Joined TG 1.3 in area Mormon.

30 July

0224 Anchored in berth 201, Bikini.

2 August

1513 Shifted to berth 332.

9 August

0840 3100 A representative of Radsafe Section, JTF 1, aboard for radiological survey. Saltwater main in "A" compartment registered some radioactivity and two hunks in its vicinity were removed as a safety precaution; evaporator spaces all below tolerance except condensate coolers, which registered 0.35 R/24 hours; area around condensate coolers safe for 7-hour working period per day. Other spaces inspected were found free of radiation hazards.

11 August

1710 Received target ship USS Dawson (APA-79) personnel from USS Henry (APA-45).
1336 Received target ship USS Bracken (APA-64) personnel from Henrico.
1730 Target ship USS Conyngham (DD-371) personnel came aboard for berthing and subsistence.

14-22 August

Routine activities.

21 August

Underway for Kwajalein.

24 August

0713 Anchored in berth L-131, Kwajalein.

29 August

1553 Underway for Pearl Harbor.

USS Rockingham (APA-229)

20 July

0240 Published safety precautions in connection with H-hour.
1731 Anchored in berth 316, Bikini.

2 July

1407 Shifted to anchorage berth 218.
1540 Disembarked Team 1 from target ship Prinz Eugen.

3 July

0730-1630 Disembarked target vessel personnel and baggage.

7 July

0756 Underway to go alongside target ship USS Pensacola (CA-24).
0810 Moored alongside Pensacola in berth 286.
1130 Commenced furnishing saltwater services to Pensacola.
1645 Completed transfer of all personnel of target ship Nagato to USS Rockbridge (APA-228).
1848 Commenced furnishing electricity to Pensacola.

10 July

0837 Underway from alongside Pensacola.
0905 Anchored in berth 285.

13 July

0900 1545 Embarked personnel and baggage from Nagato.

3 July

1750-1830 Embarked Prinz Eugen baggage and personnel.

Shot BAKER (25 July, 0835)

24 July

0924 Commenced embarking target vessel personnel for shot BAKER, including personnel from Pensacola.
1510 Underway from Bikini.

25 July

0852 Secured from general quarters and set condition BAKER throughout the ship.

27 July

1814 Brought aboard one officer and six enlisted men, last-minute personnel of Pensacola from USS George Clymer (APA-23).

30 July

0707 Anchored in berth 240, Bikini.

1 August

1145-1530 Took on board cargo and personnel from target ships USS Hughes (DD-410), USS Rhind (DD-404), and USS Stock (DD-406).

2 August

1620 2120 Shifted anchorage to berth 353.
Recovered a sinking UCM.

5 August

0945 Received enlisted personnel from Prinz Eugen, Stock, and Rhind.

13 August

1015-1130 Embarked personnel and baggage from target ships USS Calton (APA-71) and USS Ralph Talbot (APA-70).
USS Rockingham (APA-229)

15 August
1535-1615 Discharged Prince Eugen personnel to remaining target ship USS Bladen (APA-63).

16 August
0805-0930 Disembarked Prince Eugen personnel to Bladen.

19 August
0836-1130 Discharged target ship personnel to USS Rockwall (APA-230). Total discharged: 84 enlisted men from Rhind, 86 enlisted men from Stack, and 118 enlisted men from Pensacola.

1330 Transferred 35 Catron personnel to Clymer.

1455 Transferred 24 Pensacola personnel to Clymer.

23 August
Five enlisted men each transferred from Hughes, Rhind, and Talbot to USS Sylvan (AKA-44).

24 August
1649 Underway for Kwajalein.

25 August
1220 Anchored in berth L, Kwajalein Atoll.

29 August
1548 Underway for Pearl Harbor.

USS ROCKWALL (APA-230)

15 August
1535-1615 Team B from Saratoga departed.

3 July
1050 Discharged 262 enlisted men to Saratoga. Disembarked 2 officers and 16 enlisted men to Saratoga. 44 enlisted men to LST-133, and 20 enlisted men to LST-52.

0
1100 LST-545 came alongside.

1428 Shitted to berth 223.

15 July
0
035 Disembarked 262 enlisted men to Saratoga. Disembarked 2 officers and 16 enlisted men to Saratoga. 44 enlisted men to LST-133, and 20 enlisted men to LST-52.

0
1400 LST-545 cast off.

1460 Target vessel CI-1115 moored alongside.

0
0730 LCT-1115 cast off.

16-23 July Routine activities.

18 July
0836-1130 Discharged target ship personnel to USS Rockwall (APA-230). Total discharged: 84 enlisted men to Saratoga. 1400 LST-545 came alongside.

0
1400 LST-545 cast off.

15 July
0
0730 LST-545 cast off.

23 August
1445 Transferred 24 Pensacola personnel to Clymer.

24 July
1330 Completed embarking 417 enlisted men and 24 officers of the target ships for shot Baker.

1445 Underway pursuant to CJTF I OP Plan 1-46.

25 July
0730 Commenced steaming to join CTG 1-3.

0814 Joined CTG 1-3.

1548 Underway for Pearl Harbor.

27 July
1356 Dispatched LCVP No. 15 to Rockbridge to pick up 4 officers and 11 enlisted men from Saratoga.

1435 Completed embarking passengers and hoisted LCVP No. 15.

0
0834 Anchored in berth 280, Bikini.

21 August
0200 Shifted anchorage to berth 352.

24 August
0900 Received 15 enlisted men from target ship USS Arkansas (AB-33).

0921 Received 5 officers and 132 enlisted men from target ship USS Mulford (DD-389).

10 August
0
1130 Transferred 10 officers and 110 enlisted men to Rockbridge.

12 August
1550 Transferred 26 officers and 317 enlisted men of Independence to USS Ajax (AV-6).

18 August
1315 Disembarked 1 officer and 122 enlisted men.

19 August
0930 Begun disembarking LST-52 crew to USS Dixie (AD-16).

0
1554 Underway for Pearl Harbor.
USS Rolette (AKA-99)

**USS ROLETTE (AKA-99)**

_Crew Size:_ 151
_Bikini Atoll Arrival:_ 20 March 1946
_Bikini Atoll Departure:_ 26 August 1946
_Shot ABL Location:_ 27 nmi (50 km) NE
_Shot BAKER Location:_ 54 nmi (98 km) E
_Decontamination Location:_ San Diego
_Operational Clearance:_ 28 January 1947
_Final Clearance:_ 1 February 1947

**Task Unit and Function**
The attack cargo ship Rolette was a member of Task Unit 1.3.1 (Transport Unit), Transportation Division 31. Rolette and USS Ottawa (AKA-101) were loaded with construction material at Port Hueneme, California, and sailed with 200 Seabees for Bikini on 5 March. After arriving at Bikini, they served as barracks and material stores ships for the Seabees (Reference 6, p. VII-1-20-A). Rolette was initially designated as an intratransit cargo ship; when Rolette left after BAKER, USS Sylvanie (AKA-44) took over handling intratransit cargo ships.

_Shot ABL (1 July, 0400)_

30 June
1300 Underway from berth 18, Bikini. In accordance with CJTF 1 Op Plan 1-46 for ABL day exercises.
1710 Published special ABL day safety precautions.

1 July
1900 Anchored in berth 335, Bikini.

2 July
1442 Shifted to berth 18, Bikini.

3 July
1442 Shifted to berth 56A.

5-23 July Routine activities.

_Shot BAKER (25 July, 0835)_

24 July
1628 Underway in accordance with CJTF 1 Operation Plan 1-46 for BAKER day operations.

25 July
0923 Proceeded to Kwajalein.

26 July
0723 Anchored in berth 17, Kwajalein.

27 July
1355 Underway for Bikini Atoll.

28 July
0826 Anchored in berth E, Bikini.
1550 Underway for Kungap Atoll.

20 July
0657 Anchored in berth 27, Kungap Atoll.

30 July
1610 Two civilians and 73 enlisted men reported aboard for duty with 53rd Naval Construction Battalion.
1817 Underway for Bikini from Kungap Atoll.

31 July
0650 Anchored in berth 56A, Bikini Atoll.

_USS Saivor (CVE-117)_

_Crew Size:_ 854
_Bikini Atoll Arrival:_ 24 May 1946
_Bikini Atoll Departure:_ 4 August 1946
_Shot ABL Location:_ 30 nmi (56 km) N
_Shot BAKER Location:_ 15 nmi (28 km) NE
_Decontamination Location:_ San Diego
_Operational Clearance:_ 28 January 1947
_Final Clearance:_ 1 February 1947

**Task Unit and Function**
_Saivor, an escort aircraft carrier, was a member of TU 1.6 (Naval Air Group). Saivor's mission was to train crews and prepare equipment for the atomic bomb tests to conduct photographic operations, operate helicopter aircraft for radiological reconnaissance, photography, and photographic-utility flights on shot days to provide aerial control of drone boats; to carry out air observation for embarked units and to provide mapping and other photography before and after the shots. In addition Saivor carried a complete aeromedical unit that took upper wind radar readings (Reference 6, p. VII-20-B)._

_Shot ABL (1 July, 0400)_

1 July
1000 Proceeded to Kwajalein.

2 August
1050 Shifted to berth 379, Bikini.

7 August
1413 Shifted to berth 56A.

8-20 August Routine activities.

21 August
0813-0940 Radiosonde personnel aboard to determine radioactivity level aboard ship.

23 August
1045 Fifteen enlisted men from USS LST-817 reported aboard for transportation to Eniwetok.

26 August
1626 Underway for Eniwetok.

27 August
1000 Anchored at Eniwetok.

29 August
1700 One officer and fourteen enlisted men boarded for transportation to Port Hueneme, California.

30 August
1220 Underway for Port Hueneme, California.

13 September
0959 Moored to Pier 2, Port Hueneme, California.
USS Salador (CVE-117)

5 July
0100 Underway for flight operations.
1800 Anchored in berth M4, Bikini Atoll.

13 July
1900 Underway with force and flying in area Falemau.

24 July
0930 Underway in accordance with OTFW 1 operation Plan 146.
1014 Test-fired Flam and Perry in plane guard position with Salado. Conducted flight operations.

25 July
0130 Launched aircraft.
0347 Underway for flight operations.
1131 Conducted flight operations.
1413 Conducted flight operations.
1727 Underway for flight operations.

26 July
1545 Anchored in berth M, Bikini Atoll.
1715 Underway for flight operations.

27 July
1500 Anchored in berth M, Bikini Atoll.
1630 Underway from Bikini.

29 July
1440 Anchored in berth M, Bikini Atoll.
1915 Underway to Kwajalein.

30 July
1340 Anchored at Kwajalein Atoll.
1600 Underway for Bikini Atoll.

31 July
0645 Anchored in Bikini Harbor in berth M.

2 August
1700 Underway to berth Charlie 1.

4 August
1930 Underway for Kwajalein.

5 August
1317 Moved to pier 11, hard Island, Haro.

5. p. VII 120 A. It also housed target ship crews during and following the detonations. It served on the Bikini evacuation ship during NAPPP.

USS Saint Croix (APA-231)

5 July
1610 Underway from berth W, Bikini Atoll.

1 July
0910 Anchored as part of Transport Division 14 of To 1.3 operating in area Harmon.

3 July
1310 Special instructions were received to confirm with the safety plan for ANP Ditch.

1514 Maneuvering to form astern of To 1.3 for entry into area 4.

1417 Anchored in berth 137, Bikini Atoll.

2 July
1519 Underway, steaming on various courses and speeds to conform with the channel.

1610 Anchored in berth Y4.

11 July
1915 Target vessel PT 1196 moved alongside to unaid bombardment.

1914 1415 PT 1196 moved alongside to unload cargo.

21 July
1600 1810 Y1 P. moved along side to transfer fuel (tank farm material.

18 July
1950 Underway from Bikini Atoll to Kwajalein Island.

19 July
0422 Anchored in berth M2, Kwajalein Island.

2 July
1417 Underway from Kwajalein Atoll to Majuro with 21 officers and 56 enlisted men evacuated from Bikini as passengers.

24 July
1815 Underway from Majuro to Kwajalein to transfer patients to naval hospital.

1815 Underway from Kwajalein to Majuro Atoll.

4 July
1215 Underway at Majuro.

29 July
1013 Evacuated for Kwajalein Atoll with personnel evacuated from Bikini as passengers.

27 July
1910 Underway from Bikini to Kwajalein.

1915 Completed loading all Bikini Atoll evacuees.

28 August
0115 Underway from Kwajalein to Majuro Atoll.

26 July
1055 Towed to Kwajalein Atoll. Resume, and oil dock of Bikini Atoll.

8 July
0645 Anchored in berth D, Bikini Island.
USS Saint Croix (APA-231)
30 July

In compliance with CJTF I dispatch, completed hoisting four drone boats (1/3V's) and miscellaneous pyrotechnics and boat systems on board for lift to San Diego, California.

7 August

Underway from Bikini Atoll to San Francisco via Pearl Harbor and San Diego with 79 Navy officers, 1 Marine officer, 2 Army officers, 473 Navy enlisted men, 27 Marine enlisted men, and 24 Army enlisted men with CROSSROADS drone boat unit and other equipment as cargo.

3 August

Mentioned to berth #3, Pearl Harbor.

Sakawa

Crew Size: 143

Bikini Atoll Arrival: 26 April 1946
Crew Location for Shot AB1: USS Washington (APA-229)
Unit AB1 Location: 370 yards (340 meters)
Date and Location: 7 July 1946, Bikini Atoll

Task Unit and Function:

The captured Japanese light cruiser Sakawa was a member of the U.S. Navy's task force, comprising 114 naval personnel, who were evacuated before AB1.

Shot AB1 (1 July, 0800)

CJTF I directed Sakawa to be moved to a berth for badly damaged ships of such size and quality that the after portion was not radio logically viable.

1630: Crew Size: 335

Bikini Atoll Arrival: 29 May 1946
Bikini Atoll Departure: 23 August 1946
Crew Location for Shot AB1: USS Rockbridge (APA-28)
Unit AB1 Location: 895 yards (818 meters)
Date and Location: 7 July 1946, Bikini Atoll

Task Unit and Function:

The heavy cruiser Salt Lake City was a member of Task Unit and Function.

Shot AB1 (1 July, 0800)

0800: 1030 Evacuated crew to Rockbridge in preparation for AB1.

0730: The commanding officer and 133 men reboarded the ship with a radio dome monitor, and continued clearing lower deck compartments. Completed radio logical clearance of entire ship, set condition Zebra below the second deck, and evacuated the ship for the night.

0810: 1030: The commanding officer and a boarding team of 30 men reboarded the ship with a radio dome monitor and continued clearing the lower deck compartments. Completed radio logical clearance of entire ship, set condition Zebra below the second deck, and evacuated the ship for the night.

0810: 1030: The commanding officer and a boarding team of 160 men reboarded the ship and continued clearing the lower deck compartments. Completed radio logical clearance of entire ship, set condition Zebra below the second deck, and evacuated the ship for the night.

0800: 1030: The commanding officer and a boarding team of 160 men reboarded the ship and continued clearing the lower deck compartments. Completed radio logical clearance of entire ship, set condition Zebra below the second deck, and evacuated the ship for the night.

0800: 1030: The commanding officer and a boarding team of 160 men reboarded the ship and continued clearing the lower deck compartments. Completed radio logical clearance of entire ship, set condition Zebra below the second deck, and evacuated the ship for the night.
6 July
0500 Team A and B, consisting of 150 men, and the commanding officer boarded to continue inspection of the ship and clear away debris.
0535 Underway to anchorage, assisted by ATR-40 and USS Auckland (ATF-48).
0612 Anchored in vicinity of berth 164.
1640 The commanding officer and boarding team departed for Rockbridge, except for the security patrol.

7 July
0930 3451 All personnel transferred from Rockbridge to Salt Lake City.

5 July
0845 0900 USS Conservier (ARS-42) passed Salt Lake City abeam to starboard; reading indicated 2-hour tolerance at about 30 feet (9.1 meters).

23 July
0430 Transferred 55 men to Rockbridge in preparation for test BAKER.

24 July
0915 1100 Evacuated remaining officers and enlisted men to Rockbridge.

27 July
0844 USS Auckland (ATF-48) passed Salt Lake City abeam to starboard; reading indicated 2-hour tolerance at about 30 feet (9.1 meters).

28 July
0940 Reclaimer passed Salt Lake City, which was down by the stern and listing to starboard.

29 July
1307 Reclaimer passed alongside Salt Lake City. No change in list or trim. One-hour tolerance on ship, eight-hour tolerance in adjacent water.

31 July
1336 USS Clamp (ARS-31) directed to proceed to Salt Lake City and wash down with high-pressure hoses for 3 hours. Clamp reported monitor advised that remaining in vicinity of Salt Lake City for more than 1 hour was unsafe.

1 August
1140 USS Conservier (ARS-39) directed to proceed to Salt Lake City, place monitor on board to make Geiger readings, replenish foam supply, and return to previous anchorage.
1521 Conservier reported boarding of Salt Lake City completed.
1652 Conservier inspected Salt Lake City to check foam en route to anchorage.

1 August
1200 Special boarding team of about 50 men reported on board Conservier for reboarding Salt Lake City.

1300 Conservier moored alongside Salt Lake City's portside. Special boarding parties went on board to rig equipment in flooded spaces for pumping them out. Other parties were sent onboard to wash down the main deck areas with high-pressure hoses. A careful record was kept of the exposure of each man to radioactivity to prevent any man from receiving more than the established daily tolerance. The boarding team was on board for approximately 4 1/2 hours.

2 August
0815 The commanding officer and a team of about 50 men boarded Conservier to continue pumping out flooded spaces and decontaminating Salt Lake City. Conservier hosed down Salt Lake City for about 39 minutes. Average radiation was 3 to 4 R/24 hours on weather decks except the forecastle, which averaged 2 R/24 hours before work was begun. No readings were taken at the end of the day's work (Reference 4).

23 July
2248 Conservier moored alongside Salt Lake City's portside to continue pumping out flooded spaces. Washed down forecastle with better compound and lye solution and cleared radioactive pieces of metal on the deck. A careful record was kept of each man's exposure to radiation. Conservier took off from alongside at the end of the day's operations.

3 August
0900 The commanding officer and a boarding team of 50 men boarded Salt Lake City from USNS and began decontamination work with soap solution and sand. No other cleaning materials were available (Reference 4). Conducted radiological survey of the weather deck.

4 August
0505 The commanding officer and the first boarding team of 50 per bounded Salt Lake City and continued decontamination. Conducted radiological survey of the ship, hosed down with soap solution and sand. Flushed high-radiation areas with water from open bridge, pilothouse level, communications deck, and entire main deck, open bridge and pilothouse reduced from 15 R/24 hours to 6 R/24 hours average. Water in some drains and puddles gave high readings; the water was removed later (Reference 4).

406
USS Salt Lake City (CA-25)

4 August

1550 The third boarding party evacuated Salt Lake City and returned to Rockbridge where all men were checked for radiological contamination.

5 August

0400 Special party on board to start diesel generator.

0415 The commanding officer and a special boarding team of 50 men boarded and commenced cleaning machinery spaces and inside radiological contamination. Commenced daily radiological survey of the ship.

1035 Second boarding team reported aboard to relieve the first team.

1200 First boarding team returned to Rockbridge where all men were checked for radiological contamination.

1300 Third boarding team reported on board to relieve the second team.

1315 Second boarding team returned to Rockbridge where all men were checked for radiological contamination.

1500 Third team returned to Rockbridge where all men were checked for radiological contamination.

A complete survey was begun and readings of representative areas were recorded. Each day the same routine was followed and readings recorded to determine changes. Each day new hot spots were discovered that were not previously known to exist. Every effort was made to prevent anyone from receiving more than the established radiation tolerance. It was found necessary to caution men continually about precautions to be taken around radioactive areas. Some men were still found handling-debris with bare hands although rubber gloves were available. Men were worked in groups with one petty officer for every five or six men (Reference 4).

5 August

A strong acetic acid solution was applied to a deck area on the open bridge to determine the value of acid for decontamination. The 4-ft² area was scrubbed for 5 minutes after acid was applied and then flushed off. A control area the same size was scrubbed for 5 minutes using only water. Both areas were reduced by exactly the same amount (1.5 R/24 hours to 1.3 R/24 hours) (Reference 4).

The work parties cleared away wood grattings, bunting, and other debris from open bridge, scrubbed the deck, and washed it down. Flushed down well deck, after superstructure, and main deck aft. No caustic cleaning materials were available. Average readings on bridge and bridge house were reduced to 2.5 to 3 R/24 hours and communication deck to about 2 R/24 hours.

6 August

0915-1500 Three parties of 50 men each in 2-hour relays boarded. When the parties returned to Rockbridge, all men were checked for radiological contamination.

Sprayed lye solution on bulkheads and deck of open bridge, pilot house level, turret No. 1, communication deck, and forecastle deck. Flushed off lye solution after scrubbing with deck scrubbers, removing several coats of paint from painted surfaces. Readings generally reduced 10 to 15 percent on wooden deck, painted surfaces reduced 25 to 35 percent. Removed vent cover portside, frame 10, main deck. Reading outside was 80 R/24 hours; reading inside was 100 R/24 hours. Flushed out vent with hose, reading reduced to 8 R/24 hours (Reference 4).

7 August

0915-1500 Three parties of 50 men each in 2-hour relays boarded. When the parties returned to Rockbridge, all men were checked for radiological contamination.

Holystoned main deck from forecastle to well deck. Sprayed lye solution on bulkheads from turret No. 1 to the well deck. Lost electric power at 1:00. Unable to wash down scrubbed decks. Cleaned out contaminated newspapers and canvas from wing storage frame 60. Readings reduced from 48 R/24 hours to 4 R/24 hours. Cleaned out debris from spud locker and flushed it out. Reading reduced from 32 R/24 hours to 10 R/24 hours maximum. With about 5 R/24 hours average. A piece of wood deck was removed from the well deck after measuring the radiation of the area. The section was then brought to Rockbridge and planed down with a joiner machine by 1/16-inch cuts: 5/16 inch was removed to bring the wood to tolerance (Reference 4).

8 August

Began boarding with two parties of 80 men each in 2-hour relays to change working parties. All men were checked for radiological contamination when they returned to Rockbridge.

Completed flushing loose paint from areas where solution was applied the previous day. The solution had to be reapplied to remove the paint. All bulkhead and turrets in the forward half of the ship had the solution applied that day. Commenced spraying and flushing of bulkheads on after superstructure deck. Considerable paint was removed, although reduction in general radiation was about 15 percent. Where paint collected in puddles around drains on communication deck, reading increased from 1.5 to 5 R/24 hours. Puddles were removed (Reference 4).

9 August

Two parties of 80 men each in 2-hour relays boarded. All men were checked for radiological contamination when they returned to Rockbridge.

Removed radioactive debris from after searchlight platform. Removed jackets of radioactive sand and debris in after crane structure and around structure behind the after stack. Removed paint with lye solution from turret Nos. 3 and 4.
USS Salt Lake City (CA-25)

9 August

Salt Lake City was not boarded again for the regular daily survey conducted each morning (Reference 4) until further orders.

17 August 0830

Several members of the RadioSafe Section reported on board and checked all clothing that had been worn by men working on Salt Lake City.

17 August 1200

All personnel evacuated the ship.

24 August 2100

Salt Lake City was towed by USS Takelma (APA-113) and USS Hitchcock (APA-103) to Peleliu Sound Naval Shipyard, arriving there 29 July 1947. It was used for decontamination experiments and research.

USS San Marcos (LSD-25)

1 July 1528

Anchored in berth 94, Bikini.

2-23 July

Routine operations.

Shot BAKER (25 July, 0835)

24 July 1544

Underway to assigned area off Bikini Atoll in conformance with CQTF 1 for test BAKER.

25 July 0001

Steaming in column in area Packard with other vessels of TG 1.8.

0955

Operating with TG 1.1 in area Graham.

1431

Anchored in berth E. Bikini Atoll.

28 July 1531

Underway to sea.

1636

Steaming independently in area Mercury with USS Cumberland Sound (AV-17).

29 July 0930

Anchored 500 yards (450 meters) east of berth U. Bikini Atoll.

30 July 0925

Shifted anchorage to berth 94, Bikini.

2 August 1620

Shifted berths to anchorage in berth Tare, Bikini.

2-24 August

Remained anchored at Bikini and engaged in routine small boat services.

25 August 1630

Underway for Kwajalein.

26 August 1136

Anchored in anchorage K. berth 22, Kwajalein.

USS SARATOGA (CV-3)

Crew Size: 589

Bikini Atoll Arrival: 31 May 1946

Crew Location for Shot ABLE: USS Rockwall (APA 230)

Crew Location for Shot BAKER: Rockwall

Shot ABLE Location: 2,260 yards (2,100 meters) SSW

Shot BAKER Location: 350 yards (320 meters) SSW

Sunk 25 July 1946, Bikini Lagoon

Task Unit and Function

The carrier Saratoga was a member of TG 1.1.2 (Aircraft Carrier Unit), Carrier Division 31. It was a target vessel during CROSSROADS. Its crew was evacuated before AH-1 and BAKK-1 and did not return. Among the experimental equipment aboard were clothing and food provided by the Quartermaster Unit, and ammunition and representative items from Army Signal Unit.

Shot ABLE (1 July, 0900)

30 June 0950-1120

Evacuated crew to Rockwall in preparation for AH-1.

1 July 1332

A bedliner fire was noted on Saratoga. Flight deck is set fire.
USS Saratoga (CV-3)

1 July

1748 ATC 40 ordered to fight the fire on Saratoga, but not to board it.

14091437 ATC 40 alongside Saratoga to fight fire. Reported fire extinguished (Reference 6, pp. VII-7-8 and VII-11-7 A).

1730 USS Shikakuni (AN 88) (Team B) reported joining a boarding team on Saratoga.

1921 Shikakuni reported Saratoga clear for boarding (Reference 6, p. VII-11-7 A).

1936 Shikakuni reported Saratoga radioactive frame 90 aft.

1941 Shikakuni reported its inspection of Saratoga was completed.

2 July

0415 Shikakuni reported Saratoga lighter event (Reference 6, p. VII-11-24 A).

The only evidence of appreciable radioactivity was on the rails and flight deck structure on the after quarter where 0.7 P/4 hours was recorded by a Geiger counter at 1206 on 2 July. Since the sea on the port side had been declared radioactivity on 1 July, the water poured onto the flight deck by the salvage vessels in extinguishing the flight deck fire may have been the cause (Reference 33).

24 July

Crew transported to IJN aircraft carriers.

24 July

Navy Sino-1145 evacuated crew to Rockwall in preparation for NAP.

Shot Walik (25 July, 0506)

25 July

0416 Team chartered Saratoga lighter event. (Reference 6, p. VII-1-41).

0518 PM chartered lighter event. (Reference 6, p. VII-1-41).

0618 PM chartered lighter event. (Reference 6, p. VII-1-41).

1119 PM chartered lighter event. (Reference 6, p. VII-1-41).

1510 CPO 1st class. 11 Saratoga could not be sent home and allowed from the target area without leaving. 11 on shore line with direction to leave the area in tow the very high radioactivity of the water near the center of the target had very high radioactivity of the water near the center of the target and very high radioactivity of the water near the center of the target area. (Reference 6, p. VII-1-41).

1610 CPO 1st class 11 Saratoga could not be sent home and allowed from the target area without leaving. 11 on shore line with direction to leave the area in tow the very high radioactivity of the water near the center of the target had very high radioactivity of the water near the center of the target and very high radioactivity of the water near the center of the target area. (Reference 6, p. VII-1-41).

1730 CPO 1st class 11 Saratoga could not be sent home and allowed from the target area without leaving. 11 on shore line with direction to leave the area in tow the very high radioactivity of the water near the center of the target had very high radioactivity of the water near the center of the target and very high radioactivity of the water near the center of the target area. (Reference 6, p. VII-1-41).

1810 CPO 1st class 11 Saratoga could not be sent home and allowed from the target area without leaving. 11 on shore line with direction to leave the area in tow the very high radioactivity of the water near the center of the target had very high radioactivity of the water near the center of the target and very high radioactivity of the water near the center of the target area. (Reference 6, p. VII-1-41).
An boarding party located in the rear proporcion of the compartments, had a problem to remove some water. The of the party returned to the bilge.

A boarding party located in the rear proporcion of the compartments, had a problem to remove some water. The party

A boarding party located in the rear proporcion of the compartments, had a problem to remove some water. The boarding party returned to the bilge.
### USS Searaven (SS-196)

**12 August**

**R/24 hours:** Topside maximum 0.25 R/24 hours

**1400**

**USS Melville (AKS-23) washed boat with pressure hose.

**14 August**

**0840**

Boarding team came on board for inspection and decontamination. Concentrated on bridge and connning tower superstructure. Applied strong lye solution to all surfaces and allowed it to remain 3 to 4 hours before washing down (Reference 4). Topside average, 0.7 R/24 hours; Topside Maximum, 0.31 R/24 hours (In dog house); below decks, sweet.

**1408**

Boarding team on board for inspection and decontamination. Concentrated on bridge and connning tower superstructure. Applied strong lye solution to all surfaces, allowing 3 to 4 hours before washing down. Also washed down top side with salt water continuously throughout washing period (Reference 4). Below deck, sweet; Topside average, 0.17 R/24 hours; topside maximum, 0.21 R/24 hours.

**15 August**

**0840**

Crew absent, shifting anchor.

**0940**

Underway to shift berthing.

**1000**

Anchored in berth 109, Bikini.

**1045**

Boat secured.

**1125**

Decontamination party aboard. Topside average, 0.14 R/24 hours; Topside maximum, 0.70 R/24 hours.

**16 August**

**1404**

Decontamination team aboard to continue decontamination. Topside average, 0.16 R/24 hours; Topside maximum, 0.34 R/24 hours (In dog house); Below deck, sweet. Initial inspections were completed, but the boat's reports were not received.

**17 August**

**1045**

Decontamination team aboard to continue decontamination procedures.

**1300**

Decontamination team returned to continue decontamination procedures. Topside average, 0.94 R/24 hours; Topside maximum, 0.57 R/24 hours (In dog house).

**Table A.11.** Topside radiological readings (R/24 hours) on USS Searaven (SS-196).

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<th>Date</th>
<th>Bow</th>
<th>Fwd</th>
<th>Aft</th>
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<th>Stern</th>
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**Source:** Reference 4.

The entire deck of Searaven was wood except for the area over the mufflers and near the bow. Scrubbing seemed effective on the wooden deck planking only during the first few days of scrubbing. After this the top of the planking was bare. The sides and lower portion were inaccessible. Removal of decking on 10 August allowed cleaning dust and contaminated paint beneath, thereby lowering readings.

Since Searaven was scraped and repainted with only one coat of paint before arriving at Bikini, there were few areas of heavy paint. Removal of light paint and dust by scrubbing did have an initial effect of greatly lowering radioactivity. The majority of Searaven's superstructure had become so ruined through age and exposure during war patrols that removal of all rust was impossible. On several steel castings, which could be cleaned bare, the readings were 0.1 to 0.2 R/24 hours below surrounding areas. No decontamination work was done below decks since all compartments were originally below 0.1 R/24 hours. For some became so as topside readings dropped (Reference 4).

Searaven arrived in San Francisco on 14 October 1946 and was decontaminated on 11 December 1946.
**USS Severn (AO-61)**

- **Crew Size:** 145
- **Bikini Atoll Arrival:** 24 May 1946
- **Bikini Atoll Departure:** 24 August 1946
- **Shot ABLE Location:** En route from Pearl Harbor to Bikini
- **Shot BAKER Location:** 15 nmi (28 km) off Los Angeles
- **Decontamination Location:** Los Angeles
- **Final Clearance:** 3 November 1946

**Task Unit and Function**

The oiler Severn was a member of 7U-1-8.1 (Repair and Service Unit). Severn provided fuel and water for other support ships. During the test series, it made two trips to Pearl Harbor to refuel.

**Shot ABLE (1 July, 0900)**

- **1 July**
  - 0900 En route from Pearl Harbor to Bikini.
  - 0833 Moored to USS Wildcat (AKW-2) in berth 370.
  - 1651 Underway.
  - 1720 ETA-187.
  - 1750 Departed Bikini Lagoon for Pearl Harbor via Kwajalein.

**Shot ABLE (1 July, 0900)**

- **16 July**
  - 0744 Underway to shift berths.
- **17-18 July**
  - Remained anchored; performed routine duties and was not in contact with target vessels.
- **18 July**
  - 0900 VOG-70 came alongside to starboard.
- **19 July**
  - 0920 Anchored in berth 205, Bikini.
- **20 July**
  - 1501 Underway to shift berths.
- **23 July**
  - 0935 VOG-63 came alongside to port.
- **24 July**
  - 1459 Underway for area Packers.

**Shot BAKER (25 July, 0835)**

- **25 July**
  - 0835 Observed shot BAKER.
- **30 July**
  - 0724 Entered Bikini Lagoon.
- **31 July**
  - 0145 Underway.

---

**USS Shakamaxon (AN-88)**

- **Crew Size:** 38
- **Bikini Atoll Arrival:** 24 May 1946
- **Bikini Atoll Departure:** 24 August 1946
- **Shot ABLE Location:** 18 nmi (33 km) S of Los Angeles
- **Shot BAKER Location:** 10 nmi (19 km) S of Los Angeles
- **Decontamination Location:** Pearl Harbor
- **Operational Clearance:** 14 December 1946
- **Final Clearance:** 4 January 1947

**Task Unit and Function**

The net laying ship Shakamaxon was a member of 7U-1-2.1 (Salvage Unit). Shakamaxon's main duties included salvaging the damaged target vessels after the tests, performing emergency repairs, and fighting fires.

**Shot ABLE (1 July, 0900)**

- **1 July**
  - 1148 Target vessel LCI(L)-1115 alongside 2 hours for freshwater.
  - 1150 Target vessel LCI(L)-549 alongside 1 hour.
  - 1324 Departed Bikini Lagoon for Kwajalein.

---

412
USS Shakamaxon (AN-88)

3 July
0800 Shakamaxon told all ships in its sector were clear and that boarding teams aboard as directed (Reference 6, p. VII 271 A).
0915 Boarding team aboard Sagatoga. Reported Sagatoga outcome (9, p. VII 274 A).
1041 Reported SHKAMAXON completed and proceeding to target ship USS Missouri (BB-63).
1103 Reported boarding team aboard Wells. (Reference 6, p. VII 271 A).
1111 Reported target ship USS Mogford (DD 419) Geiger count and all ships in sector completed.
1140 Directed to proceed to anchorage.
1215 Boarding team discharged bound for USS Wharton (AP 7) in a small boat.
1245 Anchored in berth B.

3 July
Operating on night legs performing routine duties not involved with target vessels.

4 July
1100 1149 Laid and stretched leg in array area.
1400 1624 Laid and stretched mooring leg in array.
1905 Anchored in berth B.

5 July
0631 Recovered mooring leg.
0731 0750 Proposed to operate by laying mooring leg.
1741 1741 Laid and stretched mooring leg.
1800 Laid to bury in array area.
1900 Anchored in berth B. Hiko.

6 July
0440 0408 Laid and stretched mooring leg.
1131 1111 Laid and stretched mooring leg.
1900 Anchored in berth B. Hiko.

7 July
1100 1100 Moved to USS Gilmore (APA 101) to load heavy leg and anchor.
1410 Anchored in berth B. Hiko.

8 July
1200 Moved to lay multiple USS Gibbons (AM 66). Laid and stretched leg.
1000 Underway for USS Rolette (AKA 59).
1157 Anchored in berth B. Hiko.
1242 Anchored in berth B. Hiko after taking on anchor from USS Rolette (AKA 59).

9 July
1410 Laying in array area for meeting of target vessel April 11.
1916 Received and connected mooring wire to antenna of April 11. Laid and stretched mooring wire.
1712 Anchored in berth B. Hiko.

10 July
1410 Underway to array area.
1115 Anchored in berth B.
1140 Moved to bury in array area.
1940 Began stretching leg尴尬: way wilihing berth.
1031 1111 Stretched leg.
1902 Anchored in berth B.

15 July
0914 Moved to anchor leg to buoy.
1005 1014 Directed leg on buoy.
1200 Underway to array.
1242 Moved to array.
1315 Underway to array area. Received leg from USS Oregon (AN 85). Laid and stretched leg.
1415 Moved to array to receive mooring leg.
1711 Laid and stretched leg.

16 July
1140 1101 Laid buoy fiber chain. Underway to Hiko.
1245 Laying to off target submarine USS Shige (SS 345).
1305 Underway to array area. Received leg from April 11.
1801 1810 Laid and stretched leg.
1845 Anchored in berth B. Hiko.

17 July
Routine activities: not involved with target vessels.

18 July
1100 Cleared target ship USS Illinois (APA 11).
1115 Proceeding to target ship USS Belle Lake City (CA 201).
1400 Cleared Belle Lake City.
1801 Anchored in berth B. Hiko.

19 July
0041 0104 Made preparations for use after working through the night w1thlling to emerging submarines.

24 July
1100 USS Providence (Ark IV). USS Clam (Ark 31). USS Current (ARK 47), and Shakamaxon directed to stay away from the line through target ships. Fillmore and USS Catholic (ARK 75) and not to cross the line without further orders.
Shakamaxon was 31-20 target vessels. Fillmore and 111 2/2 were first for a boarding team. Directed to place boarding team on board.
Reported Fillmore Geiger count.
1422 Reported boarding team back on board. Proceeding to 111 1/2.
1425 Requested supply the Fillmore, boarding team on board.

413
USS Shaka maxon (AN-88)

26-29 July Anchored; not involved with target vessels.
30 July Moored portside of SkuE.
1600 Underway to anchorage.
1810 Anchored in berth Tart, Bikini.
1 August Continued to plant submarine mooring in lieu of Eneu Island (Reference 6. p. VII-1-66 B).
2 August Performed routine activities in Bikini; not involved with target ships.

USS Shaka maxon (AN-88)

8 August Boarding team from Wharton embarked.
0900 Alongside Muskin; boarding team disembarked.
0910 Reembarked boarding team.
1020 Alongside target ship Mayrant (DD-402); boarding team disembarked.
1034 Reembarked boarding team; underway for target ship USS Dawson (APA-79); boarding team disembarked.
1035 Reembarked boarding team.
1100 Alongside target ship USS Barrow (APA-61); boarding team disembarked.
1209 Repotted aboard.
1204 Alongside target ship USS Barrow (APA-61); boarding team disembarked.
1305 Reembarked boarding team.
1333 Boarding team disembarked to Wharton.
1352 Anchored in berth 105, Bikini.
1500 Anchored in berth 51, Bikini.

9-11 August Routine operations; not involved with target vessels.
12 August Alongside Muskingum to take off torpedoes.
1215 Target vessel LCT-1115 came alongside.
1215 Coped off; operation completed.
1227 Underway from Muskingum.
1305 Anchored in berth 51, Bikini.
1333 Underway to Salt Lake City.
1333 Anchored in berth 108, Bikini.
1350 Anchored in Bikini; not involved with target vessels.

13-18 August Operated in Bikini; not involved with target vessels.

14 August Anchored in berth 108 after refueling and receiving water.
19 August Alongside target ship USS Hughes (DD-410) to take aboard pump and generator to Salt Lake City.
0850 Underway from Hughes to Salt Lake City.
1040 Underway to Salt Lake City.
1040 Anchored in berth 108, Bikini.
1355 Anchored in Bikini; not involved with target vessels.
1355 Underway to Salt Lake City.
1605 Anchored in Salt Lake City.
1645 Anchored in berth 108, Bikini.

20 August Anchored in Bikini; not involved with target vessels.

5 August Radiate monitors of boarding team #8 reported aboard from USS Haven (AH-12), composed of 1 officer, 4 enlisted men, and 1 civilian.
0947 Eight-man working party of Gaspoden came aboard.
1100 Eighteen additional members of boarding team #8 reported aboard.
1125 Working party, composed of 17 members of target ship USS New York (BB-34), reported aboard.
1125 Laying to in vicinity of New York.
1131 Anchored in berth 108, Bikini.
1227 Underway from alongside Pensacola.
1235 Underway to Salt Lake City.
1543 Anchored in Salt Lake City.
1605 Anchored in berth 108, Bikini.
1645 Anchored in Bikini; not involved with target vessels.

16 August Laying to pick up boarding team from Wharton.
0850 Moored to target ship USS Pensacola (CA-24) to furnish electrical power to port anchor windlass.
0850 Underway from alongside Pensacola.
1045 Anchored in berth 108.
1227 Alongside target ship USS Ralph Talbot (DD-390) to take its anchor aboard.
1227 Talbot anchor aboard.
1407 Underway to anchorage.
1407 Anchored in berth 108, Bikini.
1650 Alongside target ship USS Ralph Talbot (DD-390) to receive 3-inch pumps.
1655 Underway from Salt Lake City.
1755 Anchored in berth 108, Bikini.

21 August Moored to target ship USS Pensacola (CA-24) to furnish electrical power to port anchor windlass.
0845 Underway from alongside Pensacola.
1045 Anchored in berth 108.
21 August Underway to Salt Lake City.
1227 Alongside target ship USS Ralph Talbot (DD-390) to take its anchor aboard.
1227 Talbot anchor aboard.
1407 Underway to anchorage.
1407 Anchored in berth 108, Bikini.
1650 Alongside target ship USS Ralph Talbot (DD-390) to receive 3-inch pumps.
1655 Underway from Salt Lake City.
1755 Anchored in berth 108, Bikini.
19 August Alongside Salt Lake City to receive 3-inch pumps.
0835 Underway from Salt Lake City.
0835 Alongside Hughes to unload pump and Talbot's anchor.
1040 Underway from Hughes; duty completed.
1132 Having placed anchor and pump aboard.
1132 Anchored in berth 108, Bikini.
24 August  Anchored in vicinity of berth 108, Bikini.

25 August  Underway from USS Gypsy (ARS-1) to vicinity of target ship USS Fallon (APA-81).

26 August  Moored to Fallon to place transport anchor and chain aboard; furnished electrical power to anchor windlass on Fallon.

27 August  Departed Bikini Lagoon for Kwajalein.

28 August  Arrived at Kwajalein.

6 September  Underway to Guam.

USS Shangri-La (CV-38)

24 August  Anchored in berth 285, Bikini.

25 August  Underway from Bikini to Roi with Turner and Cecil.

26 August  Catapulted two TBMs for Roi Island.

27 August  Received aboard three drone aircraft from a lighter.

28 August  Underway from Roi Island for air rehearsal of BAKER.

29 August  Launched 12 F6F drone-control aircraft and 3 F6F drones.

30 August  Landed six F6F drone-control aircraft.

1 September  Anchored in berth 228, Bikini.

10 September  Underway for Guam.

Crew Size: 1,935
Bikini Atoll Arrival: 5 June 1946 (Rot Namur)
Bikini Atoll Departure: 25 July 1946
Shot ABLE Location: 43.8 nml (81 km) SE
Shot BAKER Location: 40 nml (71 km) SE
Final Clearance: By 22 November 1946

Task Unit and Function

The aircraft carrier Shangri-La was a member of TU 1.6 (Navy Air Group). Shangri-La was responsible for training personnel and preparing equipment for atomic bomb tests. Four drone aircraft (F6Fs) flew from Shangri-La and were used to collect radioactive samples from the nuclear cloud; the drone-control aircraft remained a safe distance from the detonation while directing the drones via radio control. In addition, a complete aerological unit, which took radar upper wind soundings at Bikini, was aboard Shangri-La.

Shot ABLE (1 July, 0900)

30 June  Underway from Roi Anchorage, Roi Island, Kwajalein Atoll. In company with USS Turner (DD-834) and USS Charles P. Cecil (DD-835).

1 July  Launched four drone and sixteen drone-control aircraft.

2 July  Underway from Roi to Bikini with Turner and Cecil.

3 July  Entered Bikini entrance to channel.
USS Shangri-La (CV-38)

26 July
1515 Self-propelled barge tied up alongside with two F6F planes to be transferred aboard.
1602 Self-propelled barge alongside to transfer two F6Fs to board.

27 July
0955 Self-propelled barge alongside to deliver one TBM and one F6F drone.

28 July
1240 Received barge from alongside to deliver two TBM aircraft.
1455 Received barge alongside to deliver two TBM aircraft.
1520 Received barge alongside to deliver one SNR aircraft.
1637 Underway from Hoi Island to Pearl Harbor.
2 August

USS Sioux (ATF-75)

Crew Size: 66
Bikini Atoll Arrival: 11 June 1946
Bikini Atoll Departure: 28 August 1946
Shot ABLE Location: 94 nmi (174 km) NNW
Shot BAKER Location: 17 nm (31 km) WSW
Decontamination Location: Los Angeles
Operational Clearance: 28 November 1946
Final Clearance: 4 December 1946

Task Unit and Function
The fleet ocean tug Sioux was a member of TF 1-8.1 (Repair and Service Unit). Sioux moored target aircraft for Shot BAKER and engaged in salvage, towing, emergency repair work, and decontaminating target vessels.

Shot ABLE (1 July, 0900)
1452 Received one F6F aircraft on board to be transported to target ship USS Pennsylvania (BB-38).
1456 Underway to go alongside Pennsylvania.
1544 Moored starboard side to portside of Pennsylvania.
1625 Placed F6F aircraft on deck of Pennsylvania.
1530 Underway, returning to anchorage.
1455 Anchored in berth 106, Bikini.

12 July
0820 Moored starboard side to target ship USS Arkansas (BB-33).
0915 Began hoisting cargo from deck of Arkansas and placing it aboard LCT-1415.
1220 Underway to conduct towing operation.
1652 Anchored in berth 106, Bikini.

13 July
0726 Moored starboard side to Saratoga.
0805 Received one F6F aircraft from Saratoga for transportation to target ship USS Iowa (BB-61).
0900 Underway to Harrow.
0905 Placed F6F aircraft on deck of Harrow.
0933 Underway to target ship USS Nevada (BB-36).
1155 Moored starboard side to Nevada, preparing to lift Army test equipment from deck of Nevada and place it on LCT-1461.
1311 Moved equipment from Nevada to LCT-1461.
1655 Underway shifting to Nevada's starboard bow.
1125 Moored starboard side to starboard bow of Nevada.
1146 Resumed removing Army test equipment from deck of Nevada to LCT-1461.
1636 Underway to anchorage.
1651 Anchored at Bikini.

14 July
0810 Moored starboard side to Pennsylvania.
0810 Received one Army truck from Pennsylvania for delivery to USS Chilton (APA-38).
0840 Underway to Chilton.
0900 Moored to Chilton.
0905 Placed Army truck on board Chilton.
1010 Underway for routine towing operation.
1215 Moored starboard side to Saratoga.
1217 Saratoga placed Army test equipment aboard LCT-1415.
1220 Underway with LCT-1415 in tow to go alongside Arkansas for more Army test equipment.
1430 Moored portside to Arkansas.
1550 Received Army test equipment from Arkansas and placed it aboard LCT-1415.
1600 Completed unloading equipment from Arkansas.
1607 Underway with LCT-1415 in tow to target ship USS Salt Lake City (CA-25).
1715 Moored starboard side to Salt Lake City, removed box of freight from deck of Salt Lake City.
1744 Underway with LCT-1415 in tow to Chilton, then proceeded to anchorage.
1740 Anchored in Bikini.

15 July
1715 Moored portside to target ship USS Gulf (DD-71).

416
Moored YO-132 alongside port-side of USS Ajax (AR 6).

Underway, reporting to USS Palmyra (AKS [73]) for assignment.

1330

Anchored in vicinity of Wahoo.

Bloux directed to get underway to proceed to target ship USS Wilson (DD 408) where it would embark monitors, then thoroughly wash Wilson using high-pressure water stream (Reference 6, p. VII 70-20).

Underway to wash down the hull and superstructure of Wilson.

Underway to go alongside USS Langley (CV [2] - 24)

2 August

Completed removing armor plate from console; left.

1900

22 August

Performed routine duties in Bikini and relieved target vessel.

4 August

Anchored in Bikini Lagoon.

Anchored off Kewa Island, Bikini.

Underway to berth 44 to take AKW 29 in tow.

Moved AKW 29 to area off Kewa Island.

Anchored in berth 100, Bikini.

Underway from Bikini Lagoon to Kwajalein Atoll.

Moored in berth A 21, Kwajalein.

Underway with AGT 27 in tow from Kwajalein to Bikini.

Anchored Bikini Lagoon, preparing to meet AGT 27 alongside target ship USS Langley (APA 63) in berth 27.

Moored AGT 27 alongside Langley in berth 27.

Anchored in berth 100, Bikini.

Underway to Kwajalein Atoll.

Anchored in Kwajalein Atoll.

Anchored in Bikini Lagoon, berth 7.

Anchored in berth 47, Bikini.

Moored alongside port-side of target ship USS Hughes (DD 410), making fast for towing.

Underway with Hughes in tow alongside southwest.

Placed bow of Hughes in entrance of AKW 29.

Placed YO-132 alongside port-side of USS Ajax (AR 6).

Underway, reporting to USS Palmyra (AKS [73]) for assignment.

Anchored in vicinity of Wahoo.

Bloux directed to get underway to proceed to target ship USS Wilson (DD 408) where it would embark monitors, then thoroughly wash Wilson using high-pressure water stream (Reference 6, p. VII 70-20).

Underway to wash down the hull and superstructure of Wilson.

Anchored in Bikini Lagoon.

Moored YO-132 alongside port-side of USS Ajax (AR 6).

Underway, reporting to USS Palmyra (AKS [73]) for assignment.

Anchored in vicinity of Wahoo.

Bloux directed to get underway to proceed to target ship USS Wilson (DD 408) where it would embark monitors, then thoroughly wash Wilson using high-pressure water stream (Reference 6, p. VII 70-20).

Underway to wash down the hull and superstructure of Wilson.

Anchored in Bikini Lagoon.

Moored YO-132 alongside port-side of USS Ajax (AR 6).

Underway, reporting to USS Palmyra (AKS [73]) for assignment.

Anchored in vicinity of Wahoo.

Bloux directed to get underway to proceed to target ship USS Wilson (DD 408) where it would embark monitors, then thoroughly wash Wilson using high-pressure water stream (Reference 6, p. VII 70-20).

Underway to wash down the hull and superstructure of Wilson.

Anchored in Bikini Lagoon.
USS Sioux (ATF-75)
15 July

1324 Cast off from Hulman and proceeded to anchorage.
1431 Anchored in berth 32, Bikini.
17 August
0835 Underway with USS Hulman (IX-150) low tow for Kwajalein.
21 August
1050 Anchored Quarrie in berth K-4, Kwajalein.
1405 Underway from Kwajalein to Bikini.
24 August
0845 Anchored in berth 77, Bikini Lagoon.
25 August
0815 Underway from Bikini to Kwajalein with ABV in tow.
26 August
1110 Anchored in berth K-2, Kwajalein.
7 September
1930 Target vessel 1/1 in 1/2 model alongside to deliver oil.
8 September
1330 Transferred Kwajalein for Pearl Harbor.

USS Skate (SS-305)

USS Skate (SS-305)

1050 Midgun reported Sklate beached and anchored fore and aft (Reference 6, p. VII 1 81 A).
1605 Sklate officers made trip to Eniwetok Island in small boat and circled Sklate. Noted sign on each side reading: "Danger Keep Clear. Very Radioactive." The superstructure was mangled, but inner and outer hulls appeared to be intact.
0711 Small boat with reboarding team departed from Butlereau.
1904 Arrived on Sklate.
1940 Secured Sklate. Reboarded Sklate through the open engine room hatch. With the exception of explosive percentage of hydrogen in battery compartments, encountered no dangerous gases or radiactivity.
21 July
0746 Completed opening seal. Anchored in berth 37, Bikini.
5/17 July
0824 Crew reboarded and lived aboard Sklate.

Butlereau (25 July, 0835)

24 July
1400 Completed rigging boat for slow boat and secured the watch.
1505 Crew evacuated to Butlereau.
1904 Butlereau underway and stood out of the lagoon.
21 July
0824 Sklate moved fore and aft to bring between berth 34 and 49 in Bikini Lagoon.
1404 VM and VS-43A informed CYP 1 and CYP 2 that they planned to transit target area; Machine likely and 250 logistic (500 AM) to trans ship being planted on the side of the castle island.
1904 USS Akusho (ATF-149) underway from target area with Sklate in tow.
21 July
0824 Aircraft directed to move Sklate with salvage crane and heavy wire using this heavy tow ship to main location of anchor and to lay retrieving wire.

USS Skate (SS-305)

1030 July
0916 Adjusted period washing down Sklate. Followed up on experimental section with fresh water and ice and on another section with diesel fuel (Reference 6, p. VII 1 50 B).
1300 July
0926 Aircraft demonstrated Sklate (Reference 6, p. VII 1 50 D).
14 August
0845 Aircraft commenced washing down Sklate (Reference 6, pp. VII 1 84 B and VII 1 50 B).
14 August
1904 Executive officer boarded for thealla area with the 13th representative who was making his daily check of radiactivity.
15 August
1145 1445 Sklate beached by all officers, men and a radiological monitor. Washed down.
**USS Skate (SS-305)**

**5 August**

Topside for 1 hour with handybilly pump. Threw all topside manila lines overboard as they were very radioactive. Venting pressure from all compartments.

**6 August**

1400-1515

Five officers and nineteen men boarded Skate and worked to reduce radioactivity. Scrubbed topside with boiler compound for 3/4 hour and washed down with one handybilly pump. Swabbed stern with hydrochloric acid. There was a definite immediate drop in readings due to the acid wash (Reference 4).

**7 August**

1150-1449

Four officers and sixteen men boarded Skate for decontamination work. USS Wanderer (ATF 178) gave Skate a lye bath in the morning. Scrubbed with boiler compound for 3/4 hour and washed down with one handybilly pump (Reference 4).

**8 August**

1400-1530

A decontamination party of five officers and fifteen men boarded Skate. Wanderer gave Skate a second lye bath and a 2-hour soaking down with saltwater. Scrubbed for 1 hour with boiler compound. Washed down with one handybilly pump (Reference 4).

**9 August**

0815

Five officers and crew transferred from Skate to remaining target ship USS Fillmore (APA 83).

EU. 1020-1100

Decontamination team aboard. Washed down topside with two handybilly pumps for 7 hours. Removed wood deck by after hawser hatch (Reference 4).

**10 August**

0815-0940

Washing team on Skate. Scrubbed forward of conning tower with trichloroethylene. Washed down for 7 hours with two handybilly pumps (Reference 4).

**11 August**

0810-1415

Working party on board.

**12 August**

0800-0950

Working party on board.

1040-1140

Decontamination by USS Belvoir (AG 24). Scrubbed topside with boiler compound for 7 hours and washed down with two trim line hoses. Completed treatment using a lye bath (Reference 4).

**13 August**

0530

Working party aboard Skate, prepped in decontamination treatment. Scrubbed topside between FR and AK hatch with boiler compound for a total of 4 hours and washed down with trim line hoses. Scrubbed conning tower and periscope ports with hydrochloric acid. Washed it off, then returned for operation.

1005-1045

USS Odyssey (ASD-1) alongside to deliver anchor and chain.

1500-1730

USS Chickasaw (ATF-83) gave Skate a lye bath (Reference 4).

**14 August**

0845-1545

Boarding team and monitor aboard. Scrubbed topside with boiler compound for a total of 3 hours and washed down thoroughly with two trim line hoses (Reference 4).

**15 August**

0930-1600

Boarding team aboard. Scrubbed topside with boiler compound and washed down thoroughly with two trim line hoses for 5 hours. Disposed of wood deck from forward 40 MM platform. Monitor aboard.

**16 August**

0905-1055

Boarded with 16-man maneuvering team and monitor. Skate underway. Anchored between berths 186 and 188. Washed down for 4 hours with two trim line hoses.

1545

All hands returned to Fillmore via decontamination barge ALP-27 alongside USS Geneva (APA-86).

**17 August**

0945-1515

Boarding team, monitor aboard. Commenced cutting away line lockers forward of conning towers (Reference 4).

**19 August**

0830-1500

Decontamination working party aboard Skate for sandblasting. Completed cutting away line lockers forward of conning tower. Washed down with one handybilly pump. Commenced sandblasting hull between conning tower and main induction.

**20 August**

0900-1500

Decontamination party aboard. Continued sandblasting between conning tower and main induction. Washed between hatch and conning tower for 2 hours with one handybilly pump (Reference 4).

**21 August**

0845-1515

Boarding team on Skate for topside decontamination work.

**22 August**

0630

Three man anchor detail aboard for trip to Kwajalein.

**23 August**

1010

Underway, towed by ATH 40 to Kwajalein.

**24 August**

1940

Anchored in berth A 13, Kwajalein.

2400

Towed to San Francisco by USS Fulton (AG 111), arriving there on 22 October.

419
**USS Skate (SS-305)**

Table A.12: Radiological readings (kR/24 hours) aboard USS Skate (SS-305).

<table>
<thead>
<tr>
<th>Date</th>
<th>Bow</th>
<th>Forward</th>
<th>葱</th>
<th>Over</th>
<th>Engine</th>
<th>Stern</th>
<th>Topsides</th>
<th>Average</th>
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Source: Reference 4.

**USS Skipjack (SS-184)**

28 July

Skipjack had one salvage hose buoy and one deep buoy showing. In addition, one of the submarine marker buoys was on the surface, Bubbles were rising in vicinity of hose buoy (Reference 10).

29 July

1528 Attempt to surface Skipjack by blowing forward tanks was unsuccessful (Reference 5, p. 6-0-D-28).

30 July

1100 USS Coucal (ASR-8) moored near Skipjack. Geiger check showed water 0.1 to 0.3 R/24 hours, buoys 1.5 R/24 hours. Commenced blowing forward tanks.

No movement on Skipjack. Secured blowing. Connected up after hoses using shallow-water diving outfit.

Blew forward and after tanks. Skipjack did not move from position on bottom. (There were two anchors attached aft and three weights and one anchor forward.)

Secured. Further work on Skipjack required a survey of conditions on the boat by a diver.

1 August

1440 Coucal directed to proceed to submarine area, locate Skipjack, and begin planting necessary moorings to resurface submarine (Reference 6, p. VII-1-69-B).

1445 Coucal reported operations complete, anchored in berth, and rigged mooring for diving on Skipjack. Ready to start diving as soon as radiological conditions permit.

August 2

0835 Coucal reported moored over Skipjack ready to start diving as soon as radiological conditions permit.

1100 Coucal reported Skipjack on bottom on even keel. Deck of submarine covered with coral (Reference 6, p. VII-1-73-B).

1632 Coucal reported having time to make one more inspection dive before sundown. Directed to remain moored over Skipjack (Reference 6, p. VII-1-75-B).

1930 Coucal reported Skipjack inspected from bow at to salvage air connection to 2C and 3H main ballast tanks with exception of portside of conning tower. Boat listing 3 to 5°. One-quarter inch line coral sand silt forward Jack, little aft. Salvaged air connections to number 2A, 2C, and 2H main ballast tanks. No structural damage found (Reference 6, pp. VII-1-75 B. and VII-1-76-B).

3 August

0958-1938 Diving operations conducted on Skipjack by Coucal: no damage discovered by diver. Salvage hoses were found cut and kinked.

4 August

0745-1810 Coucal continued diving operations on Skipjack.

5 August

0800-1715 Diving operations conducted on Skipjack by Coucal. Efforts to salvage Skipjack.
USS Skipjack (SS-184)

5 August

were unsuccessful. All ballast tanks except 2A showed a.r. leakage at or near tank tops. Operations on Skipjack secured.

6-9 August
Diving operations conducted on Skipjack.

13 August
Diving operations conducted on Skipjack by USS Widesone (ARS-1).

14-15 August
Salvage operations on Skipjack continued.

17 August
Minor progress made on salvage of Skipjack.

19 August
Attempts to make tight the tops of the main ballast tanks on Skipjack proceeding slowly.

20 August
Salvage on Skipjack proceeding slowly (Reference 10).

3 September
Skipjack raised. Boarded at 1305.

5 September
Skipjack departed Bikini for Kwajalein, towed by USS Gypsy (ARS-1).

7 September
Arrived at Kwajalein.

11 September
Departed Kwajalein for Pearl Harbor, towed by Segal and USS Palmyra (ARS (ARS-3)).

22 September
Arrived at Pearl Harbor.

USS Sphinx (ARL-24)

Crew Size: 155
Bikini Arrival: By 14 June 1946
Bikini Departure: 19 August 1946
Shot #6: Location: 26 mi (41 km) ILN
Shot Bikini Location: 26 mi (41 km) ILN
Decontamination location: Los Angeles
Operational Clearance: 14 February 1947
Final Clearance: 23 April 1947

Task Unit and Function
The landing craft repair ship Sphinx was a member of Task Unit 18.1.8.1 (Repairs and Service Unit). Sphinx provided a maintenance and repair facility that was in use 82 percent of the time from 1 June to 25 July. Sphinx provided repairs 16 hours and 48 minutes on 22 August 1946.

Shot Atoll (1 July, 0000)

10 June
1430 Underway in assigned operating areas.

1 July
Steaming in “Y” formation with USS San Marino (DD-139), USS Saginaw Hall (LSD 5), USS Fire Screen (APA-62), USS Joliet (APA-87), and USS 1ST JAP 1 area picket off Bikini Atoll.

17 August Anchored in Berth 283, Bikini.

2 July
1930 Anchored in Berth 17, Bikini Atoll.

3-23 July
Routine activities; no contact with target vessels.

USS Sphinx (ARL-24)

Shot BAKER (25 July, 0835)

24 July
1348 Proceeded out of the harbor.

25 July
0857 Steamed in company with Group II of TC 1.8 in area for BAKER test. Proceeded independently to Rongelap Atoll.


30 July
0640 Underway en route to Bikini Atoll.

1711 Anchored in berth 117, Bikini.

2 August
1641 Anchored in line between berths S and V, Bikini Atoll.

5 August
1010-1030 Radiological Investigation party from USS Haven (AH-12) aboard to inspect ship evaporators.

7 August
1135 Anchored in berth 117, Bikini Atoll.

19 August
1031 Underway for Kwajalein.

26 August
1245 Moored to Lucy C in berth 15, Kwajalein.

29 August-26 September
At Kwajalein, routine activities.

27 September Target vessel 1C-329 moored alongside approximately 1 hour.

28 September-27 November
Routine activities.

28 November
Sent two HAVPs and crew to assist firefighting aboard ICD 179.

29 November-11 December
Routine activities.

17 December
Radiological safety party boarded Sphinx to conduct a survey. The survey indicated that the ship was generally free of contamination except for the saltwater system. This contamination occurred to almost all the non-target ships that had entered Bikini lagoon during late July or August 1946. The radiological monitors recorded an acid decontamination of the saltwater system and a recontamination on the ship upon its arrival at Pearl Harbor and the West Coast. As a result of the survey, Sphinx received a radiological operational clearance to proceed to the West Coast.

13 December
Routine activities.

14 December
Departed for Wake Island.
USS Stack (DD-406)

(Crew Size: 102)

(USS Stack) 17-0406)

1 August

1225

USS Achomawi (ATF-180) underway to Stack.

1316-1400

Achomawi washed down with midship monitor (Reference 1.

1320

Achomawi). Captain and crew, baggage, and records from

1400-1420

Achomawi transferred to USS Rockingham (APA

1537-1541

Sprayed with lye solution.

1621-1643

Achomawi washed down portside with midship monitor.

1652

Achomawi underway to berth 145 (Reference 1. Achomawi).

2 August

0800

Commanding officer, first lieutenant, and eight men reboarded Stack to decontaminate it.

0936

Achomawi underway for Stack.

1006-1009

Achomawi sprayed Stack with lye solution.

1017-1021

Two men from Achomawi boarded Stack.

1038-1043

Achomawi sprayed Stack with lye solution.

1223-1232

Captain of Achomawi, a civilian, and members of the Achomawi boarding team on Stack.

1314-1330

Achomawi sprayed Stack with lye and boiler compound solution.

1350-1352

Achomawi sprayed Stack with lye and boiler compound solution.

1420-1430

Achomawi washed Stack's portside with water.

1441-1504

Achomawi's party took readings on Stack.

1515

Achomawi underway to berth 377 (Reference 1. Achomawi).

1520

Captain, first lieutenant, and eight men left Stack.

3 August

0731

Achomawi underway for Stack.

0840-0932

Achomawi washed down Stack with saltwater (Reference 1. Achomawi).

0936-1000

Decontamination team 1 and 2 from Stack boarded Stack to decontaminate it.

1057-1055

Achomawi washed down Stack with saltwater on the portside (Reference 1. Achomawi).

1130

Decontamination teams 1 and 2 left Stack.

1130

Decontamination team 3 and 4 reboarded Stack to decontaminate it.

1520

Decontamination team 3 and 4 left Stack.

4 August

0800

Decontamination team 3 and 4 reboarded Stack.

1015

Decontamination team 3 left Stack.

1215

Decontamination team 4 left Stack.

1220

Decontamination team 1 and 2 reboarded Stack.

1630

Decontamination team 1 and 2 left Stack.

6 August

1006

ATA-180 underway to Stack.

1010

ATA-180 working party of one officer and six enlisted men from Stack came aboard to assist in decontamination work.

1110

ATA-180 anchored about 500 yards, 1457 meter, north of Stack in target array.

1226

ATA-180 underway to wash down Stack with decontamination solution.

1227

ATA-180 washed down Stack.

1400-1500

ATA-180 Gelser monitors took readings on Stack.

1500

ATA-180 underway (Reference 1. ATA-180).
USS Stack (DD-406)

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12 July

Boarding team returned with report on
13 July

14 July

Unarmed to vicinity north of target
ship USS Nevada (BB 36) and then
anchored to receive fire from target
cruiser. Anchored north of Nevada near
beach 14. Unarmed to vicinity north of
Nevada awaiting order to attach leg
assembly alongside Nevada. Cast off
Nevada.

14 July

Unarmed to vicinity north of target
ship USS Nevada (BB 36) and then
anchored to receive fire from target
cruiser. Anchored north of Nevada near
beach 14. Unarmed to vicinity north of
Nevada awaiting order to attach leg
assembly alongside Nevada. Cast off
Nevada.
23 July
0630 Salvage boat came alongside starboard side, commenced taking on 1-inch wire.
0750 Finished transferring heavy weights to salvage boat.
1041 Finished attaching heavy weights to Nevada.
1110 Underway to moor to stern of Nevada to plant balls 100 feet (91 meters) off stern of Nevada.
1130 Moored to stern of Nevada.
1140 Commenced planting heavy weights.
1544 Finished planting heavy weights astern of Nevada. Proceeding to plant heavy weights between Nevada and Arkansas.
1856 Anchored between Nevada and Arkansas.
1900 Commenced planting heavy weights.
1958 Proceeding to plant heavy weights between Nevada and Arkansas.
1945 Commenced planting heavy weights near Nevada.
2310 Anchored between Nevado and Arkansas.
2340 Anchored.

30 July
0227-0325 Reached berth R to lee of Enew Island.

31 July
0630 Salvage boat came alongside starboard side, commenced taking on 1-inch wire.
0750 Finished transferring heavy weights to salvage boat.
1041 Finished attaching heavy weights to Nevada.
1110 Underway to moor to stern of Nevada to plant balls 100 feet (91 meters) off stern of Nevada.
1130 Moored to stern of Nevada.
1140 Commenced planting heavy weights.
1544 Finished planting heavy weights astern of Nevada. Proceeding to plant heavy weights between Nevada and Arkansas.
1856 Anchored between Nevada and Arkansas.
1900 Commenced planting heavy weights.
1958 Proceeding to plant heavy weights between Nevada and Arkansas.
1945 Commenced planting heavy weights near Nevada.
2310 Anchored between Nevada and Arkansas.
2340 Anchored.

1 August
0630 Salvage boat came alongside starboard side, commenced taking on 1-inch wire.
0750 Finished transferring heavy weights to salvage boat.
1041 Finished attaching heavy weights to Nevada.
1110 Underway to moor to stern of Nevada to plant balls 100 feet (91 meters) off stern of Nevada.
1130 Moored to stern of Nevada.
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1544 Finished planting heavy weights astern of Nevada. Proceeding to plant heavy weights between Nevada and Arkansas.
1856 Anchored between Nevada and Arkansas.
1900 Commenced planting heavy weights.
1958 Proceeding to plant heavy weights between Nevada and Arkansas.
1945 Commenced planting heavy weights near Nevada.
2310 Anchored between Nevada and Arkansas.
2340 Anchored.

4-6 August

7 August
0440 Mooring team aboard.
0925 1112 Boarding team aboard Gasconade, underway to Gasconade.
1150 1155 Boarding team disembarked for Wharton.
1245 1425 Anchored.

9-11 August

12 August
1108 Underway to assist USS Coucal (AGB-8) in mooring buoy.
1115-1132 Stopped near Gasconade to hoist buoy on deck.
1157 Began planting buoy off bow of Coucal in line with bow of target ship USS Pennsylvania (BB 38).
1159 Completed dropping anchor.
1253 Completed planting buoy on bearings, proceeding to buoy off Pennsylvania.

26 July
0440 Shifted to berth 379. Suncock and Oneota assigned to unload chain and anchors from Off Kino to be used for Test CHARLIE (Reference 6. p. VII-1-68 H).

29 July
Anchored near berth 379.
13 August
Anchored as before.

14 August
0859 Underway to go alongside target submarine USS Parche (SS-384) to clear Parche's fouled anchor.
0910-1110 Alongside Parche to clear fouled anchor.
1118-1201 Anchored in vicinity of Parche; hoisted imperative motor launch aboard.
1242 Underway to vicinity south of Nevada to recover small cylinder marker buoy.
1309-1345 Stopped south of Nevada; hoisted buoy on deck and secured collapsible balloon to it.
1435 Anchored in berth 54A, Bikini.

15 August
0807 Underway to Crittenden to clear fouled anchor.
0840 In vicinity of Crittenden, awaiting arrival of monitor; captain and working party of Crittenden aboard.
0940 Monitor arrived and boarded Crittenden.
0954-1000 Moored alongside Crittenden.
1630 Cleared and housed fouled Crittenden anchor.
1700 Underway from Crittenden to Palmyra.
1721 Crittenden captain and men disembarked.
1735 Anchored in berth 54A, Bikini.

16 August
0755 Underway to target ship USS Dawson (APA-79) to furnish power to hoist anchor.
0825 In vicinity of Dawson, awaiting arrival of monitor.
0835 Monitor aboard Dawson.
0845 Moored alongside Dawson.
1153 Underway to Gasconade to assist Eilah in clearing fouled anchor.
1225 Moored to stern of Gasconade.
1320 Proceeding to go alongside target ship USS Brule (APA-68) to furnish power to hoist anchor.
1330 Moored alongside Brule.
1540 Underway to USS Chikaskia (AO-54) to take on fuel.
1747 Anchored in berth 54 after refueling.

17 August
0824 Underway for Pennsylvania to furnish power to hoist anchor.
0850 In vicinity of Pennsylvania, awaiting arrival of monitor and working party.
0920 Officer in charge of working party came aboard.
1020 Unable to furnish power to hoist anchor; officer and working party left ship.
1334 After taking on water from Wildcat; anchored in 54A.

18-23 August
Anchored as before.

24 August
0843 Underway to go alongside Harrow to furnish power to hoist and house anchor.
1121-1255 Moored to Harrow, hoisting and housing anchor.
1310 Moored alongside target ship USS Brule (APA-66) to hoist and house anchor.
1312 Passed power line to Brule.

1 September
Arrived at Kwajalein.

1554 Anchor on Brule fouled; tools, working party on board, having received tolerance for day (daily allowable tolerance at CROSSROADS was 0.1/24 hours); took in power line.
1602 Underway from Brule to anchorage.
1640 Anchored in berth 54A.

25 August
0827 Underway to go alongside Brule to furnish power to house anchor.
0847 Monitor and working party aboard Brule.
0916 Moored alongside Brule.
0921 Ship-to-shore powerlines connected up and furnished power to anchor windlass on Brule.
1213 Finished furnishing power to Brule; completed housing Brule's anchor.
1333 Cast off lines from Brule.
1344 LST-220 anchor housed; disconnected powerline; USS Buccee (ATF-107) took LST-220 in tow.
1502 Transferred monitor and working party to Palmyra.
1530 Anchored in berth 54A, Bikini.

26 August
0845 Underway to go alongside target ship USS Catron (APA-71).
0925 Moored alongside Catron.
0935 Commenced furnishing power for hoisting Catron's anchor.
1415 Underway from Catron to anchorage.
1502 Anchored in berth 91.

27 August
1110 Underway to go alongside target ship USS Hanne (APA-60) to furnish power to hoist anchor.
1113 Assistance not needed, returning to anchorage.
1119 Anchored in berth 91.

29 August
0838 Underway to go alongside target ship USS LST-220 to furnish power for housing anchor.
1122 Moored to LST-220.
1124 Forward anchor of LST-220 housed and secured; USS Preparer (ARS-8) took LST-220 in tow.
1155 Clear of LST-220; underway for anchorage.
1230 Anchored in berth 128.
1338 Moored to Butte.
1555 Butte's anchor housed; disconnected powerline; USS Buccee (ATF-107) took Butte in tow.

30 August
0645 Underway to go alongside target ship USS Rhind (LST-404) to take it in tow.
0646 Moored alongside Rhind.
0711 Underway from Bikini en route to Kwajalein with Rhind in tow.
1 September
Arrived at Kwajalein.
USS Suncock (AN-80)

2 September Underway from Kwajalein to Pearl Harbor with Elah in tow.

USS Sylvania (AKA-44)

Crew Size: 208
Bikini Atoll Arrival: 19 April 1946
Bikini Atoll Departure: 25 August 1946
Shot ABLE Location: 72 nmi (41 km) [ unknown]
Decontamination Location: Puget Sound
Operational Clearance: 7 December 1946 (Seattle)

Task Unit and Function
The attack cargo ship Sylvanie was a member of TU 1.6.5 (Survey Unit). USS Rejoice (AKA-99) was initially designated as IntraTransit cargo ship. Upon Rejoice's departure following Test BAKER, Sylvanie took over the handling of IntraTransit Cargo.

Shot ABLE (1 July, 0900)
28 June Anchored at Rongelap Atoll.
30 June 1541 Underway from Rongelap Atoll; en route to area Packard.
1 July 0700 Arrived area Packard.
0705 Commenced steaming in company with USS Howelstich (AGS-4) to join TU 1.8.
0805 Joined TU 1.8 in column formation.
0925 En route to Rongelap, Rongerik, Allinginae area to conduct oceanographic survey.
1624 Continued steaming on various courses to conform with oceanographic survey in vicinity of Allinginae, Rongelap, and Rongerik atolls.
2-4 July Continued oceanographic survey.
4 July 2100 Departed Rongelap Atoll area for Bikini Atoll.
5 July 1105 Anchored in berth 231A, Bikini Atoll.
6-23 July Routine operations not involving target vessels.

Shot BAKER (25 July, 0835)
24 July 1424 Underway proceeding to survey area of Bikini Atoll.
25 July 0600 Steaming independently en route to area Packard, conducting oceanographic survey.
0644 En route to Rongelap Atoll.
1400 Anchored at Rongelap Atoll.
30 July 1651 Underway from Rongelap Atoll; to Bikini Atoll.
31 July 1041 Anchored in berth 40, Bikini Atoll.

USS Telamon (ARB-8)

2 August 1708 Anchored in berth Mike, Bikini Atoll.
7 August 0848 Anchored in berth 40, Bikini Atoll.
13 August 1315 Crew of target ship USS Gasconade (APA-85) received aboard for billeting.
25 August Underway from Bikini to Kwajalein.
26 August 0850 Anchored in berth 172, Kwajalein.
27 August 1453 Underway for Pearl Harbor.

TAIROT, RALPH M.; see USS RALPH M. TAIROT (00-390)

USS Telamon (ARB-8)

Crew Size: 150
Bikini Atoll Arrival: By 14 June 1946
Bikini Atoll Departure: 15 August 1946
Shot ABLE Location: Anchored at Kwajalein
Shot BAKER Location: 16 nmi (30 km) NE
Decontamination Location: Los Angeles
Operational Clearance: 12 December 1946
Final Clearance: 21 December 1946

Task Unit and Function
The base repair ship Telamon was a member of TU 1.8.1 (Repair and Service Unit). It was part of the maintenance and repair facility.

Shot ABLE (1 July, 0900)
1 July Anchored in berth K-18, Kwajalein Harbor.
1630 Underway en route to Bikini Atoll.
2 July 1507 Anchored at berth 1465, Bikini Atoll.
7 July 1652 Anchored in vicinity of target ship USS Independence (CVL-22).
9 July 1459 Anchored south of berth 129, Bikini.
12 July 1318 Anchored in berth 1465, Bikini Harbor.

Shot BAKER (25 July, 0835)
24 July 1405 Underway from Bikini Harbor to Rongelap Atoll in company with Group 11, CTU 1.8.7, via Packard area.
25 July 1649 Anchored in berth 10, Rongelap Harbor.
30 July 0702 Underway from Rongelap to Bikini.
1600 Anchored in berth 1465, Bikini.
2 August 1618 Anchored between berths S and V, Bikini.

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**USS Telamon (ARB-8)**

7 August
- 0912 Anchored in berth 146S, Bikini.
- 14 August
- 1047 Anchored in berth 62, Bikini.
- 15 August
- 1509 Underway from Bikini with LCT-1359 in tow for Pearl Harbor.
- 26 August
- 1129 Moored in berth 7-5, Pearl Harbor.

**USS TOMBIGBEE (AOG-11)**

**Crew Size:** 86

**Bikini Atoll Arrival:** By 14 June 1946

**Bikini Atoll Departure:** 21 August 1946

**Shot ABLF Location:** 21 nmi (39 km) NNE

**Shot BAKER Location:** Anchored at Rongelap Atoll

**Decontamination Location:** Los Angeles

**Operational Clearance:** 31 December 1946

**Final Clearance:** 4 January 1947

**Task Unit and Function:**

The gasoline tanker TOMBIGBEE was a member of TU 1.8.1 (Repair and Service Unit). It provided fuel for the task force.

**Shot ABLF (1 July, 0900)**

1 July
- 1810 Entered Bikini Lagoon.
- 1845 Anchored in berth 34J.

2 July
- 0932 Underway.
- 1023-1206 Moored alongside USS San Marcos (LSD-25), berth 94N.
- 1250 Anchored in berth 343.

3 July
- 0931 Underway.
- 1016-1304 Alongside target vessel YOG-83.
- 1400-1556 Moored alongside USS Presque Isle (ARB-44), berth 95.
- 1640-1840 Alongside target ship USS LST-220.
- 1846 Anchored in berth 31.

4 July
- 0830 Underway.
- 0941-1025 Alongside target ship USS Hughes (DD-410).
- 1057-1310 Moored alongside USS Gunston Hall (LSD-5).
- 1350-1445 Alongside target ship USS Muskin (DD-413).

5 July
- 0931-1350 Alongside target ship Prinz Eugen.

There was no further contact with target vessels until after BAKER.

24 July
- Departed Bikini for Rongelap Atoll.

**Shot BAKER (25 July, 0835)**

25 July
- 0835 Anchored at Rongelap Atoll.

**USS TOMBIGBEE (AOG-11)**

31 July
- 0635 Entered Bikini Lagoon.
- 0711-1103 Moored alongside USS Enoree (AO-69), berth 305.
- 1134-1650 Alongside USS Severn (AO-61), berth 370.
- 1702 Anchored berth 343.

1 August
- Underway.
- 0821 Moored alongside USS Mount McKinley (AGC-7), berth 112.
- 1216-1523 Moored alongside USS Quarz (IX-150), berth 108.
- 1655 Anchored berth 147.

2 August
- Underway.
- 1000 Moored alongside USS Saidor (CVE-117), berth 34.
- 1527 Anchored berth Peter Roget.

4 August
- Underway.
- 0925-1028 Moored alongside USS Sphinx (ARL-24), berth 117.
- 1415-1425 Anchored.
- 1505-1830 Anchored in berth 380.
- 1842 Moored alongside USS Rockbridge (APA-228), berth 222.

6 August
- 1229-1505 Alongside Prinz Eugen.

14 August
- 1203-1516 Moored portside to target ship USS Fillmore (APA-83) to discharge freshwater.

**Shot BAKER (25 July, 0835)**

1842 Anchored in berth 334.

19 August
- 1350-1745 Alongside target ship USS Bladen (APA-63).

20 August
- 1119-1322 Alongside target ship USS Niagara (APA-87).

21 August
- 1744 Departed Bikini Lagoon for Kwajaiein.

22 August
- 1258 Anchored in Anchorage A, berth F, Kwajaiein.

23 August
- 1016-1328 Alongside target ship USS Cortland (APA 75).

24 August
- 0937-1311 Alongside Bladen to discharge freshwater.

26 August
- 1356-1613 Alongside Niagara.

28 August
- 1507-1644 Alongside Bladen.
- 1702-1805 Alongside Cortland.

5 September
- 1030 Departed Kwajaiein for Pearl Harbor.
**USS Trippe (DD-403)**

**Crew Size:** 135

**Bikini Attack Arrival:** 1 June 1946

**Bikini Attack Departure:** 20 August 1946

**Crew Location for Shot BAKER:** USS Bayfield (APA-33)

**Shot ABLE Location:** 16 nm (33 km) NE

**Shot BAKER Location:** 1.320 yards (1.2 km) NNW

**Sunk:** 3 February 1948 near Kwajalein after deck house 0.8 R/24 hours, fantail

**Task Unit and Function:** The destroyer Trippe was a member of TU 1.2.3 (Destroyer Unit). Destroyer Division 4. It was a target vessel for BAKER.

**Shot ABLE (1 July, 0900):**

1 July: Steaming independently in area Hudson

0911: Anchored in berth 341, Bikini Lagoon.

2 July: Anchored in berth 130A, Bikini.

12 July: Anchored in berth 129, Bikini.

16 July: Underway to shift berths.

1108: Anchored 610 yards (558 meters) from target ship USS Nevada (BB-36).

1335: Seven men were evacuated to USS Bayfield

(ATA-192). [Note: topside maximum listed in the boarding reports believed to be in error, since the maximum topside value on 7 August was 19 R/24 hours.]

11 July: Anchored 510 yards (466 meters) from Nevada.

1330: Transferred three men to Bayfield for transfer of personnel prior to test BAKER.

18 July: Completed evacuation of all personnel to Bayfield for William Day rehearsal.

19 July: Reboarding teams returned from Bayfield to put Trippe in operating condition.

21 July: Evacuated 40 men to Bayfield.

24 July: Evacuated all remaining personnel.

1010: All personnel reported aboard Bayfield.

**Shot BAKER (25 July, 0835):**

28 July: USN reported Geiger readings of 0.6 R/24 hours at 250 feet (76.2 meters).

30 July: USN reported Geiger readings of 1.5 R/24 hours at 100 feet (30.5 meters).

1 August: ATA-192 directed to proceed to target ship USS Mayrant (DD-402) and Trippe for thorough washing with high-pressure hoses.

501b: ATA-192 completed its work on Mayrant and began work on Trippe.

1400: Entire Trippe crew transferred to USS Mayrant (APA-211).

**USS Tuna (SS-203)**

**Crew Size:** 97

**Bikini Attack Arrival:** 30 May 1946

**Bikini Attack Departure:** 22 August 1946

**Crew Location for Shot ABLE:** USS Botlomneu (APA 275)

**Shot Location for Shot BAKER:** USS Bottlomneu

**Shot ABLE Location:** 2,194 yards (2.0 km) NNW

**Shot BAKER Location:** 1,320 yards (1.2 km) NE

**Sunk:** 24 September 1948, off southern California coast

**Task Unit and Function:** The submarine Tuna was a member of TU 1.2.4 (Submarine Unit). Submarine Division 111. It was a target vessel for CROSSROADS.

**Shot ABLE (1 July, 0900):**

6 August: Sprayed and washed down by ATA-192.

7 August: Geiger readings topside averaged 4.0 R/24 hours. topside maximum 19.0 R/24 hours; below deck average 1.0 R/24 hours. below deck maximum 6.0 R/24 hours.

8 August: Bridge superstructure 2.4 R/24 hours, after deck house 0.8 R/24 hours, fantail 0.4 R/24 hours; sprayed and washed by USS Achomawi (ATF-148).

9 August: Geiger readings report: forecast average 0.4 R/24 hours, main deck average 2 R/24 hours, engineering spaces average 0.3 R/24 hours.

10 August: Commanding officer and inspection party aboard. Geiger readings topside average 2.0 R/24 hours. topside maximum 100.0 R/24 hours (sic); below deck average 0.7 R/24 hours. below deck maximum 7.5 R/24 hours. Inside No. 1 gun mount 60.0 R/24 hours. No information available regarding time aboard Trippe. [Note: topside maximum listed in the boarding reports believed to be in error, since the maximum topside value on 7 August was 19 R/24 hours.]

11 August: Trippe unit transferred to USS Dixie (AD-14).

15 August: Staff inspection completed on Trippe and made available for disposition by CPOC 12.

20 August: Towed from Bikini to Kwajalein by ATR-87.

22 August: Arrived at Kwajalein.

28 August: Trippe decommissioned.
USS Tuna (SS-203)
30 June

with CTF 1 Operation Plan 1-46 and proceeded to Bettineau for billeting.

1 July

1529 USS Elah (AN-79) ordered to check water around Tuna carefully before boarding. (Reference 6, p. VII-1-20-A).
1542 Elah reported Tuna not boarded.
1545 Elah reported Tuna Geiger sour (Reference 6, p. VII-1-12-A).

2 July

0724 Elah proceeding to Tuna.
0739 Elah reported boarding team on Tuna (Reference 6, p. VII-1-20-A).
0800 Elah reported Tuna Geiger sweet (Reference 6, p. VII-1-21-A).
1147-1425 Commanding officer, radiological monitor, three officers, and thirty men reboarded Tuna. Geiger became normal in accordance with Instructions of CROSSROADS Submarine Unit. Commanding officer, radiological monitor, three officers, and thirty men reboarded Tuna for inspection. Conditions normal. Reboarded normal routine.
1610 Remaining men came aboard.

3 July

1545 Underway for USS Fulton (AS-11). Tuna secured for submergence; four officers and twenty men disembarked to Fulton.
1545 Widgeon commenced venting Tuna for submergence in accordance with Instructions of CROSSROADS Submarine Unit.
1400 Submergence completed. Four officers and remaining crew disembarked for Bettineau.

5 July

1638 USS Recliner (ARS-42) backed away from area of Tuna submergence. Water very radioactive. Also a report was received that one of the submerged submarines (believed to be Tuna) was sighted in its normal submerged position (Reference 6, pp. VII-1-13-B and VII-1-15-B).

21 July

0924 Recliner sighted Tuna in submergence position, apparently undamaged (Reference 6, p. VII-1-70-H).
1135 USS Culver (AS-61) surfaced Tuna using normal surfacing procedure. Geiger reading 8.0 8/s. No apparent damage. (Reference 10).
1645 Recliner inspected surfaced Tuna (Reference 6, p. VII-1-21-B).

28 July

0845 Recliner passed target submarines Tuna and USS Longbeach (SS-395). Tuna showed signs of flooding and structural leaks (Reference 6, p. VII-1-21-B).

3 August

0910 Commanding officer, officers, and radiological monitor embarked to continue inspection, testing, and decontamination work.

1000 Curval directed Elah to remove Tuna's anchors, stern anchors first.
1012 Elah directed to take anchors recovered from Tuna to wet storage off Tonchebi Island.
1029 Elah moored portside to Tuna.
1050 Completed operations underway.
1101 Elah reported all anchors had been removed; all had been turned off (Reference 6, p. VII-1-20-B).
1245 USS Chickasaw (AF-83) directed to take Tuna in tow to buoy in lee of Wokin and to buoy its anchors when cutting them out (Reference 6, p. VII-1-31-B).

29 July

0724 Chickasaw (AF-83) directed to take Tuna in tow to buoy in lee of Wokin and to buoy its anchors when cutting them out (Reference 6, p. VII-1-31-B).
1010 Commanding officer, radiological monitor, and 18 enlisted men reboarded and commenced recontamination procedure and inspection of boat. Tuna secured, and evacuated. Jump deck radioactivity within tolerance. Damage negligible (Reference 10).

31 July

0720 Commanding officer, 3 officers, radiological monitor, and 18 enlisted men reboarded and commenced recontamination procedure and inspection of boat. Tuna secured, and evacuated. Jump deck radioactivity within tolerance. Damage negligible (Reference 10).

1 August

1245 Commanding officer, officers, radiological monitor, and crew reboarded to continue inspection, testing, and decontamination work. Almost half the radiological equipment had been damaged (Reference 10). Tuna was decommissioned using saltwater wash and lyke bath on biode (Reference 4). Secured ship and evacuated.

2 August

0910 Commanding officer, officers, and radiological monitor embarked to continue inspection, testing, and decontamination work.
USS Tuna (SS-203) 3 August

0850 Entire crew aboard, including officer, Decontamination process continuing. Ship decontaminated using saltwater wash. Tape was below radiological tolerance inside pressure hull (Reference 10). 10 August

1620 Post secured and evacuated.

4 August

0835 Commanding officer, officers, radiological monitor, and crew relocated to continue inspection, testing, and decontamination work. Office and crew of target submarine USS Kajak (SS 307) completed temporary additional duty. Office, decontamination work, Office and crew of target submarine USS Squalus (SS 203) completed temporary additional duty. Office, decontamination continued with saltwater wash and was bath for bridge, gun mount, and hull induction (Reference 4).

1530 Post secured and evacuated.

5 August

0925 Executive officer, officers, radiological monitor, and crew relocated to continue inspection, testing, and decontamination work. Office and crew of target submarine USS Squalus (SS 203) completed temporary additional duty. Office, decontamination work, Office and crew of target submarine USS Squalus (SS 203) completed temporary additional duty. Office, decontamination continued with saltwater wash and was bath for bridge, gun mount, and hull induction. All electrical equipment was cleaned up. Inside all machinery was tested except low places (Reference 10). Saltwater wash administered (Reference 4).

1525 Post secured and evacuated.

6 August

0905 Commanding officer, officers, radiological monitor, and crew relocated to continue inspection, testing, and decontamination work. Saltwater wash was bath for bridge, gun mount, and hull induction. Carbon dioxide sprayed on main induction (Reference 4). 13 August

0935 Commanding officer and crew returned to boat to continue decontamination and repair work. Saltwater wash administered (Reference 4). Post secured and evacuated.

1505 Commanding officer and crew returned to boat to continue decontamination and repair work. Saltwater wash administered (Reference 4). Post secured and evacuated.

1545 Commanding officer and crew returned to boat to continue decontamination and repair work. Saltwater wash administered (Reference 4). Post secured and evacuated. Secure battery charge.

1605 Commanding officer and crew returned to boat to continue decontamination and repair work. Post secured and evacuated.

1608 Commanding officer and crew returned to boat to continue decontamination and repair work. Post secured and evacuated.

7 August

1600 Commanding officer and crew with radiological monitor relocated to continue inspection, testing, and decontamination work. Saltwater wash administered (Reference 4). 13 August

1610 Post secured and evacuated. Secure battery charge.

1740 Post secured and evacuated.

1805 Post secured and evacuated.

1806 Post secured and boat secured.

8 August

0945 Commanding officer, officers, crew, and radiological monitor relocated to continue inspection, testing, and decontamination work. Saltwater wash administered (Reference 4). Post secured and evacuated.

13 August

Officers and crew returned aboard to continue decontamination work. Post secured and boat secured.

1300 Post secured and evacuated.

19 August

1945 Officers and crew returned aboard to continue decontamination and repair work. Saltwater wash administered (Reference 4). Post secured and evacuated.

20 August

Officers and crew continued to continue decontamination work. Saltwater wash administered (Reference 4). Post secured and evacuated.
**USS Turner (DD-834)**

- **Shot BARI (25 July, 0N 04):**
  - **24 July 0915:** Anchored in berth A-1, Roll Island. (Note: Order to proceed independently to Point A. Commenced building up maximum speed. Turner's mission was to assist the fighter direction in conjunction with drone control.)
  - **75 July 0811:** Detached from formation by order of CTG 1.6. Proceeded independently to Point A.

**USS Mainwright (DD-419)**

- **Shot ABK (3 July, 0000):**
  - **0600:** Mainwight evaluation completed; crew aboard Hayfield.
  - **0640:** Mainwight evaluation completed; crew aboard Hayfield.
  - **1140:** UGS Lyndock (AN 60) reported Mainwight under way; contact reported (Reference 6, p. VII-1/24). Average Geiger reading 1.5 to 2 K/24 hours.
  - **24 July:** Crew aboard Mainwight.
  - **25 July:** Crew expected to Mainwight.

Proceeding to wash down Mainwight (Reference 6, p. VII-1/24). Average Geiger reading 1.5 to 2 K/24 hours.

Current reported boarding team returned from Mainwight; standing by for instructions (Reference 6, p. VII-1/24).

**USS Hecla (ARS-42) alongside Mainwight with boarding team and monitor aboard briefly (Reference 6, p. VII-1/24).**

- **31 July 1550-1612:** Hecla alongside Mainwight with boarding team and monitor aboard briefly (Reference 6, p. VII-1/24).

**DMS message to CTJF:** "USM and radosafe inspected target ships Condungh. Mainwright, and Hayfield above and below decks. Radiological conditions are such that portions of the crews can be put aboard for decontamination. Mainwright has about three to four feet accumulated leakage in engine room bylpl's" (Reference 5, p. 6-40).

**Walnwright crew transferred from Hayfield to USS Turner (APA 23).**

- **1 August 0600:** USS Clayo (AR 23) reported proceeding to Walnwright, deck apparently on fire. Clamp reported smoke on Walnwright coming from hangar bay on deck (Reference 6, p. VII-1/24). Average Geiger readings in firerooms were 0.1 to 0.6 K/24 hours; engine room 0.5 K/24 hours; weather deck average 1 K/24 hours.

- **2 August 1600:** Ship's force clearing after engine room of water and washing down topside: expected to evacuate about 1500.

- **24 July:** Crew aboard. Secured ship. Weather deck average 0.6 K/24 hours; fire room and engine room 0.3 K/24 hours; interior spaces about 0.1 K/24 hours.

- **30 June:** Crew aboard. Secured ship. Topsides average 0.6 K/24 hours; fire room and engine room 0.3 K/24 hours.

- **4 August:** Crew aboard. Secured ship. Topsides average 0.6 K/24 hours; fire room and engine room 0.3 K/24 hours.

- **5 August:** Personnel evacuated. Topsides average 0.5 K/24 hours; topsides maximum 2 K/24 hours; below decks average 0.8 K/24 hours after engine room washed up; hull 0.4 K/24 hours.

- **6 August:** Tear A aboard; Geiger readings 0.8 K/24 hours.

- **7 August:** Tear A aboard; Geiger readings 0.8 K/24 hours.

- **8 August:** Tear A aboard; Geiger readings 0.8 K/24 hours.

- **9 August:** Tear A aboard; Geiger readings 0.8 K/24 hours.

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USS Wainwright (DD-419)

6 August

average, 0.06 R/24 hours. below deck maximum, 0.11 R/24 hours (C.P.O. mess, port bulkhead, next to skin).

1 August

0745
1000
Ship's force aboard. Evacuated ship. Topside average, 0.09 R/24 hours, topside maximum, 0.5 R/24 hours (top of director); below deck average, 0.08 R/24 hours, below deck maximum, 0.5 R/24 hours (sonar room).

8 August

0810
1612
Ship's force aboard. Topside average, 0.06 R/24 hours, maximum, 0.43 R/24 hours (mainmast); below deck average, 0.01 R/24 hours, below deck maximum, 0.32 R/24 hours (port ice box). Evacuated ship.

9 August

0810
1700
Ship's team aboard. Securing ship; teams evacuating. Discontinued decontamination work pending clearance by radio, Geiger readings, topside average, 0.004 R/24 hours, topside maximum, 0.4 R/24 hours (top of director); below deck average, 0.07 R/24 hours, below deck maximum, 0.3 R/24 hours (sonar room).

10 August

0624
1041
Ship's force aboard. Topside average, 0.06 R/24 hours, topside maximum, 0.15 R/24 hours (part of bridge); below deck average, 0.03 R/24 hours, below deck maximum, 1.0 R/24 hours (skin of bilge, sonar room).

1021
Departed ship.

11 August

1003
Ship's team aboard to pump engine room dry; reduced stern tube leaks 50 percent.

16 August

0430
Ship's team and monitors aboard for Geiger survey.

20 August

0630-1530
Mostly of Wainwright crew transferred to USS George Clymer (APA-79). Fifteen men aboard to replace stern tubes.

21 August

Commanding officer and 10 men working party from target ship USS Trippe (UC-403) boarded for 4 hours to make repairs and prepare for towing.

24 August

Towed to Kwajalein and returned for radiological survey.

Remaining Wainwright crewmembers were transferred to other ships at Kwajalein.

USS Walk (DD-723)

Shot ABLE (1 July, 0900)

30 June

1235
Underway to clear Bikini Atoll.

2000
Arrived in area Mack.

1 July

0157
Changed course and speed, left area Mack, proceeding to area Hudson to take station for shot ABLE.

0340
Arrived in area Hudson.

0941
Secured evaporators.

1201
Set normal condition bakers throughout ship.

1337
Arrived at point bearing 350°T from target ship USS Nevada (BB-361), range 50 nm (91 km). Changed to reciprocal courses of 350°T and 130°E every 15 minutes to remain in vicinity of present position.

1839 (2130)
Commenced steaming on various courses at various speeds to destroy floating object and to make radiological probe.

1932
Laying to, probing. Object in water destroyed.

1940
Completed radiological probe.

2 July

Made downwind surface patrol, axis 130°T, 350°T, 50 nm (91 km) radius.

0709
Change course, having completed crossing astern, proceeding to station Baker of radiological patrol.

0812 (0837)
Stopped all engines and commenced laying to conduct radiological patrol.

0850-1029
All engines stopped, commenced radiological patrol.

1056
Underway for Bikini with patient requiring emergency appendectomy.

1100
All engines stopped; hoisted aboard probing wire, laying both thermograph and probe.

1729
Laying in vicinity of USS Renovance (AM-13) at Bikini.

1933
Proceeded to clear Bikini region.

1659
Stopped all engines, laying to at point Baker (radiological patrol).

3 July

1350 (1548)
All engines stopped; on station Baker (1548) Pnk. Commenced taking bathythermograph readings.

1731
Proceeded to next station for radiological patrol.

1804
All engines stopped; on station Baker for radiological sounding off (nk) Pnk.

1900
Completed radiological soundings.

4 July

0416
All engines stopped, laying to, at point Baker for radiological sounding.

0626
Completed taking radiological patrol.
USS Walke (DD-723)

4 July

1401 Proceeding to go alongside USS O'Brien (DD-725) to pick up radiological instruments.
1522 Commenced laying to off port quarter of O'Brien.
1027 Underway to return to station off Inkoj Pass.
1042 Commenced laying to on station for oceanographic soundings.

5 July

1113 Anchored in berth 190 South, Bikini.

7 July

5 July

1346 Underway to rendezvous with Destroyer Squadron 7 and proceeded to Pearl Harbor.

15 August

1200 Moored at Pearl Harbor.

USS Wenatchee (ATF-118)

Crew Size: 99
Bikini Atoll Arrival: 30 May 1946
Bikini Atoll Departure: 10 August 1946
Shot Unit Location: 132 nmi (244 km) 51
Shot BAKER Location: 20 nmi (37 km) 14
Decontamination Location: San Francisco
Operational Clearance: 13 November 1946
Final Clearance: 13 November 1946

Shot Unit and Function

The fleet ocean tug Wenatchee was a member of 701.8.1 (Repair and Service Unit). Wenatchee maintained maintenance and repair facilities. It was involved in decontaminating target vessels, salvage, towing, and emergency repair work.

Shot Unit (1 July, 0900)

30 June

1400 Underway from Bikini for rendezvous with USS Myrtice (AV 107) at AVG 70 in row en route to Kwajalein.

1 July

0900 On route from Bikini Atoll to Kwajalein Atoll with AVG 70 in row. Large ball of fire noted on horizon (Wenatchee 132 nmi 51/54 km) from detonation.

1845 Anchored with AVG 70 in berth 67 Able gangway, Kwajalein.

2 July

1440 Underway with VP 171 in row for Bikini Atoll.

28 July

1640 Anchored in berth 307 with Bikini.

30 July

0440 Expenditure secured because of radioactivity.
1900 All oceanographic and radiological man work off Walke.
1946 Anchored in berth 307.

31 July

0411 Anchored in berth 193 North, Bikini.

2 August

0045 Underway for oceanographic cruise NII.

USS Wenatchee (ATF-118)

3-4 August

Towed oceanographic soundings.

4 August

1339 Anchored in berth L South, Bikini.

7 August

0430 Anchored in berth 190 North, Bikini.

8 August

1051 Underway for oceanographic cruise consisting of soundings station at 00-200 (1 km) intervals northward along 100° east longitude meridian.

8-10 August

Towed oceanographic soundings.

10 August

1945 Underway to rendezvous with Destroyer Squadron 7 and proceeded to Pearl Harbor.

15 August

1200 Moored at Pearl Harbor.
USS Wenatchee (ATF-118)
6 July

19 July
1600 Underway for Bikini.

20 July
0850 Anchored in berth 191 A. Bikini.

22 July
1103 Anchored abeam to Sasebo.
1113 Underway from Sasebo to USS Chowanec (ATF-100).
1422 Anchored in berth 191 A. Bikini.

Shot BAKK (25 July, 0835)

24 July
1559 Underway from Bikini Atoll.
1638 Maneuvered to get in formation with ships of TF 16.7.

25 July
0835 En route to Hongapal, Marshall Islands;
observed atomic bomb blast.
1525 Anchored in vicinity of berth 5. Hongapal Atoll.

30 July
1240 Underway with Ye 793 moored to starboard side in route to Bikini Atoll.

31 July
0900 Anchored in berth 191 A. Bikini Atoll.

1 August
0840 Commenced salvage operations on submerged ICM.
1415 Made all preparations for getting underway.
1920 Underway with ICM in tow to designated disposition area.
2020 Anchored in berth 191 A. Bikini Atoll.

7 August
1115 1900 Conducted salvage operations on beached target ship 1320 (LST 147).
1400 1910 Attempted to tow beached 1910 (LST 147) off beach.

18 August
0610 Underway, commencing operations of towing ICM 1910 off beach.
1300 ICM 1910 pulled off beach.
1310 Anchored in berth 611, Bikini.

6 August
1913 Received 500 pounds (275 kilograms) of FEI from USS Pollux (APA 4) and 500 pounds (275 kilograms) from USS Elrod (APA 22).
1400 Underway for decontamination operations.
1410 Anchored in berth 304, Bikini.

7 August
0835 Underway for decontamination work on beached ICM 1910.
1930 Anchored in berth 191 A, Bikini.
1940 Underway for decontamination work.
1950 Anchored in berth 191 A, Bikini.
USS Wenatchee (ATF-118)

8 August

0844 0915 Conducted decontamination operations on target submarine USS Skate (SS 305).
0950-1004 Conducted decontamination operations on target submarine USS Patego (SS 384).
1105 Anchored in vicinity of Incheon Island.
1255 Underway for decontamination operations on Skate.
1420 Conducted decontamination operations on Skate and proceeded to Patego.
1452-1613 Conducted decontamination operations on Patego.
1645 Anchored in berth 108 A, Bikini Atoll.

9 August

1120 Underway to assist USS Loline (AR-14) in taking target ship USL Gutierrez (APA 75) to berth 190.
1850 Anchored in berth 108 A, Bikini.

10 August

1000 Transferred decontamination tanks to LST 1184 and decontamination supplies to USS Chichagof (AF-83).
1116 Anchored in berth 1118A, Bikini.
1227 Underway to assist towing LST-1142 off beach.
1645 Anchored in berth G, Bikini.
2140 Secured tow wire to LST 127.
2345 Underway to anchorage in berth A3, Bikini.

11 August

0016 Underway to take strain on tow wire secured to LST 127.
0215 Secured salvage operations on LST 127.
0220 Anchored in berth G, Bikini Atoll.
1300 Underway, commenced to take strain on tow wire to LST 127.
1420 Secured salvage operations on LST 127.
1500 Anchored in berth G, Bikini.

12 August

0730 Underway from AP-27.
0826 Cast off AP-27 from target ship USS Canopus (APA 83).
0955 Moored AP-27 to portside of USS WAH. anch. in berth 147.
1010 Anchored in berth 147.

13 August

1352 Underway to Kwajalein.

14 August

1145 Anchored in berth 15, Kwajalein Atoll.

15 August

1616 Anchored with stern line on Skate.

16 August

0630 Underway with Skate in tow.
0926 Cast off tow wire from Skate and standing by while USS Fulton (AK 11) took Skate in tow.

20 August

1040 Underway for Pearl Harbor.

USS Wharjon (AP-7)

Decontamination Location: Puget Sound
Operational Clearance: 10 February 1947 (Seattle)

Task Unit and Function:
The transport Wharjon was assigned to TU 1.1.2 (Instrumentation Unit). The ship furnished laboratory and base facilities during the operation.

Shot AB: 1 July, 0600

36 June

1451 Underway for Inner area Graham.
2000 Proceeding at various courses and speeds to conform with traffic in Inner area Graham off Bikini Atoll in accordance with JTF 1 Operation Plan.

1 July

1050 Formed column astern of USS Haver (AV-17), Order of ships in column: Haver, Wharjon, USS Butgeron (APA 87), USS Kenneth Whiting (AV-14), USS Cumberland Sound (AV 17).
1315 Ordered to proceed independently.
1341 Anchored in berth 13, Bikini.
1655 Anchored in berth 97, Bikini Atoll.

2 July

1942 Anchored in berth 89, Atoll.

Shot BAK (23 July, 0835)

24 July

1408 Underway for Inner area Graham off Bikini Atoll in accordance with JTF 1 Operation Plan. Director of Ship Material's staff and Instrumentation unit aboard.

25 July


28 July

1617 Anchored in berth Fox, Bikini Atoll.

28 July

1617 Anchored in berth 145, Bikini Atoll.

1355 Anchored in berth 147, Bikini.

14 August

1440 Anchored in berth 91, Bikini.

25 August

1300 Underway for Kwajalein.

26 August

0900 Anchored in berth K-10, Kwajalein Atoll.

28 August

1109 Underway for San Francisco.
USS Widgeon (ASR-1)

**WIDEGON, KENNETH; see USS KENNETH WIDEGON (AV-14)**

USS WIDGEON (ASR-1)

Crew Size: 86
Bikini Atoll Arrival: By 1 June 1946
Bikini Atoll Departure: 5 September 1946
Shot ABU location: 74 nmi (44 km) E
Shot Marker location: 17 nmi (27 km) SE
Decontamination Location: San Francisco
Operational Clearance: 13 December 1946
Final Clearance: 10 January 1947

Task Unit and Function
The submarine rescue vessel Widgeon was a member of TU 1.2.7 (Salvage Unit). Its main duties included salvaging the damaged target vessels after the test, performing emergency repairs, and fighting fires.

**Shot ABU (30 June, 0800)**

**30 June**

1242 Underway to join formation of TU 1.2.7.

**1 July**

1343 Anchored in boat pool anchorage, berth E, Bikini.

**2 July**

0847 Underway in accordance with CTU 1.2.7 orders, proceeding to center of target array.

0950 Radiological monitor reported aboard.

0955 Moored portside to target submarine USS Skate (DD 395).

0957 Radiological monitor boarded and inspected Skate. Skate found to be Geiger counter.

1000 Cut Skate's forward port anchor chain to clear mooring buoy. Commenced rigging Skate for towing astern.

0935 Underway, proceeding to assigned beaching area to beach Skate.

1112 Anchored off beaching area Eniwetok Island, Bikini.

1448 Reached Skate.

1657 Radiological monitor left the ship.

1709 Anchored in berth E, Bikini.

**3 July**

Anchored as before.

**4 July**

1315 Shifted anchorages.

1820 Conducted diving operations searching for planted instruments; recovered planted instruments.

1911 Anchored in berth 106, Bikini Lagoon.

**5 July**

0541 Proceeding to center of target array for diving operations.

0615 Transferred planted instrument to USS Kenneth Whiting (AV-14).

0900-1120 Conducted diving operations; recovered planted instruments.

1354 Underway to shift berths.

1420-1735 Conducted diving operations.

1830 Moored in berth 161, Bikini.

**6 July**

0536 Underway to shift berths for diving operations.

0600 Moored in Bikini Lagoon.

0630-1010 Conducted diving operations to clear fouled anchor.

1131 Shifted moorings.

1134-1807 Conducted diving operations, recovering slipping anchor.

1858 Anchored in berth 161, Bikini Harbor.

**7 July**

1245 Completed laying four-point moor around Anderson.

1315 Moored in berth 324.

0746 Underway to go alongside USS Fulton (AG-11) to transfer submarine rescue chamber.

1014 Transferred submarine rescue chamber via motor launch to Fulton while laying to off Fulton.

1030 Moored in four-point moor in berth 163 over Anderson.

1235-1114 Conducted diving operations, searching for sunken Anderson; found Anderson.

1345 Completed laying four-point moor around Anderson.

1345 Moored in berth 324.

1008 Underway to recover four-point moor.

1120 Completed recovering four-point moor and proceeded to assigned anchorage.

1315 Anchored in berth 106, Bikini.

1210 Moored over sunken target ship USS Carlose (AV-69) in berth 219, Bikini.

1245 Conducted diving operations, searching for instruments on Carlisle.

1245 Underwater photo unit party on board.

**8 July**

0810-1636 Conducted diving operations on Carlisle.

1646 Anchored over Anderson in berth 163.

15 July

1655-1900 Conducted diving operations searching for sunken Anderson; located Anderson.

14 July

0810-1606 Conducted diving operations on Carlisle.

1646 Anchored over Anderson in berth 163.

15 July

0815-1610 Conducted diving operations over Anderson, recovering two torpedoes from Anderson.

16 July

0800-1545 Conducted diving operations, recovering anchor and chain from Anderson.
17 July 1345-1435 Conducted diving operations over Anderson. 1510 Anchored in berth 106, Bikini.

18 July 2040 Not involved with target ships.

19 July 1601 Moored over sunken target ship USS Gilliam (APA-57) in berth 160.

20 July 0603 Commenced diving operations, searching for Gilliam. Radiological monitor reported aboard in connection with diving operations. 1030 Secured from diving operations. 1105 Underway to shift anchorage. 1410 Moored over Gilliam by target ship USS Bruno (APA-66).

1638-1845 Conducted diving operations.

21 July 0800-1230 Conducted diving operations over Gilliam. 1530 Anchored in berth 187, Bikini.


24 July 0952 Moored alongside Skipjack. 0604-0742 Submerged Skipjack. 1003-1347 Submerged target submarine USS Tuna (SS-201). 1335 Radiological monitor reported aboard for CROSSROADS. 1900 Anchored in berth 90, Bikini.

5 JulY Shut BAKER (25 July, 0035) 1412-1520 Attempted to surface Apogee. 1407 While en route to assigned anchorage, commanding officer ordered commencement of distillation of freshwater. 1746 Anchored 1,700 yards (1.1 km) south of berth 376, Bikini.

29 July 0955 Underway to area of beached Pentuda. Secured evaporators.

30 July 0739 Underway to area of beached Pentuda. Secured evaporators.

31 July 0919-1001 Blew forward torpedo room and forward battery room on Dentuda. Underway to go alongside and wash down target ship USS Hughes (ID-410). Washed down Hughes. 1416-1500 Submerged Tuna to clear radioactivity. 1628-1713 Blew all ballast tanks on Pentuda. 1726-1834 Pulled Pentuda further on beach with use of beaching gear. 1928 Anchored in berth P. Bikini Harbor.

1 August 0915 Anchored in berth P. Bikini.

2 August 1600 Moored in berth 358. Bikini Harbor. Next to USS Max (AR-6) for minor repairs and upkeep.


13 August-3 September Widgeon attempted to surface Skipjack.

13 August 1330-1948 Conducted diving operations on Skipjack, connecting salvage hose to compartments and ballast tanks.

14 August 0815-1825 Engaged in diving operations on Skipjack.

15 August 0430-1915 Engaged in diving operations.

16 August 0800-1915 Engaged in diving operations.

17 August 0800-1930 Engaged in diving operations.

18 August 0715-2025 Engaged in diving operations.

15 August 0730-1900 Engaged in diving operations on salvage Skipjack.
20 August
0725-1830 Engaged in diving operations to salvage Skipjack.

21 August
0700-1915 Engaged in diving operations to salvage Skipjack.

22 August
0740-1830 Engaged in salvage and diving operations.

23 August
0645-1950 Engaged in diving and salvage operations on Skipjack.

24 August
0710-1845 Engaged in diving operations to salvage Skipjack.

25 August
0715-2035 Engaged in diving operations.

26 August
0630-1818 Engaged in diving operations.

27 August
0645-0930 Engaged in diving operations. Attempted unsuccessfully to surface Skipjack.
0827-1732 Attempted unsuccessfully to surface Skipjack.

28 August
0730-1830 Engaged in diving operations on Skipjack.

29 August
0725-1830 Engaged in diving operations on Skipjack.

30 August
0740-1920 Engaged in diving operations on Skipjack.

1 September
0735-2040 Engaged in diving operations on Skipjack.

2 September
0730-1240 Engaged in diving operations. Attempted unsuccessfully to surface Skipjack.
1229-1905 Attempted unsuccessfully to surface Skipjack.

3 September
1158 Skipjack completely surfaced. Washed down Skipjack.
1305-1535 Moored in berth 205, Bikini.

4 September
0700-1905 Engaged in diving operations on Skipjack.

5 September
1809 Underway en route to Kwajalein.

7 September
1251 Moored next to Skipjack in berth D-17, Kwajalein, after fueling.

9 September
0937-1119 1318-1403 Towed Skipjack to drydock. Redocean party on board ship for radiological clearance before sailing.

10 September
2012 Received radiological clearance for sailing from USS Haven (AH-12).

11 September
0225-1345 Test all ballast tanks on Skipjack. Underway for Pearl Harbor.

20 August
0725-1830 Engaged in diving operations to salvage Skipjack.

21 August
0700-1915 Engaged in diving operations to salvage Skipjack.

22 August
0740-1830 Engaged in salvage and diving operations.

23 August
0645-1950 Engaged in diving and salvage operations on Skipjack.

24 August
0710-1845 Engaged in diving operations to salvage Skipjack.

25 August
0715-2035 Engaged in diving operations.

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0630-1818 Engaged in diving operations.

27 August
0645-0930 Engaged in diving operations. Attempted unsuccessfully to surface Skipjack.
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1305-1535 Moored in berth 205, Bikini.

4 September
0700-1905 Engaged in diving operations on Skipjack.

5 September
1809 Underway en route to Kwajalein.

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1251 Moored next to Skipjack in berth D-17, Kwajalein, after fueling.

9 September
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10 September
2012 Received radiological clearance for sailing from USS Haven (AH-12).

11 September
0225-1345 Test all ballast tanks on Skipjack. Underway for Pearl Harbor.
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 July</td>
<td>USS LST-989 moored outboard to LST-661 for water.</td>
</tr>
<tr>
<td>7 July</td>
<td>ATA-187 moored to starboard for water. 1508-1728 PM-29 moored to starboard for water. 1750-1830 YM-358 moored to starboard for water.</td>
</tr>
<tr>
<td>8 July</td>
<td>YM-463 moored to starboard for water. Target vessel LCT(L)-549 moored to starboard for water.</td>
</tr>
<tr>
<td>9 July</td>
<td>USS Deliver (ARS-23) moored to starboard for water.</td>
</tr>
<tr>
<td>10 July</td>
<td>USS Chikaska (AO-54) moored to port to discharge fuel oil and receive water.</td>
</tr>
<tr>
<td>11 July</td>
<td>Underway to go alongside target ship Prinz Eugen to discharge cargo water and boiler feed water.</td>
</tr>
<tr>
<td>12 July</td>
<td>USS Chowanoc (ATF-100) moored to starboard for water.</td>
</tr>
<tr>
<td>13 July</td>
<td>1456-1616 YRS-413 moored to starboard for water. 1540-1632 USS Chowanoc (ATF-100) moored to starboard for water.</td>
</tr>
<tr>
<td>14 July</td>
<td>PGM-31 moored to port to receive water.</td>
</tr>
<tr>
<td>15 July</td>
<td>ATA-187 moored to starboard for water.</td>
</tr>
<tr>
<td>16 July</td>
<td>ATA-180 moored to starboard for water.</td>
</tr>
<tr>
<td>17 July</td>
<td>ATA-187 moored to starboard for water.</td>
</tr>
<tr>
<td>18 July</td>
<td>Secured #2 and #3 evaporators. Secured from pumping #3 port and starboard tanks. Commenced distilling on #2 and #3 evaporator units.</td>
</tr>
<tr>
<td>19 July</td>
<td>Pumped saltwater out of tanks #1 and #4. Underway for Rongelap.</td>
</tr>
<tr>
<td>20 July</td>
<td>Pumped out saltwater. Changed courses to return to Bikini before arriving at Rongelap. Anchored in berth 310, Bikini.</td>
</tr>
<tr>
<td>21 July</td>
<td>Commenced pumping saltwater from #2 starboard and #2 port tanks over side. Secured #3 distilling unit.</td>
</tr>
<tr>
<td>22 July</td>
<td>Secured from pumping water out of #2 port and starboard cargo tanks.</td>
</tr>
<tr>
<td>23 July</td>
<td>Commenced distilling on #3 distilling unit.</td>
</tr>
<tr>
<td>24 July</td>
<td>Underway en route to Rongelap Atoll.</td>
</tr>
<tr>
<td>25 July</td>
<td>Commenced pumping saltwater from #1 port and starboard tanks over the side. Anchored in berth 21, Rongelap. Secured pumping from #1 port and starboard tanks. Commenced discharging boiler feed water directly from distilling units to Prinz Eugen.</td>
</tr>
<tr>
<td>26-29 July</td>
<td>Yo-199 moored outboard of YM-92. Received cargo water from YM-92. YM-92 commenced receiving unchlorinated distilled water for flushing tanks.</td>
</tr>
<tr>
<td>30 July</td>
<td>Yo-92 secured from receiving water. Commenced distilling in #1 tank. YM-92 received cargo water. Underway from Rongelap to Bikini. Anchored in berth 370, Bikini.</td>
</tr>
<tr>
<td>31 July</td>
<td>Commenced watering USS Severn (AO-61). USS Suncock (AN-81) moored to port for water.</td>
</tr>
<tr>
<td>1 August</td>
<td>LST-817 received cargo water. ATA-192 moored to port for water. Commenced fueling ship from Yo-199. Yo-199 received cargo water. USS Deliver (ARS-23) received water. PGM-31 moored to starboard to receive water. Completed fueling ship. Yo-199 underway. PGM-24 moored to starboard aft to receive water.</td>
</tr>
</tbody>
</table>
2 August
0915-0935 USS Yukon (AN-65) moored to starboard side for water.
1207-1312 USS Oneonta (AN-85) moored to starboard side for water.
1620-1820 After shifting berths. USS Palmyra (ARS (T) -3) moored to starboard for water.
1750-1844 USS Dutton (AGS-8) moored to port to receive water.

3 August
1055-1817 LCT-1067 moored to starboard for water.

4 August
0920-0940 USS Dutton (AGS-8) moored to starboard for water.
1035-1137 USS John Blish (AGS-101) moored to starboard for water.
1117-1132 LCT-1159 moored to port for water.
1745-1840 LCT-1177 moored to port for water.

5 August
0926-0949 YMS-463 moored to starboard for water.
1025-1130 USCGC Bramble (WAGL -392) moored to starboard for water.
1320-2318 Tontobbee moored to starboard for water.
1520-1802 USE LST-881 moored to port for water.

6 August
0842-1030 USE Wenatchee (ATF-118) moored to starboard for water.
0910-1026 USE Clipper (ARS-33) moored to port for water.
1135-1306 PGM-32 moored to starboard for water.
1305-1414 USE Achenawi (ATF-148) moored to port for water.
1314-1357 USE Chickasaw (ATF-83) moored to starboard to receive water.

7 August
0840-0905 Dutton moored to starboard for water.
1302-1342 PGM-29 moored to starboard for water.
1411-1500 PGM-31 moored to starboard for water.
1503-1555 ATA-180 moored to starboard for water.
1727-1915 Etah moored to starboard for water.

8 August
1056-1100 USE Munsee (ATF-107) moored to portside for water.
1100-1135 PGM-24 moored to starboard for water.
1135-1445 ATA-192 moored to starboard for water.
1405-1500 LCT-1361 moored to portside for water.
1500-1555 USE Sioux (ATF-75) moored to starboard for water.
1702-1715 YMS-463 moored to port for water.

9 August
1130-1300 Target vessel LCT(L)-615 moored to starboard for water.
1227-1305 YMS-354 moored to port for water.

10 August
0143-0900 USE Coucal (ARS-5) moored to starboard for water.
0907-0950 Achomawi moored to port for water.
0920-0955 PGM-25 moored to port for water.
1050-1115 PGM-29 moored to starboard.
1125-1230 ATA-187 moored to port for water.
1300-1405 Deliver moored to starboard for water.
1642-1740 PGM-31 moored to starboard for water.
1730-1758 PGM-32 moored to starboard for water.
1747-1759 YMS-463 moored to port for water.

11 August
0825-0905 Dutton moored to starboard for water.

12 August
1210-1230 ATA-124 moored to port for water.
1215-1220 LCT-1359 moored to starboard for water.
1440-1620 LCI(L)-549 moored to starboard for water.
1537-1622 Gillig moored to port for water.
1639-1750 Clame moored to starboard for water.

13 August
0804-1745 USE LCT(L)-1090 moored to port for water.
1305-1455 VQ-199 moored to port for water.

14 August
0840-1023 Shakamaxon moored to starboard forward for water.
0915-0956 YP-636 moored to portside for water.
1010-1055 PGM-23 moored to portside for water.
1032-1050 YMS-463 moored to starboard aft for water.
1425-1525 Munsee moored to portside for water.
1426-1440 Dutton moored to starboard for water.
1430-1605 Oneonta moored to starboard aft for water.
1431-1515 YMS-354 moored to port forward; outboard for water.
1714-1725 USE LCT(L)-977 moored to starboard aft for water.

15 August
0945-1040 Target vessel LCT-1115 moored to starboard for water.
1316-1355 LCT-1316 moored to port for water.
1322-1509 LCT-1280 moored to LCT-1361 for water.
1507-1602 Blish moored to starboard for water.
1650-1910 LCT-817 moored to starboard for water.

16 August
0952-1100 USE Achenawi moored to portside for water.
1345-1442 LCT-1377 moored to starboard for water.
1453-1529 ATA-124 moored to starboard for water.

17 August
1040-1303 Suncock moored to starboard for water.
1103-1215 ATA-192 moored to port for water.
1240-1324 YMS-413 moored to port for water.
1837-1853 YMS-463 moored to starboard for water.

18 August
0822-1004 LCT(L)-1062 moored to port for water.
0905-1040 Tontobbee received water.
1010-1035 Dutton moored to port for water.
Two radSAFE inspectors came on board to test for radioactivity and left. All working spaces safe for personnel.
YW-92 moored to starboard to discharge water.

19 August
0900-1159 YW-92 underway from alongside, having discharged water.
Underway to Kwajalein.

20 August
1140 Anchored in berth George, anchorage Able, Kwajalein.

21 August
1000-1415 YW-94 moored to starboard for water.
22 August
1120-1245  YW-94 underway from alongside after receiving water.
1537-1640  Munsee moored starboard forward for water.
24 August
1310-1346  YO-178 alongside to receive water.
1705  YW-94 alongside to receive water.
25 August
0807  YW-94 underway from alongside.
26 August
0953-1017  APA-192 moored to starboard forward for water.
1650-1913  Tumbalbae moored to starboard for water.
28 August
1656  Underway from Kwajalein en route to Pearl Harbor.
9 September
1506  Moored to berth F-7, Pearl Harbor.

USS WILSON (DD-408)
0400  Last-minute personnel departed. Ship set for BAKER.
1 August  All personnel moved from Bayfield to USS Dexter (APA-237).
7 August  The Initial boarding party boarded Wilson prior to washdown to take readings. Trained in port mount torpedo tubes and retrieved auxiliary echo sounding gear from fantail. Sprayed ship with hot solution of lye and boiler compound, allowing it to set 1 hr before washdown with high-pressure hose. (See Table A.14.) Took comparative readings after washdown. Four men boarded the ship and received exposures between 0.5 and 0.75 R. [No film badges located; exposures are assumed to be estimated.]

Table A.14. Representative Geiger readings (R/24 hours) on reboarding USS Wilson (DD-408), 7 August 1946.

<table>
<thead>
<tr>
<th>Location</th>
<th>Before Washdown</th>
<th>After Washdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecastle deck forward</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Under forward uptakes</td>
<td>9.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Main deck machinery</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Main deck fantail</td>
<td>4.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Superstructure deck forward</td>
<td>5.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Bridge wing port</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Bridge wing starboard</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Rubber mats, bridge wing, port (max)</td>
<td>16.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Forecastle deck, starboard, frame 11 (min)</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>10 feet (3 meters) from side (avg)</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>Inside after deckhouse (avg)</td>
<td>3.0</td>
<td>4</td>
</tr>
</tbody>
</table>

Note:
*No reading.
Source: Reference 4.

9-10 August Wilson boarded; unit of personnel unknown.
12 August Commanding officer and inspecting party of 11 men loaded Wilson. list of personnel.
13 August Recovered casualty film images. No readings taken.
15 August Anchor detail aboard: attempted recovery of underwater object with negative results due to fouling with part anchor. No readings taken. Forecastle tolerance 3 hours. Partially aboard about 2 hours.
16 August Anchor detail aboard: concluded recovery of underwater object with assistance of
**USS Wilson (DD-408)**

### 16 August

**USS Elkia (AN-79):** anchor placed on forecastle, but not secured to deck due to absence of proper material. Tolerance remained 3 hours on forecastle. Unpainted, or with light coat of paint, forecastle deck had low Geiger readings because of its excellent drainage; heavily painted maindeck and fantail with comparable drainage had readings double or three times that of forecastle (Reference 1). Party aboard about 3 hours, 15 minutes.

18 August  Working party boarded to hoist anchor and prepare it for towing to Kwajalein by ATA-189. Transferred 53 men to USS Rockwell (APA-208).

19 August Underway in tow by ATA-189 for Kwajalein. Transferred 33 men to Rockwell.

21 August Arrived at Kwajalein.

28 August **Wilson** decommissioned.

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**YMS-354**

**Crew Size:** 28

**Bikini Atoll Arrival:** 27 March 1946

**Bikini Atoll Departure:** 14 September 1946

**Shot ABLE Location:** 64 nmi (119 km) E (Kongelap)

**Shot BAKER Location:** 65 nmi (120 km) E (Kongelap)

**Operational Clearance:** 20 December 1946

**Final Clearance:** 10 February 1947

**Task Unit and Function:**

The minesweeper YMS-354 was a member of TR I.A.5, (Survey Unit). As part of the survey unit, its mission included surveying the probable effects of the nuclear tests on fish and other wildlife and conducting an oceanographic survey to determine the character of the ocean currents in and around Bikini Atoll.

**Shot ABLE (1 July, 0000)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 0930 Anchored in south pass of Kongelap.</td>
</tr>
<tr>
<td>03 July</td>
<td>Underway to Bikini.</td>
</tr>
<tr>
<td>04 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 1205 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>05 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 1605 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>09 July</td>
<td>Engaged in fishing surveys in Bikini Lagoon. returning to Bikini Lagoon each day.</td>
</tr>
<tr>
<td>12 July</td>
<td>Moored alongside USS Jena (AK 8).</td>
</tr>
<tr>
<td>14 July</td>
<td>Moored to YMS 358.</td>
</tr>
<tr>
<td>15 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 0530 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>17 July</td>
<td>Underway for Kongelap. 1205 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>18 July</td>
<td>Moored at Kongelap.</td>
</tr>
<tr>
<td>19 July</td>
<td>Underway to conduct fishing survey. 1205 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>21 July</td>
<td>Underway for Kongelap. 1205 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>24 July</td>
<td>Underway for Bikini. 1400 Moored to Bikini.</td>
</tr>
<tr>
<td>29 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 0615 Moored in berth 20A, Bikini.</td>
</tr>
<tr>
<td>08 August</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 1415 Moored to WU Lebu (AK 6) in Bikini Atoll.</td>
</tr>
<tr>
<td>09 August</td>
<td>Underway to conduct fishing survey. 1415 Moored to YMS 411, Bikini.</td>
</tr>
<tr>
<td>10 August</td>
<td>Underway to conduct fishing survey off Bikini Atoll. 1415 Moored to YMS 411, Bikini.</td>
</tr>
</tbody>
</table>

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**Crew Size:** 28

**Bikini Atoll Arrival:** 27 March 1946

**Bikini Atoll Departure:** 14 September 1946

**Shot ABLE Location:** 64 nmi (119 km) E (Kongelap)

**Shot BAKER Location:** 65 nmi (120 km) E (Kongelap)

**Operational Clearance:** 20 December 1946

**Final Clearance:** 10 February 1947

**Task Unit and Function:**

The minesweeper YMS-354 was a member of TR I.A.5, (Survey Unit). As part of the survey unit, its mission included surveying the probable effects of the nuclear tests on fish and other wildlife and conducting an oceanographic survey to determine the character of the ocean currents in and around Bikini Atoll.

**Shot ABLE (1 July, 0000)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 0930 Anchored in south pass of Kongelap.</td>
</tr>
<tr>
<td>03 July</td>
<td>Underway to Bikini.</td>
</tr>
<tr>
<td>04 July</td>
<td>Underway to conduct fishing survey of Bikini Lagoon. 1205 Moored in berth 20A, Bikini.</td>
</tr>
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<td>Underway to conduct fishing survey off Bikini Atoll. 1415 Moored to YMS 411, Bikini.</td>
</tr>
</tbody>
</table>
YMS-354

10 August

12 August
1200
Boat at Bikini Atoll.

13 August
0630
Underway to conduct fishing survey of Bikini Atoll.

14 August
1700
Anchored at Bikini.

14-16 August
Conducted fishing surveys of Bikini Atoll, returning each day to base in Bikini Lagoon.

22 August
1710
Entered drydock of AKL IV.

23 August
0800
Ship clear of drydock. 1110
Anchored in berth 311A, Bikini.

27 August
2 September
Engaged in wire dragging operations and
wire drag surveys off the southern area
of Bikini Atoll. Returned each day to
Bikini.

4-11 September
Conducted wire drag surveys, returning
to anchor each evening in southwest Bikini Lagoon.

12 September
1130
Underway for Panajelito.

14 September
1520
Anchored at Panajelito.

21 October
0600
Underway to Loch.
Last Unit and Station
The NWC-15 was a member of TV L.B.1 Survey Unit. As part of the Survey Unit, its mission included surveying the probable effects of the bow ties on fish and other wildlife and conducting an ornithological survey to determine the character of the ocean current in and around Nikit Island.

Shot Alli (July 1, 1946)
1 July 0000 Arrived at Morange Atoll.
2 July Underway for fishing operations.
3 July Underway for fishing operations.
4 July Underway for fishing operations.
5 July Underway for fishing operations.
6 July Underway for fishing operations.
7 July Underway for fishing operations.
8 July Underway for fishing operations.
9 July Underway for fishing operations.
10 July Underway for fishing operations.
11 July Underway for fishing operations.
12 July Underway for fishing operations.
13 July Underway for fishing operations.
14 July Underway for fishing operations.
15 July Underway for fishing operations.
16 July Underway for fishing operations.
17 July Underway for fishing operations.
18 July Underway for fishing operations.
19 July Underway for fishing operations.
20 July Underway for fishing operations.
21 July Underway for fishing operations.
22 July Underway for fishing operations.
23 July Underway for fishing operations.
24 July Underway for fishing operations.
25 July Underway for fishing operations.
26 July Underway for fishing operations.
27 July Underway for fishing operations.
28 July Underway for fishing operations.
29 July Underway for fishing operations.
30 July Underway for fishing operations.
31 July Underway for fishing operations.

Shot Alli (July 1, 1946)
1 July 0615 Pull out of formation for fishing operations.
1300 Revisited at Morange.
2 July 0700 Engaged in routine fishing operations at conclusion returned to Morange.
9 July 0700 Engaged in routine fishing operations at conclusion returned to Morange.
12 July 0700 Engaged in routine fishing operations at conclusion returned to Morange.
15 July 0700 Engaged in routine fishing operations at conclusion returned to Morange.
22 July Engaged in steaming wire dragging operations at conclusion returned to Morange.
31 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
14 September 0900 Underway from Morange to Portau.
15 September 1946 Moored in Portau.
21 October Underway from Portau to Portau.

Shot Alli (August 1, 1946)
21 July 0615 Pull out of formation for fishing operations.
1230 Revisited at Morange.
7 August Engaged in routine fishing operations at conclusion returned to Morange.
16 August Engaged in routine fishing operations at conclusion returned to Morange.
19 August Engaged in routine fishing operations at conclusion returned to Morange.
26 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
31 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
14 September 0900 Underway from Morange to Portau.
15 September 1946 Moored in Portau.
21 October Underway from Portau to Portau.

Shot Alli (August 1, 1946)
21 July 0615 Pull out of formation for fishing operations.
1230 Revisited at Morange.
7 August Engaged in routine fishing operations at conclusion returned to Morange.
16 August Engaged in routine fishing operations at conclusion returned to Morange.
19 August Engaged in routine fishing operations at conclusion returned to Morange.
26 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
31 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
14 September 0900 Underway from Morange to Portau.
15 September 1946 Moored in Portau.
21 October Underway from Portau to Portau.

Shot Alli (August 1, 1946)
21 July 0615 Pull out of formation for fishing operations.
1230 Revisited at Morange.
7 August Engaged in routine fishing operations at conclusion returned to Morange.
16 August Engaged in routine fishing operations at conclusion returned to Morange.
19 August Engaged in routine fishing operations at conclusion returned to Morange.
26 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
31 August Engaged in steaming wire dragging operations at conclusion returned to Morange.
14 September 0900 Underway from Morange to Portau.
15 September 1946 Moored in Portau.
21 October Underway from Portau to Portau.
15 July 2005 Underway for Fneu Island.

16 July 0900 Anchored at Fneu Island.

21 July 0900 Commenced taking soundings near reefs on western side of Fneu Island. 1500 Anchored at Fneu Island.

24 July 1555 Conducted geological survey. 1800 Anchored at Fneu Island.

Shot Range (25 July, 0915)

7 July 1701 Scientists aboard to conduct biological survey on northeast end of Fneu Island. 1950 Anchored at Fneu Island.

26 July 1 August Engaged in geological and biological surveys in vicinity of Fneu Island.

1 August 1454 Underway from Fneu Island to Hikini Atoll.

2 August 0210 Anchored at Hikini Island anchorage, Hikini Atoll.

3 August 0950 Anchored in berth 251A, Hikini Atoll.

5 August 1245-1600 Took soundings at southeast tip of Hikini Island and entire outer eastern end of Hikini Atoll. 1700 Anchored at Hikini Island anchorage.

6 August 0955-1247 Took dredging samples and engaged in dredging operations. 1407 Anchored at Hikini Island anchorage.

7 August 0956 Underway to take soundings off outer edge of Hikini Atoll. 1000-1600 Took soundings. 1900 Anchored at Hikini Island anchorage.

8 August 0822 Underway to take soundings on seaward side of Hikini Reef. 0943-1009 Took soundings. 1722 Anchored in berth 251A, Hikini Atoll.

9 August 0845 Underway to conduct biological survey. 1210-1220 Conducted biological survey. 1316 Anchored in berth 251A, Hikini Atoll.

11 August 0500-1956 Conducted survey; anchoring in berth 251A, Hikini, at conclusion.

17 August 0800-1915 Conducted biological survey; anchored berth 251A, Hikini.

28-31 August Engaged in wire dragging operations, anchoring each night at Hikini.

1-6 September Engaged in wire dragging operations, remaining in Hikini lagoon at end of the day.

9-11 September Engaged in dragging operations; remained in harbor at end of the day.

14 September 1150 Underway for Kwajalein.

15 September 1340 Anchored in anchorage K-15, Kwajalein.

21 October Departed Kwajalein for Guam.
APPENDIX A
REFERENCES

1. **Ships' Logs**
   (Cited by ship's name, e.g., Reference 1, ATA-192).

2. **Major Damage Report**
   (A report specified by OpPlan 1-46 for each target ship -- often referred to as "Report No. 5").

3. **Commanding Officer's Report**
   (A report specified by OpPlan 1-46 for each target ship -- often referred to as "Report No. 11").

4. **Decontamination Reports**
   (A report from the target ships' commanders on decontamination activities following BAKER).

   January 1947
   NTIS AD 473 986 XRD-206

   January 1947
   XRD-206

7. **Message from the Radsafe Group on USS Haven**
   021002Z October 1946 S-36 60Z 267

8. **Inspection Reports**
   (For the cited target ship)

9. **Geiger Readings, USS Crittenden (APA-77)**
   Commanding Officer to Commander Task Group 1.2
   23 August 1946

10. **Boarding Reports**
    (For the cited target ship)

11. **Dispatch from Commander Task Group 1.2 aboard USS Rockingham (APA-229) to Director of Ship Material**
    3 August 1946
APPENDIX B
RADIOLOGICAL SAFETY DOCUMENTS

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<th>Description</th>
<th>Page</th>
</tr>
</thead>
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<td>Extracts from Commander Joint Task Force 1 Operation Plan</td>
<td></td>
</tr>
<tr>
<td>1-46, Annex E -- Safety</td>
<td></td>
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<tr>
<td>-- Appendix I: General Considerations of Radiological Safety, Test ABLE</td>
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<td>-- Appendix II: Radiological Safety Plan, Test ABLE</td>
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<td>-- Appendix IV: Safety Precautions</td>
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<tr>
<td>-- Appendix IX: General Considerations of Radiological Safety, Test BAKER</td>
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</tr>
<tr>
<td>Extracts from &quot;Safety Precautions Incident to Boarding Target Vessels Laid-Up at Kwajalein and Bikini.&quot; Letter from CTG 1.2, 30 Aug 1946</td>
<td>485</td>
</tr>
<tr>
<td>Extracts from Commander Task Group 10.12 Operation Plan</td>
<td></td>
</tr>
<tr>
<td>CombBikResurveGrp No. 1-47</td>
<td></td>
</tr>
<tr>
<td>-- Annex I: Radiological Safety and Health Plan</td>
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</tr>
<tr>
<td>Appendix I: Radiological Safety and Health Plan</td>
<td>490</td>
</tr>
<tr>
<td>Appendix II: Radiological Safety Plan</td>
<td>496</td>
</tr>
<tr>
<td>&quot;Radiological Reconnaissance of Bikini Island and Prayer Island,&quot; memorandum from Bikini Resurvey Radiological Safety Officer, 16 July 1947</td>
<td>500</td>
</tr>
<tr>
<td>Report of Findings, Medical-Legal Board, Bikini Scientific Resurvey</td>
<td>501</td>
</tr>
</tbody>
</table>
1. THE PROBLEM — GENERAL INTELLIGENCE

(a) When an atomic bomb explosion occurs, physical forces of extreme intensity are released at the center of the disturbance. They are propagated outward in all directions.

(b) Casualties may be produced directly by blast, heat, light, ultra violet radiation, gamma rays, neutrons and radioactive fission products which give off beta and gamma radiation. These are described as primary effects.

(c) Casualties may be produced indirectly as a result of secondary hazards created by the above primary influences.

(d) The flash from the explosion will cause heat burns similar to those produced by any explosion. Even thin clothing provides some protection against this form of flash burn. Wood is charred on the surface within certain areas. Fires may be started.

(e) The light is so intense that the retina of the eye may be seriously damaged by this influence alone. The skin may be "sunburned" by the ultraviolet radiation. Reflections from the water may intensify the heat and ultraviolet light radiation effects.

(f) The blast is similar to that of most explosions but somewhat more prolonged in duration and of much greater intensity and extent.

(g) The most harmful radiation appears in two forms. The primary radiation which occurs at the time of the flash is indeed a flash of hard gamma rays and neutrons. This flash exposure is very short. Casualties are likely to result from this primary radiation if the exposure occurs within 4,000 yards of the center of the disturbance.

(h) These neutrons create a secondary hazard by inducing radioactivity in certain elements within the range of approximately 2,000 yards. As a result, objects in the area immediately under the bomb will become radioactively hazardous to personnel. Similarly, particulate matter in the air within range of these rays may become radioactive, and present an airborne hazard. Similarly, the water may present a waterborne hazard.

(i) Besides the above sources of radioactivity there is still a third form. As the bomb is lit, so-called "fission products" are discharged into

*With changes entered through 15 July 1946, Change #7.
the air, mostly in particulate form, and they constitute a cloud of highly radioactive material which makes up the "downwind" hazard. Most of this material is carried to 20,000 to 60,000 feet, becomes greatly diluted and dispersed by the wind and air movements and is borne "downwind." Gradually the particulate matter falls out. This "fall-out" may set up localized areas of hazard. It appears unlikely that there would be any significant hazard from this airborne dissemination at a distance of more than 200 nautical miles from the target.

(j) A rain of radioactive droplets may occur as a result of these tiny radioactive particles serving as a nucleus for the formation of rain droplets. This would probably follow "downwind" behavior. If the humidity of the air is high at the time of firing, the shock wave may compress the air to such an extent that rain may be produced and if so, this rain may contain radioactive material.

(k) Fission products will be deposited in the water directly and present a waterborne hazard.

(l) The above paragraphs describe the general features of the radioactivity hazard and it is with these facts in mind that the Radiological Safety Plan TEST ABLE is prepared (Appendix II to this Annex).

2. PROTECTION

(a) Against the primary effects, underground shelters offer considerable protection providing they are of such a nature as to withstand the light, heat, and blast, and provided they have sufficient thickness of earth or concrete intervening to filter out the gamma rays and the neutrons. This is purely passive defense. Equivalent thickness in steel is required on ships for protection against the primary radiation hazard which accompanies the flash.

(b) Against the secondary radioactivity hazards detection and avoidance provide the best protection. This is the basis of the Safety Plan as far as radiological hazards are concerned.

(c) Against the light injuries to the eyes, special goggles are required for personnel within 25 nautical miles of the flash if looking at it.

3. DETECTION

Suitable instruments indicate directly both the presence of and intensity of the radioactivity at a given place. This applies to air, surface of land and water, subsurface water, target ships, drones, aircraft, and any situation where radioactive contamination might be present.

4. AVOIDANCE

Area reconnaissance, the maintenance of a "contamination situation map," and the posting of areas of hazard constitute the active measures for avoidance.

5. ANTICIPATED HAZARDOUS AREAS

(a) Immediately under the bomb burst there will be a large area of dangerous radioactivity. This will probably be more extensive in the water
after the surface burst than after the air burst and more extensive in the air after the air burst.

(b) Downwind, an airborne radioactive hazard will exist. The characteristics of this will depend on meteorological influences (altitude, wind speed and direction, variations in wind speed and direction at various altitudes up to 60,000 feet, humidity of air).

(c) Contaminated water from the lagoon may move down current, in accordance with prevailing water mass movement. The order of magnitude of the radioactivity is not known. It will certainly be much greater in the surface burst than in the air burst.

(d) The "fall out" from downwind cloud may set up contaminated water masses downwind and these water masses will follow prevailing currents. Dispersion may be slow.

(e) There is some indication that dilution may be facilitated in the water by dispersion and vertical mixing of the radioactive materials. If so, this will materially influence downcurrent surface water contamination and enhance safety.

(f) All individuals or objects entering contaminated areas may transfer hazardous radioactivity to clear areas. Examples -- drones sampling column or clouds, craft entering contaminated areas of lagoon, etc.

(g) Relation of compartmentation, ventilation, etc. on target ships to persistence or intensity of radioactivity is unknown and must be explored during this operation. It must be assumed that there is a significant relationship favoring the build-up and persistence below decks.

6. OPERATIONAL INTELLIGENCE

(a) When fission occurs the immediate reaction is intense radiation of ultra-violet light and heat waves, gamma rays, and neutrons. This is accompanied by the formation of a large ball of fire. A shock wave is initiated which is more sustained than that of an ordinary explosion. The ball of fire produces a mushroom-shaped mass of hot gases, the top of which rises at the rate of 10,000 feet per minute at least until it reaches about 30,000 feet. In the cone-shaped trail is left a "column" of boiling clouds, 3 to 10 nautical miles in diameter, characterized by extremely high temperatures, a moment of incandescence, noxious gases, violent turbulence and a strong updraught. Surrounding this visible column is an invisible cone-shaped zone of highly dangerous contamination. The column is then carried downwind, the direction and velocity being determined by the direction and velocity of the wind at the various levels of air from 0 to 60,000 feet altitude where the top, or "crest" probably layers out.

(b) [not reproduced]

(c) Even at 20 nautical miles the light is of such intensity as to be painful to the unprotected eye, producing an immediate temporary blinding, lasting for a half hour or more. The heat of the flash is felt on the bare skin. Approximately 50 seconds after detonation, at 10 nautical miles, the push of the shock wave or waves is felt distinctly and the roar of the explosion is heard. It, like the shock wave, is more sustained than the sharp crack of the normal TNT explosion.
Areas of radioactive hazard thus occur (1) immediately under the bomb burst, (2) in the air and in the downwind clouds, and (3) on the surface of land or water where radioactive materials fall out of the downwind clouds.

By means of instruments such as Geiger-Müller Counters it is possible to detect the areas of contamination and to measure the intensity of the radioactivity.

The unit of radioactivity selected for practical purposes is the roentgen. For purposes of safety in this operation, it is considered that an individual should not have a total exposure of over 50 or 60 roentgens in two weeks. If an individual receives 10 roentgens in one day, or 60 roentgens in two weeks he will be withdrawn from active participation in the operation. The maximum allowable dose or tolerance for daily exposures over a long period is 0.1 roentgen.

The intensity of the radioactive hazard tends to decrease with time due to (1) decay of radioactive materials and (2) dispersion, dilution, and transference from the immediate site.

The intensity of the radiation from the fission products in the "column" decreases inversely with time in hours after the first hour so that an area which had 15 roentgens per hour at one hour after detonation would have an intensity of 7.5 roentgens at two hours after detonation and 5.0 roentgens at three hours, assuming, however, that no additional radioactivity had been added in the meantime (fall out of cloud, wind drift of particles, etc.). This latter point is especially important to those in the downwind positions (planes and DDs).

Besides the Geiger counters, photographic film is used as an indicator of exposure to radioactivity. Certain personnel will wear film badges to indicate absence or presence of radioactivity exposure.

Test B will present problems somewhat different from Test A but the general principles will remain the same. The radioactivity in the water will undoubtedly be greater and contaminated areas remain hazardous for a longer period.
APPENDIX II
RADIOLOGICAL SAFETY PLAN, TEST ABLE

Organization:
Radiological Safety Section, Chief of Section
(a) Radiological Safety Control Unit
(b) Radiological Safety Advisory Board
(c) Radiological Safety Reconnaissance Units
   (1) 2 PBM Units
   (2) 2 Helicopter Units
   (3) 6 "Downwind" Destroyer Units
   (4) 3 "Upwind" Destroyer Units
   (5) 6 Lagoon Patrols
       6 Gunboat (PGM) Units
       20 LCPL Units
   (6) 6 "Cloud tracking aircraft" Units
   (7) 2 Drone Boat Units
(d) Radiological Safety Monitor-Adv1sors
(e) Radiological Safety Technical Service Units.

1. GENERAL INFORMATION. Appendix I to this Annex contains general information on the radiological situation expected to develop. It is the responsibility of the Manhattan District to prepare and execute this plan and to pass on the qualifications of and train the personnel necessary thereto.

2. MISSION. To protect personnel from the hazards peculiar to the use of the atomic bomb during Operation CROSSROADS and to enable personnel to return safely to the target area at the earliest possible moment.

3. TASKS
   (a) The Radiological Safety Control Unit will consist of the Section Chief and his control staff. This unit will be based in Radiological Safety Control, aboard MT. MCKINLEY. It will receive, plot, and analyze radiological information sent in by the reconnaissance and advisory units. It will maintain the radioactivity situation map. It will control the reconnaissance units in order to obtain the necessary information. It will consult with the advisory units. It has the ultimate, complete, and vitally important responsibility of advising CJTF-1 as to the location, severity, and probable significance of hazardous areas, and advising him on action recommended for the safety of personnel. It will furnish to CJTF-1, prior
to How hour, a prediction as to the probable downwind direction of the cloud mass and the downwind current movement of the contaminated water masses.

(b) The Radiological Safety Advisory Board will consist of the senior scientists and officers of the Safety Section. This board will advise the Chief of the Radiological Safety Section on technical matters including correlation of aerologic and oceanographic data and anticipating likely air currents and water currents that might govern the distribution of the bomb cloud and water extensions. This board will assist the section chief in preparing the radiological predictions prior to ABLE and BAKER days. It will assist the section chief in preparing his reports of the operation, particularly the technical section thereto.

(c) The radiological safety reconnaissance units are composed of one or more "monitors" and their assistants. The term "monitor" will be applied to personnel of this section qualified for service in the radiological measurement activities of the section. They will be placed on various reconnaissance destroyers, gunboats, landing craft, and planes. They will operate directly under the Chief of the Section and must at all times be in direct communication with him through his control unit. They are equipped with portable Geiger counters and other radiological equipment that indicate the presence of and measure the intensity of the radioactivity. "Personnel badges" (film) will be carried on the person of all monitors and their assistants. These will serve to detect total exposure. These badges will be worn for one day only, will be collected by the senior monitor of each unit, and will be labelled as to date, area, and name. They will be turned over as soon as practicable, to the Photometric Unit, Radiological Safety Section, on board HAVEN. In their reports to Control, monitors will report the instrument used and the radiological strength in terms of roentgens. Monitors will generally operate within the safe fringe outside the limit of the danger areas. The success of all these reconnaissance units depends primarily on excellent communications between monitors and control and on accurate and easily understood descriptions of the position the monitor at the time of each report and the accurate location of the areas he is reporting on. Each monitor of individual monitoring party will be in direct two-way communication with Radiological Safety Control at all times.

For purposes of describing positions and courses of ships and planes carrying reconnaissance units a radiological axis will be used. The origin of this axis will be the target. Its direction, to be announced by CJTF-1 (by dispatch to all radiological safety reconnaissance units) about How minus one hour, will be based on the direction of the wind at all altitudes. At the time it is announced it may be in the same direction as the sector axis but, whereas the sector axis may be changed from time to time, the radiological axis will not be changed unless there is a wind shift of more than 20°. Thus the axis itself is described as 000° (RRA) or 360° (RRA). Weather predictions indicate that this axis will be approximately 090° (True).

3.(c)(1) PBM Units. A PBM unit consists of one senior monitor and one assistant embarked in a PBM. Each unit is equipped with a minimum of:
There will be two such units, one of which acts as a reserve during the first phase of the operation. They will be based at Ebeye. These units will make the first radiological reconnaissance of the lagoon area. The two PBMs will take station at Orbit Point "Victor" (bearing $315^\circ$ (T) distant 30 nautical miles from the target), at 2,000 feet altitude, by How hour minus thirty (30) minutes. On order of CJTF-1, probably about Mike hour plus twenty (20) minutes, the PBMs will proceed in company to a position 5 nautical miles upwind of the target or to such other positions as may be directed by CJTF-1. They will break formation and PBM Charlie will approach the lagoon along the sector axis. When 3 nautical miles from the target the plane will start traversing the suspect area, at 2,000 feet altitude, in a series of parallel flights normal to the wind direction and closing in on the target. These flights shall be not less than 6 nautical miles long, 3 nautical miles on either side of the target, and 1 nautical mile apart except that flight lines 1/2 nautical mile apart will be flown between points 1 mile either side of the target. If a dangerous amount of radioactivity is not encountered, the PBM will continue until 2 nautical miles past the target. As soon as PBM Charlie finishes this pattern it will drop down to 1,000 feet and repeat it. It will also notify PBM Dog, which will come in at 2,000 feet and will cover the same area (a rectangle 6 nautical miles by 5 nautical miles) by making similar flights parallel to the wind direction, with the first such flight on the side nearest the entrance to the lagoon of Tab 1 to this Appendix. Upon completion of this it will withdraw to the upwind position until PBM Charlie has completed the crosswind explorations at 1,000 feet when PBM Dog will repeat its pattern at this altitude. PBM Dog will repeat its pattern at this altitude. PBM Charlie will repeat its pattern at 500 feet, again followed by PBM Dog. As each plane finishes at 500 feet it will withdraw to the upwind station, report, and await further orders. If indications of dangerous radioactivity are encountered the path is shortened and a series of short passes are made of Tab 1 to this Appendix. The object is to just approach the contaminated area and then turn abruptly, circle upwind, and then move downwind for the next pass, until the limits are roughly located. Upon arriving at a point 2 nautical miles downwind of the target each plane will discontinue the exploration and return to the upwind position and await orders. If the examination at any level cannot be completed, explorations at lower levels will not be attempted unless ordered, and planes will withdraw to the upwind position. Further movements of these units will be ordered by CJTF-1 in accordance with the radiological situation at the time.
these units embarked in Destroyers 722, 723, 724, and 725 of Destroyer Division 71 and [Destroyers] 781 and 694 of Destroyer Division 72. The Destroyers and the embarked units are equipped as follows:

General for each:

- 2 Geiger counters #263
- 1 Ionization meter #247
- 50 Casualty badges
- 350 Personnel badges
- 1 Counting rate meter with recorder and distant indicator. Water tap lines attached to an intake for radiological measurement purposes.
- 1 Deep-water counter with recorder and deep-water indicators plus 1,000 feet length electric cable and reel, davit, and one spare probe.

Special for DD 722, 723, 724, and 725:

- 5 Nansen bottles
- 6,250 feet 5/32" wire
- 1 Oceanographic sampling winch, meter wheel, and davit
- 1,000 4-oz. bottles
- 1,000 16-oz. bottles
- 2 Plankton nets
- 375 Kelvin wounding tubes
- 1 Dathythermograph winch, instruments, and boom.

Special for DD 722 and 724:

- 1 Filter Queen with proportional alpha counter
- 1 Scanning counter

Special for DD 770 and 781:

- 3 Nansen bottles
- 1,000 feet 1/8" wire
- 1 B.T. winch, meter wheel and davit for oceanographic sampling
- 500 4 oz. bottles
- 500 16 oz. bottles
- 2 Plankton nets
- 105 Kelvin wounding tubes.

The function of these units is to define and measure the water and surface air contamination outside of the lagoon. They will establish the early limits of the radiologically dangerous areas in air and water, will trace
the movement of the cloud masses, will obtain surface and deep-water samples for testing groups and oceanographers, and will obtain biological samples.

At Mike hour, Destroyer 722 will be at Point "Willys." 725 at the "Initial Point." 781 at Orbit Point "Baker," and 724 and 723 in area "Hudmon." At the "bomb away" signal, 725 and 781 will proceed on course 90° (HHA) at maximum speed for 30 minutes and will then return at half that speed to a bearing of 165° (HHA) from the target, with the 725 40 nautical miles distant and the 781 60 nautical miles distant.

At Mike hour, 722 proceeds to a point just off the entrance to the lagoon, makes a thorough radiological reconnaissance of the entrance, and then runs along the southern edge of the atoll and proceeds to a point bearing 165° (HHA) from the target, distant 22 nautical miles. It turns onto course 270° (HHA) and crosses the cloud path. When the first appreciable indication of radioactivity is noted in the surface water, the Destroyer will stop and the unit will take deep-water samples and deep-water radiological measurements at 50-foot intervals down to the maximum depth at which radioactivity is detected. It will then continue crosswind. When the peak of greatest activity is reached, probably when on bearing 180° (HHA) from the target, similar samples and measurements will be taken. The same procedure is used when the surface water indications are just dying out. When this Destroyer reaches the line bearing 195° (HHA) from the target, it will make a left turn onto this bearing line and will follow it to a point 80 nautical miles distant from the target, where it will make a similar crossing of the path back to bearing line 165° (HHA). At Mike hour, Destroyers 724 and 723 leave area "Hudmon" and proceed in that order around the northern edge of the atoll. At Mike hour, Destroyer 694 will proceed at maximum speed to join Destroyers 723 and 724 and thereafter will continue with them on crosswind patrol. They round the western end of the atoll until they intercept the line bearing 195° (HHA) from the target. They follow this bearing away from the target until the individual ships reach the points at which they will cross over to the other boundary of the cloud path (165° (HHA) from the target). Destroyers of both patrols will make crossings from one boundary line to the other in a leapfrog fashion, taking soundings as described above for the 722.

No crossing may be made without permission of CJTF-1. No destroyer will make a crossing until all crossings nearer to the target have been started, unless otherwise ordered by CJTF-1. The two outside bearing lines, 165° (HHA) and 195° (HHA), may be changed by order of CJTF-1. Between Mike plus 1 and Mike plus 3 hours, the maximum speed for all "downwind" destroyers will be 10 knots. Between Mike hour and Mike plus 1 hour and at all times after Mike plus 3 hours, maximum speed will be 20 knots. Exception to this is the 30 minute run of 725 and 781 immediately after release of the bomb. These operations will continue in the above manner until the distant limits of detectable radioactivity are reached. Thereafter, when ordered by CJTF-1 (approximately ABLE plus two days), they will return to the region of the atoll and, as ordered by CJTF-1, will take such stations as will enable them to survey the spread of the contaminated water through the reef channels and will continue there until such waters are free of
contamination. Any Destroyer finding itself in an area with a radioactivity of more than 0.1 roentgen per twenty-four hours will withdraw immediately to a safer point.

3.(c)(4) [not reproduced]

3.(c)(5) Lagoon Patrols. A lagoon reconnaissance patrol consists of one gunboat and its embarked unit and three or four LCPLs and their embarked units, as tabulated below. The senior monitor in the gunboat shall direct, supervise, and coordinate the work of the radiological units of the gunboat and its attached LCPLs. The Commanding Officer of the gunboat is the patrol commander. He shall be guided by the technical advice of the senior monitor in directing the movements and other activities of the patrol. A Gunboat Unit consists of two or three senior monitors and assistants. One or two oceanographers will be attached to each unit. There are six such units, each of which is embarked in a gunboat (the term PGM will not be used in order to prevent confusion with PBM). Each unit has the following equipment:

1 Ion meter #7
1 Geiger counter #263
1 Ionization meter #247
1 Counting rate meter with recorder and distant rate meter
1 Deep-water counter with recorder and distant indicator plus 500 feet electric cable and hand-operated reel
3 Nansen bottles
1,000 feet wire; 1 B.T. winch, 1 boom
250 4-oz. bottles
350 16-oz. bottles
125 Kelvin tubes.

An LCPL Unit consists of three monitors and at least one assistant, embarked in an LCPL. There will be 20 such units. Three or four of these units will be attached to each of the six lagoon patrols. Five LCPLs will be equipped with surface rate meters and will be known as the "Able" Type. They will be numbered "Able" one through five. The other fifteen will be known as the "Baker" Type and numbered "Baker" six through twenty. Oceanographers will be attached, if available, to each of the "A" Type units. Marine life parties will be attached to Units B19 and B20. All units carry the following equipment per unit:

2 Geiger counters #263
1 Ionization meter #247
Personnel badges for 50 per cent of personnel
100 Water sample bottles
Lagoon charts
3 Casualty badges.
Each LCPL will have, in addition to the usual crew, a boat officer. The boat officer is in command of the boat and has complete authority over all personnel in it. He will be guided by the advice of the senior monitor in directing the movements of his boat and on matters pertaining to its radiological mission and safety. A primary duty of the boat officer is the accurate plotting of the boat's positions.

The Patrols are constituted as follows:

<table>
<thead>
<tr>
<th>Patrol Name</th>
<th>Gunboat</th>
<th>LCPLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass</td>
<td>23</td>
<td>A1, B9, B12, B19</td>
</tr>
<tr>
<td>Cobalt</td>
<td>24</td>
<td>A6, B7, B8</td>
</tr>
<tr>
<td>Gold</td>
<td>25</td>
<td>A2, B10, B11</td>
</tr>
<tr>
<td>Iron</td>
<td>29</td>
<td>A3, B13, B14</td>
</tr>
<tr>
<td>Nickel</td>
<td>31</td>
<td>A4, B15, B16</td>
</tr>
<tr>
<td>Steel</td>
<td>32</td>
<td>A5, B17, B18, B20</td>
</tr>
</tbody>
</table>

The duties of the patrols are to determine the early boundaries of the contaminated area in the lagoon and to trace the movement of the area and the changes in the intensities of the radioactivity in the contaminated waters. When the situation permits, some of these units may be diverted by the Chief of the Radiological Safety Section to other scientific activities. At the time of detonation, the gunboats are in area "Packard," and ARTEMIS, APPLING, and HENRICO are in area "Mercury." At Mike hour, the gunboats will move into area "Caterpillar" and the APAs and AKAs to area "Cadillac." As soon as favorable reports are received from DD-722, probably by Mike plus one hour, CJTF-1 will order these units to approach the lagoon. The gunboats will take position in line abreast, 600-yard interval, across the lagoon; in order from the right 23, 24, 25, 29, 31, and 32. They will stand by until joined by their LCPL units. As quickly as practicable the LCPLs will be launched not more than one nautical mile from the lagoon entrance and will join their respective gunboats. As soon as each patrol is assembled, it will proceed carefully to its assigned sector. These are as follows:

- Brass to Argentina
- Cobalt to Brazil
- Gold to Chile
- Iron to Denmark
- Nickel to England
- Steel to France.

In each patrol, the gunboat will lead the way to the line of target ships within its sector, work down the line toward the center, and establish a forward position at the edge of the contaminated area and about midway...
between the boundaries of its sector. If no contaminated water is found in a particular sector the senior monitor of that patrol will report immediately to the Chief of the Radiological Safety Section and the patrol will be reassigned. The LCPLs will closely follow their gunboat to the assigned line of target ships and will work down that line in alternate serpentine courses about the targets. They will also investigate the ships not in line. They will then assist the gunboat in more closely determining the boundaries of the contaminated area. They shall report their positions and readings every 30 minutes or whenever significant radiological changes are encountered (a sudden or steady rise in readings of 0.01 R). Should communications in LCPLs fail, they will communicate their findings to their PGM for transmission to Radiological Safety Section on MT. MCKINLEY as expeditiously as possible. As the area changes in position and intensity, each patrol will continue to trace it. As soon as possible, CJTF-I will order the two upwind patrols to move around the target and take over the two, hitherto unassigned, downwind sectors, "Greece" and "Holland." The upwind positions will be taken over by the "Upwind" Destroyer Units. LCPLs B19 and B20 will be released by the Chief of the Radiological Safety Section for other duties as practicable.

3.(c)(6) Cloud-Tracking Aircraft Units. These Units consist of one monitor and one assistant embarked in a B-29 or F-13. A photographer will be attached to each unit. There will be six such units, two of which will be in reserve, the other four divided into 2 pairs. Each unit is equipped with a minimum of:

- 1 Geiger counter #263
- 1 Ionization meter #247
- 2 Personnel badges
- 1 Electrometer pencil

These units will attempt to follow the course of the high-level cloud mass and report its positions as it is carried downwind. The Photographer will take pictures of the cloud, which will be sent to the Chief of the Radiological Safety Section as soon as possible. Prior to How hour these units are based on Kwajalein. At Mike hour plus 30 minutes the two pairs of units will take station on either side of the cloud approximately 30 nautical miles from it, bearing 90° (RRA) and 270° (RRA) from it at 25,000 feet, or high enough to be above the normal cloud ceiling, if possible. These planes should fly back and forth on courses parallel to, and keeping pace with, the high cloud mass; they will keep at the optimum distance from the cloud for ease of observation. The planes of each pair will fly in opposite directions on a flat oval course in order to obtain the best fixes on the dimensions and positions of the cloud and the best possible photographs for later checking of this information. The pilots will report to the Force Fighter Director on the visibility of the highest cloud mass, its apparent height, size and position, and its movement. These reports will be made every fifteen minutes. All reports will be immediately transmitted by the Force Fighter Director to Radiological Safety Control. On detection of the presence of radioactivity, the pilot will immediately report it and, with advice from the monitor, ascertain the extent of the hazard in order to outline the extent of the hazardous area.
The pilot will be guided by the monitor when the necessity of taking evasive action arises due to dangerous amounts of radioactivity. In such a situation, the ventilators will be closed until clear of the contaminated area to avoid as much contamination inside the plane as possible. The monitor will be guided by the limitations as to safe or permissible exposures in accordance with basic radiological safety measures set forth in Appendix I to this Annex. They will at all times take into consideration the possibility of contamination of the fuselage and the possibility of contamination and exposure of the personnel while returning to the air base. The pilot will keep in mind the possibility that a dangerous amount of radioactive material may bar his path toward his air base, forcing him to seek an alternate course free from such danger. He must therefore terminate his survey while he still has sufficient fuel for several times his straight course to the base.

3.(c)(7) A drone boat unit consists of a remotely controlled LCVP with a radio broadcast geiger counter installed. It is used primarily for sampling purposes, but the radiological information obtained should be very valuable to this section. At about Mike plus thirty minutes, the drones will proceed from the entrance of the lagoon to the target and return in accordance with the Drone Boat Plan (Annex CC).

(d) Radiological Safety Monitor-Advisors. The Chief of the Radiological Safety Section will assign trained monitors to certain commands and planes within the force and will properly equip them. These monitors will advise their commands and pilots on subjects concerning radiological safety. Although their duties are not primarily reconnaissance, it is essential that they be able to communicate rapidly with Control on matters of radiological safety for two purposes: (1) to report any evidences of radioactivity, and (2) to receive advice on actions to be taken for safety reasons.

One group of these monitor-advisors must be planned for separately from the others, as they are almost as important from a reconnaissance as from an advisory standpoint. This is the group of monitors and their assistants who are assigned to the Director of Ship Material (see Re-boarding and Inspection Plan -- Annex X). One or two of these monitors will be attached to each of the ten Boarding Inspecting Teams. Ten additional monitors are assigned to a special pool to be employed as the Director of Ship Material may required. Each of the monitors of pairs of monitors assigned to the ten teams will have the following equipment:

- 1 Geiger counter #263
- 1 Ionization meter #247
- 1 Zuto (6 only)
- Report sheets
- Personnel badges.

Each individual will have:
- Coveralls, boots and gloves
- Gas mask

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Oxygen breathing apparatus
First aid equipment
Emergency ration and canteen of water.

The duties of these monitors must be coordinated with those of the damage control, safety and medical personnel. The monitors will report, as promptly as possible, any radiological findings to the radiological safety section of the fighter. In addition, these monitors will distribute beforehand, in written form, the necessary badges, personnel badges, and personnel badge reader guides assigned to certain target ships. They will also receive training in the use and handling of such instruments. The duties of the personnel include:

- Calibration of film exposure standards
- Preparation of necessary and personnel badges
- Instruction of personnel in film handling
- Calibration of exposure as indicated by film

The unit will provide personnel badges (film) to personnel entering hazardous areas. These badges will be collected each day by the monitors, and the personnel will accept and record the radiation exposure of each officer or employee. The monitors will analyze samples of water, soil, etc., for both chemical and radiological standards.

In addition, the monitors will provide personnel with proper instruction for handling, and equipment, and for handling the laundry and clothing of the personnel.

Furthermore, the monitors will provide information as to the personnel and the equipment used, and the administrative and technical staff of personnel in regard to radiological hazards and behavior of the personnel and clothing.

In cooperation with the radiological personnel, the special radiological equipment will be utilized, in conjunction with the personnel

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3. (x)(5). Monitors will frequently check radioactivity of various parts of their own ship or craft, including underwater hull and all intakes, particularly condensers, boilers, and other places where there may be a concentration from contaminated water.

3. (x)(6). Monitors, and personnel accompanying them on radiological reconnaissance, will carry their own food and water while on a mission.

3. (x)(7). Special situations may permit the assuming of a calculated risk in order to let certain key personnel enter a hazardous area to make highly desirable observations when the total amount of radiation to be received is less than 10 roentgen units. This may be permitted only on direct instructions from Radiological Safety Control. Details of the situation and clearance therefor will be carefully logged by the accompanying monitor and at Radiological Safety Control.

3. (x)(8). It is possible that the cloud of radioactive materials will be in the path of all travel between Kwajalein and Guam or Kwajalein and Johnston for part of the time during the period from Mike plus 24 hours to Mike plus 48 hours. Other air routes may be similarly threatened. It will be possible on 15.4 minute day to predict fairly accurately the probable course of the cloud movement during the period Mike hour to Mike plus 24 hours, during this period, Mike hour to Mike plus 24 hours, the course of the cloud can be plotted fairly accurately, and from field reconnaissance data available at that time the hazard across these flight paths can be predicted for that and subsequent periods.

3. (x)(9). No flights within 150 nautical miles of Bikini will be permitted unless as a part of Operation CROSSROADS (see Air Plan - Annex P, and Security Plan - Annex K). Recommendations concerning release of this restriction will be made to JTF I by the Chief of the Radiological Safety Section after consultation with the Aerologist at Radiological Safety Control and after the corroboration of pertinent data has been made.

3. (x)(10). The general disposition of ships on 15.4 minute day is shown in Annex J to this plan.

3. (x)(11). The primary considerations that govern the entry into the lagoon relate mainly to the hazard to personnel. Of these, the radiological hazard in of itself, will not be because of the lack of information relative to just how intense, how widespread, and how prevalent it may be.

3. (x)(12). The radiological Safety Section will join the rest of JTF I in a full scale training on Queen day.
3.(x)(14). An official report of scientific and operational data will be submitted, through Technical Staff channels, to CJTF-1. The usual operation report will be submitted through channels. See Annex BB.

3.(x)(15). Historical data will be prepared as directed by Deputy Task Force Commander for Technical Direction (Annex BB).

3.(x)(16). For movements of MT. MCKINLEY and HAVEN see Annex A.

4. Logistics in accordance with Annex B and Appendix VII to this Annex.

5. Communications in accordance with Annex C and Appendix VI to this Annex. Chief of Section in HAVEN except when in MT. MCKINLEY between Queen minus one day and about ABLE plus five days and during similar period at time of Test "B."

APPENDIX IV
SAFETY PRECAUTIONS

1. SAFETY OF PERSONNEL ABOARD BOMB AT TIME OF DETONATION
   (a) Protection at Time of Detonation
      (1) General. CJTF-1 will direct the operations of ships and aircraft in such a manner as will ensure a maximum degree of safety to all personnel involved.
      (2) Billets of Time of Detonation
         (aa) No ships will be permitted closer than 10 (10) nautical miles to the point of detonation at the time of detonation.
         (bb) Most of the ships of the Force will be 70 nautical miles or more from the point of detonation at the time of detonation.
         (cc) Ships and personnel essential to the safe and expeditious accomplishment of the technical mission will be approximately 30 nautical miles from the point of detonation at time of detonation. These ships will be 20 nautical miles at time of detonation.
         (dd) The position of the DEFT-ARML (Annex I Priority Point) will be established on the basis of wind direction at intended time of detonation.
         (ee) The ships of the Force will be directed to operate at depth equal or greater than a line through point A and normal to the DEFT-ARML.
(3) **Individuals at time of detonation**

(aa) Individuals on board ships of the Force will be protected collectively by the operation of the ships from the hazards of blast, heat, and radioactivity. This protection is a primary consideration in establishing the distances ships will be from point of detonation at time of detonation.

(bb) Individuals on board ships of the Force will be required to take individual action in the protection of their own eyes at the time of the detonation. The required action is given. The responsibility for carrying out this action is that of the individual himself. This fact will be made known properly to all individuals concerned by those having proper responsibility therefor.

(cc) All Commanding Officers of ships shall observe the following safety regulations in regard to personnel who are not provided with goggles.

1. At hour minus 10 minutes, Commanding Officers of all ships within 30 nautical miles of Bikini Atoll will assemble on deck all hands not otherwise required below decks, to observe phenomena of the bomb explosion.

2. At hour minus 5 minutes, commanders will have read clearly over the loud speaker system the safety regulations that have been specifically prepared by CJTF. The instructions read to ships' personnel will include what to do and how and where to face between the time the command is given to look away and the occurrence of the bomb flash. Commanding officers shall clearly indicate direction in which to look.

3. At the signal "RELEASE MINUS TWO MINUTES" Commanding Officers shall order all hands (a) to face in a direction properly indicated by him as being away from Bikini Atoll, (b) to look down at the deck, (c) to shut their eyes, and (d) to cover their closed eyes with the bent arm against the face. Personnel will remain in this position until after the flash, at which time they may "carry on." It is safe to view with the naked eye the phenomenon column that follows the flash.

(dd) All Commanding Officers of the ships shall observe the following safety regulations in regard to personnel who are provided with approved goggles:

1. The Commanding Officer shall add "ALL HANDS GOGGLES TO HIS COMMAND at the time of "RELEASE MINUS TWO MINUTES."

2. Those with approved goggles may look directly at the flash or otherwise as they desire.

3. They must put away goggles until after the flash. The flash may be taken as the signal to remove the eye protection and observe the phenomena that follow the explosion.
(ee) Approved goggles (Navy All Purpose Goggles, 4.5 Neutral Density Filter Replacement) will be provided for all personnel on ships nearer than 20 nautical miles at time of intended detonation (H hour) and for observers (not ships' personnel) on Press and Observer ships.

(ff) Emphasis, throughout, will be placed by responsible leaders on the fact that, while no serious damage can result from looking at the flash at a distance of 20 nautical miles or more, the flash is so blinding it will prevent the individual from seeing the beautiful display of colors in the incandescent column of cloud and the gigantic clouds that follow the explosion.

(b) By direction of CJTF-1, these instructions pertaining to individual protection of the eyes are included in the operations plan and will further form the basis of suitable instructions to be issued separately to (a) commanding officers, and (b) press and observers.

(c) There need be no concern on the part of individuals for their personal safety if they will (a) follow the commands of their respective commanding officers, (b) observe the intent of the instructions as to safety for the eyes, and in the case of participating observers, monitors, operational and technical personnel intimately participating in the operation, if they observe all requirements of this annex.

2. DANGER FROM RADIOACTIVE OBJECTS ON TARGET SHIPS

On target ships and possibly on the islands of the lagoon, certain objects may become dangerous to handle due to the effects of radiation, or to contamination with radioactive material. Because of this subtle hazard no personnel of the Force will handle objects on target ships unnecessarily. Under no circumstances will personnel be taken from target ships. This is particularly important as far as scrap metal is concerned. Commanding Officers will disseminate the required information to personnel within their command, and will enforce this safety regulation. This regulation will apply not only to service personnel but to civilian technical observers and to official visiting observers, as well.

3. SAFETY OF PLANE AND AIRCRAFT PERSONNEL

(a) General Safety Precautions Applicable to All Air Operations

(1) With the exception of the bomb carrying and pressure drop aircraft and each other aircraft that CJTF-1 may direct, all planes all home between how many 2 hours and Mike plus 10 hours will be equipped with a dosimeter counter, or will carry a dosimeter with a portable counter.

(2) Personnel in planes all home between how many 2 hours and Mike plus 10 hours, including the bomb carrying and pressure drop aircraft, will wear on each person a personal badge supplied by the radiological safety section through the Air Control Unit to indicate whether or not they have been exposed to radioactivity. In each aircraft there will be a collection of one casualty badge to record possible higher intimation of radiation.

4th
(3) At MIKE hour no aircraft will be within twenty (20) nautical miles radius of the Target, except that certain aircraft whose missions require may be fifteen (15) nautical miles radius from the Target (Appendix II to Annex F); and the bomb-carrying airplane and pressure-drop aircraft, which must be 10 nautical miles (slant range) from the point of detonation, going away, at MIKE hour plus 40 seconds. Between MIKE hour and MIKE plus six minutes, no aircraft will approach closer than 8 nautical miles to the cloud column. Between MIKE plus six minutes and MIKE plus thirty minutes, all aircraft will maintain a minimum distance of 8 nautical miles from the point of detonation and will keep clear of the Radiological Danger Sector, which is defined as an atmospheric and surface area of radioactive contamination that commences at the center of the target array and spreads leeward with the prevailing winds. The Radiological Danger Sector will be announced from Flag Headquarters and will be bounded by true bearings from the center of the target array.

(4) No plane will approach closer than 8 nautical miles to the rising column or the visible cloud, or within 10 nautical miles of a visible "downwind" cloud mass, even if equipped with instruments for detecting and measuring radioactivity.

(5) In the column that follows the ball of fire (MIKE hour to MIKE hour plus 6 minutes), the radioactive hazard will be pretty well confined to the visible column and to the air within 2 to 3 miles of it. If approached, it should be upwind or downwind. In the "downwind" areas, the visible cloud will probably be surrounded by an invisible envelope beyond the visible cloud. The downwind "fallout" of radioactive particles will also be invisible. It is to detect these invisible hazards that radiological instruments and monitors are provided.

(6) Between MIKE hour plus 6 minutes and MIKE plus 30 hours, no planes will be airborne in any of the areas occupied or traversed by the cloud and its fallout except (1) those required by the Radiological Safety Section in the execution of the Safety Plan, (2) those specifically cleared by the Deputy Commander for Aviation, or (3) unless Radiological Safety Control, based on reconnaissance, declares the area safe earlier than MIKE plus 30 hours. Included in (1) would be planes required for safety reconnaissance and those for air and rescue and safety patrol.

(1) [omitted]

(6) All planes equipped with instruments or radiological instruments, except pilots, in single seated planes, will, while airborne, maintain a two-way communications contact on a specially allocated frequency, with Radiological Safety Control, Flag Headquarters, until 1. They will be subject to the safety requirements of this control. Pilots in single seated planes will maintain such contact with the Force Fighter Director on safety demands.

(7) During all other operations, the Commander Joint Task Force One will be continuously advised from Flag Headquarters Safety Control.
Flag Headquarters, JTF-1, as to the safety of operating planes
and personnel in order that he may terminate the operation or
direct such changes in operations as the situation may require
for the safety of operating personnel.

(10) CJTF-1, on advice of the officer in charge of Radiological Safety
Control, will direct when and where planes may be airborne, as
soon as reconnaissance indicates area of hazard and areas free
from hazards due to radioactivity.

(11) Radiological measurement instruments will be provided by Radio-
logical Safety Section for all manned planes during the air opera-
tions except the bomb-carrying and pressure-drop aircraft and
others specifically excepted by CJTF-1 above.

(12) Personnel from Radiological Safety Section will be assigned to
units participating in air operations in order to provide required
briefing and indoctrination of personnel for those specific oper-
atations, and to provide technical advice and monitoring services
essential to safe conduct of the operation. The senior repre-
sentative of the Radiological Safety Section so assigned will be
responsible for getting required instruments and approved goggles
to the operating unit and will see that the instruments are prop-
erly installed in the plane. He will issue "casualty badges" and
"personnel badges" (film) to personnel before flights.

(13) All operational planes, including drones, which have been airborne
between Mike hour and Mike plus 30 hours, will be monitored for
radioactivity on landing. This will be the responsibility of the
monitor assigned to the air unit for this specific purpose and
will not be the responsibility of the monitor within the particu-
lar plane. In monitoring planes, the monitor will pay special
attention to the oil filter and to oil splashes on the exterior of
the plane where radioactive particles will be held, if at all.
on the plane. It is believed that, excepting the drones, no other
planes will collect enough radioactive material to be a hazard
to ground crews. In the case of the oil splashes or oil filters
that are contaminated, the hazard will have little range (a few
feet at the most). Risk will be incurred only by (a) prolonged
exposure within a few feet of the contaminated part of parts of
the plane (hours, not minutes) and/or (b) direct touch or handling
of the oil filter or oil splash. Most radioactive particles will
not adhere to the clean skin of the plane. Greasy spots and oil
splashes will collect radioactive particles. Heating down with
water would remove most of the loosely attached radioactive par-
ticles if there were any there. Air movement (wind) would have
the same influence. This would occur (a) naturally in flight, (b)
standing in the open (weathering).

(a) "Drones" will be considered as being heavily contaminated
until proven otherwise by the monitor specifically assigned
to the drone landing site. He will be prepared to keep per-
sone far from the immediate vicinity of the drone until
he has monitored it and advised the local commander of its
safety or hazard. He will then advise the local commander on
to the necessity for posting sentries, delimiting areas of hazard, and such other actions as are required to protect personnel locally. Ground crews and personnel approaching drones that have been exposed will wear "personnel" badges as provided by, and in accordance with the instructions of, the monitor assigned to the landing site.

(bb) In the event that seaplanes are forced to land in contaminated waters, it will be the responsibility of the monitor specifically assigned to the seaplane base, or other landing place, to apply such measures as are required for detection of hazard on return of the aircraft to base and make recommendation to the local commander as to actions desirable to protect personnel locally.

(cc) The above considerations (bb) apply to PUMs engaged in reconnaissance of the air over the lagoon.

(14) [Deleted]
(15) [Deleted]
(16) Except for certain missions especially authorized by Radiological Safety Control, the pilot of any airplane, upon finding radioactivity, will take immediate evasive action, leaving the area in such a manner as to put the area of contamination directly on his stern as quickly as possible.

(17) When a pilot encounters a situation such as that described in paragraph (16), he will take the necessary action at once and report the observations and his actions, including position and altitude, to Radiological Safety Control, Flag Headquarters, CTF-1 as promptly as practicable.

(18) The action described in paragraphs (16) and (17) is a "MUST" as life shall not be risked beyond this point.

(19) If planes do not encounter conditions depicted in paragraph (16), they will continue with the operation as planned.

(20) All monitors, and all personnel employing radiological measuring instruments, will keep a log of observations if at all practicable. These logs should confirm the information reported to the Radiological Safety Control, Flag Headquarters, CTF-1.

(21) Any air operation may be terminated at any time by the Commander Joint Task force One on advice from the Chief of the Radiological Safety Section. If it appears that continuation of the operation entails an unwarranted risk. Meteorological conditions may alter the behavior of the radioactively contaminated column, or of the downwind cloud, in such a manner as to prevent an unpredictable hazard. This is unlikely to occur before Mike hour plus 6 minutes. The likelihood increases progressively after this time, requiring that the initial phase of the air operations be concluded by Mike hour plus 30 minutes.

(22) "Casualty badges" (titanium) and "personnel badges" (titanium) used in air operations will be collected by personnel of Radiological
Safety Section upon completion of the operation. These devices will be suitably labelled and as promptly as possible returned to Photometric Division, Radiological Safety Section on board HAVEN for processing.

(23) Personnel and planes engaged in these air operations will be monitored by personnel of the Radiological Safety Section immediately after landing. Observations will be logged and where significant readings are found, reported at once to Radiological Safety Control, Flag Headquarters, CJTF-1.

(24) If planes for press, radio, nonparticipating observers, or photographic purposes are airborne during the period of the air operations, or thereafter, they will comply with the requirements of this appendix.

(25) Should any plane be unable to maintain contact with the Force Fighter Director, and hence be unable to get directions relative to hazardous areas, the pilot will take such action as will take him at once toward safer upwind areas and withdraw from the operation until communications are reestablished.

(b) Protection of Pups at "H" Hour

(1) General-purpose goggles fitted with ND 4.5 Filter Replacements will be provided all personnel airborne at "H" hour. An exception in the case of the Navy Drone Unit (Tank Unit 1.6.1), which will employ a special blue amber combination of light filters specified by dispatch. No other unit will deviate from the use of ND 4.5 goggles unless so authorized by CJTF-1. Senior radiological monitor attached to air operation units will see to it that they are available and will check to see that all personnel airborne at this time are so equipped before taking to the air. He will also see to it that they have had previous instructions in the proper use of the goggles and in eye protection.

(2) The bombardier on the bomb-carrying aircraft will announce a warning to put on goggles at two minutes before the time of bomb release. At start of the automatic tone signal (one minute before bomb release), all personnel will adjust the goggles over their eyes. (Note exception as to signal in para. 3.(d)(4) below.) Immediately after announcing "bomb away" for the last time, the bombardier will issue his final warning to put on goggles.

(3) At signal for bomb release ("bomb away," stop of tone signal), as an extra precaution all personnel will turn their faces away from the target until after the flash of light and heat occurs, after which they may immediately remove the goggles and observe the rise of the fireball on column of smoke.

(4) Copilot(s) In planes with copilot, will take extra precautions to ensure greater safety. They will attempt to protect eyes completely. Copilot(s) will have goggles adjusted by release time. 5 minutes. At start of automatic tone signal one minute before bomb release, copilot(s) will cover goggles and eyes with hood in order to completely protect the eyes. After the flash, arm and
goggles may be removed and the column observed. This will permit copilots to take over in case pilot is temporarily blinded.

(5) The chances that a pilot will be partially blinded while using these goggles are remote, particularly if the pilot's position is such that he cannot, or does not, view the explosion directly.

4. The Chief of the Radiological Safety Section will issue to the force such additional safety precautions as are necessary.

APPENDIX IX

GENERAL CONSIDERATIONS
RADIOLOGICAL SAFETY
TEST BAKER

1. PHENOMENA ACCOMPANYING THE EXPLOSION

In Test BAKER, the mechanism of the nuclear reaction will be identical with that in Test ABLE. However, since the explosion in Test BAKER will occur in a water rather than in a gaseous medium, the phenomena that will be observed as a result of this explosion will be quite different from those that were seen in Test ABLE.

In Test ABLE, the sphere of hot gases formed by the nuclear reaction has been aptly described as a "ball of fire" that rises rapidly toward the stratosphere. In Test BAKER, the hot gases will take the form of a rapidly expanding "bubble" below the surface of the water of the lagoon. This "bubble" quickly rises to the surface of the water. It is the interaction of the "bubble" with the water that is responsible for the new or modified phenomena that are described below.

A. RADIATION

The water that encloses the "bubble" is much more effective in absorbing radiation (both gamma rays and neutrons) than in air. Hence, the primary radiations produced by the nuclear reaction will have a much smaller range than they did in the ABLE shot.

B. HEAT AND LIGHT

The water will cool the hot gases much more rapidly than did the air. Hence, the temperature of the "bubble" when it reaches the surface of the lagoon will be low as compared with the initial temperature. This means that heat and light will not be emitted in intensity that will injure personnel nearby. Observers in the air and in surface vessels will see an illumination of the water and overlying clouds but will not be conscious of a "ball of fire" rising from the surface of the lagoon.
C. WATER BLAST

The water will accept a certain portion of the energy of the "bubble." This energy will then be propagated in the water outwards from the explosion in the form of a shock wave. This water blast will be more damaging to ships' hulls than was the airblast (the analogue of the water blast in the previous test). Probably, various reflections may either enhance or diminish the forces exerted in different locations so that the damage may not be uniformly or symmetrically distributed about the center. This has its analogue in airblast also.

D. MOVEMENT OF THE WATER

The rapid expansion of the "bubble" will cause a number of different types of responses in the surrounding water: (a) A mound of water and steam in the "dome" above the expanding gas bubble will be thrown upward from the surface of the water. This water will rise to a height estimated to be 5,000 to 8,000 feet and before breaking up into spray will have a calculated diameter of about 2,500 feet. (b) After the water from the "dome" has ceased rising, its summit will be pierced by a jet of water forced up from the bottom of the lagoon with the collapse of the gas bubble. This jet of water, called the "plume," may extend vertically two or three miles into the air in a matter of 10 to 15 seconds. Most of the water will fall to the lagoon in a matter of minutes. A small fraction of the water may remain suspended in the air as vapor. This column of vapor has been called the "ghost plume." Some of the gaseous detonation products in the "bubble" may escape up the ascending water and spray mass and collect about the top of the plume. These will be radioactive.

E. WAVE FORMATION

As a result of the movement of the huge masses of water described under section D, waves will be produced on the surface of the lagoon. These waves will spread out from the point of detonation in a concentric fashion. The waves will probably not be greater than 50 to 75 feet in height and 500 yards in length. At a radius of 4,000 feet the wave height will decrease rapidly as the waves move outward.

F. DISPOSITION OF FISSION PRODUCTS

As the bubble disappears, the fission products formed by the nuclear reaction will be dispersed in the water of the lagoon, as well as in the water of the dome and the plume. It is estimated that fifty percent or more of the fission products will be present in a circumscribed area in the lagoon within a few minutes after the explosion. Water vapor containing fission products will remain in the vicinity of the plume as a "ghost plume." The upper portion of this ghost plume may eventually form a low lying cloud that will be carried off by the prevailing winds. It is possible that such a cloud may draw in the fission products from a wide area and concentrate them in the form of rain. The high-level mushroom-shaped cloud so characteristic of nuclear explosions in air will
not occur in this test, although a small cap of vapor may develop at the top of the plume.

2. HAZARDS RESULTING FROM THE EXPLOSION

The hazards resulting from Test BAKER can be divided into two types according to the time at which they make their appearance.

A. IMMEDIATE HAZARDS

(1) LIGHT AND HEAT

The water will shield the observers from the initial intense flash of light and heat and will rapidly cool the bubble so that these factors will not present a serious hazard to observers. Thus, the explosion can be viewed with safety by the naked eye from a distance of 7 or more miles.

(2) WATER AND AIR BLASTS

The blast waves will not be strong enough to affect ships at a distance of ten or more miles from the point of detonation, particularly because of the interposition of the reef.

(3) FRAGMENTS

It is possible that large fragments may be accelerated to high speeds in the air and that their trajectories may extend for considerable distances. It is extremely unlikely that these fragments will cover a distance of ten miles.

(4) WAVES

A series of waves on the surface of the lagoon will be formed by the explosion. These waves may have an initial height of 5 to 75 feet, but will rapidly expend their energy and probably not wash over Bikini Atoll. The waves will not endanger ships at a distance of 10 miles.

(5) RADIATION

The range of the gamma rays and neutrons produced by the nuclear reaction should be much less than that in Test ABLE because of the radiation-absorbing properties of the water surrounding the "bubble" as it is formed. The fission products present in the "bubble" will then be mixed intimately with the water in the plume and lagoon. Those fission products in the plume should emit intense radiation over a small distance in the air because there is considerable absorption of radiation by the water in the plume. Hence, there is no reason to believe that there is a hazard from radiation at the points of observation.

B. DELAYED HAZARDS

(1) DELAYED HAZARDS OF THE WATER OF THE LAGOON AND TARGET VESSELS DUE TO RADIOACTIVITY

It is estimated that the greater part of the fission products will be present in the lagoon after the water in the plume has returned to the surface. Most of the radioactivity that has not
gone up in the air will be uniformly distributed throughout the volume of a cylinder of water whose central axis will be formed by a line drawn upward to the surface of the water from the point of detonation. Most of the radioactive fission products in the water and spray that return to the lagoon from the plume will probably fall around and over this cylinder and shortly thereafter form a tongue on the surface extending several miles in the downwind direction from the contaminated cylinder described above. All ships in the area occupied by the tongue thus will be heavily contaminated by radioactive materials falling from above. Thus, it is the hazard from the radiation emitted by the fission products present in the large volume of water in the target area that present the greatest hazard to personnel returning to the lagoon. The hazardous radiation will be primarily gamma and beta in character. Beta rays are dangerous only if the radioactive materials are kept in contact with the skin for a long period of time or if the materials are taken into the body in appreciable quantities. The danger to personnel from inhalation or ingestion of radioactive materials is nonexistent when the radiation hazard in the cleared area is below 0.1 R/24 hours.

(2) DELAYED HAZARDS OF THE WATER OF THE AIR IN THE REGION OF THE "GHOST PLUME" DUE TO RADIOACTIVITY

The residual radioactive materials that have been left in the air with water droplets in the ghost plume should be rapidly carried away by the prevailing winds within thirty minutes after the explosion so that there should be no danger from these materials except in the downwind region.

(3) DELAYED HAZARDS OF THE CLOUD DUE TO RADIOACTIVITY

As mentioned above, it is possible that the upper portion of the plume may form a low-lying cloud, the radioactivity of which may be precipitated in the form of rain in the downwind area. This hazard may be greater in Test BAKER than in Test ABLE since the airborne radioactive material will be concentrated in the lower altitudes. However, for the same reason, the danger sector will be narrower in the BAKER Test.

3. PROTECTION

A. Against the primary effects of radiation, distance will provide necessary protection.

B. Against the secondary effects due to excessive waves, airblast and underwater shock, distance will provide necessary protection.

C. Against the secondary hazards due to radioactivity, detection and avoidance provide the best means of protection. This will form the basis of the Safety Plan as far as radiological hazards are concerned.
4. DETECTION AND MEASUREMENT OF RADIOACTIVITY

Suitable instruments will indicate both the presence and intensity of the radioactivity at a given place. The methods successfully employed in Test ABLE will be used. Instruments will include Geiger counters, proteximeters, pencil electrometers, ionization chambers, personnel badges (film), casualty badges (film), surface rate meters, underwater counters, "probe" meters, etc.

5. AVOIDANCE AND MEASUREMENTS

Area reconnaissance, maintenance of "contamination situation maps," designation of contamination areas by suitable means to JTF-1, and the posting of dangerous areas in ships or on land surfaces will constitute the active measures of avoidance. Exposures in excess of 0.1 roentgen per day will be avoided and this will be the limit of tolerance acceptable during the operation. This can be effectively measured by the methods employed in Test ABLE. This is well within the safety limits. In Test BAKER, due to the greater intensities of residual radioactivity anticipated, it will be particularly necessary to observe this limitation of exposure.

6. ANTICIPATED HAZARDOUS AREAS

A. IN THE AIR

(1) Air immediately over the surface of the lagoon, particularly directly over the center of the target array, may be dangerous due to: (a) radiation from surface of the water of the lagoon and from the target ships, and (b) to fallout of mist containing radioactive materials.

(2) The most serious radiation hazard will exist in the air within 3 feet of the surface of contaminated water. This will be particularly serious in the surface water initially in the central target area and particularly during BAKER Day. The intensity of gamma radiation from the target area water will be great enough to be hazardous for vertical distances of from 500 to 4,000 feet. These hazards due to water contamination may persist for several days and decrease in intensity with time and dilution with clean lagoon water. It is likely that the air for some distance above the surface of the water of the lagoon and downwind of the explosion may present a relatively high content of radioactive materials in mist or vapor that will be hazardous to planes flying at altitudes of 500 to 1,500 feet for several hours.

(3) Beyond the lagoon and downwind there will be an airborne hazard due to radioactive mist or particles. In some instances this may be held up in a low-level cloud, which may present a serious hazard. This may travel downwind for a distance of 100 to 150 miles or more. At a distance of 200 to 300 miles, it is unlikely that any air hazard may exist for air operations. Airlanes at a distance of over 400 miles will be endangered at no time.
B. IN THE LAGOON

(1) WATER HAZARDS

(A) SURFACE WATER

The surface water (to a depth of 40 feet) will contain radioactive particles that are initially deposited in the central area of the target array and will tend to move down current at a rate of approximately 0.5 knot. Downwind of this central area, there will be additional contamination of surface water as a result of water falling from the "plume." This will make surface operations dangerous downwind and down current from the central area for an unpredictable time since the exact pattern of the contaminated surface area cannot be predicted, since much of it will depend upon the character of the surface winds and waves and the height and characteristics of the "plume" arising from the explosion.

(B) Subsequently, the surface water will receive an additional contamination. This may arise from contaminated water that has formerly been in the lower layers of the lagoon and moves in the opposite direction to the surface layers; thus, this deep layer can come up to the surface (upswell) upwind to the target area. Following this upswelling the deep water mixes its contamination with the surface water and moves downcurrent with it. It is anticipated that many subtle hazards difficult to forecast may arise in the water of the lagoon during the first three or four days. Later, the distribution of the radioactive material within the water of the lagoon may tend to be more homogeneous. Brisk surface winds will tend to favor mixing and dilution. Some surface water will leave the lagoon and will carry with it some radioactive material. Some entrances to the lagoon may be hazardous as a result of this. Winds, tides, and length of time decay following a detonation will exert important influences in this respect.

(C) SUBSURFACE WATER

Subsurface water (below 40 feet) will be contaminated with radioactive material initially in the region of the central target area. This will tend to move generally to the east "upwind" at a rate of approximately 0.1 knot (while the surface moves to the west at approximately 0.3 knot). Mixing and diffusion of the radioactive material within the water may be so slow as to prolong the persistence of very hazardous undiluted masses of water with high radioactivity. This may give rise to irregular areas or patches both below the surface and on the surface of the water of the lagoon.

(2) HAZARDS IN TARGET SHIPS

(A) TOPSIDE SURFACES

Topside surfaces will become contaminated with water containing radioactive materials. This will arise from water falling
from the "plume" and from contaminated water of the lagoon being splashed on the target ships. In general, there will be negligible induced radioactivity in the metals of the ship. Evaporation of the water will tend to leave radioactive fission products dried on the exposed surfaces of the ships.

**B**  **BELOW DECKS**

Below decks and in compartments of the target ships, radioactive hazards will be found due to some extent to radioactivity in the water outside the compartment or radioactive material on the surface of the ship. In the main, the more serious hazards will arise from water initially highly contaminated and trapped within the compartment. Due to the fact that this water will usually not be diluted by water from without the compartment, the benefits of dilution, mixing, and dispersion will be lacking. This will result in localized hazards of relatively high intensity and probably with greatly increased persistence.

**C**  **HAZARDS ON THE ISLANDS OF THE ATOLL**

If waves of contaminated water roll over the land surfaces, radioactivity may be found in these areas. It is likely this will not occur during the early phases following the explosion as the contamination within the water is well localized. Later, land surfaces downwind may be contaminated by water or mist settling out from the air. Later, also contamination within the water of the lagoon may extend into such areas as may wash up on the sandy beaches of the islands. Lesser contamination may be found at variable distances from the beach, depending on how far the wind may carry contaminated spray and droplets in from the beach. Serious hazards will hardly be developed in this manner.

**D**  **HAZARDS AT A DISTANCE**

Airlanes beyond 400 miles will not be endangered at any time. It is probable that no hazard will exist for planes operating at distances beyond 300 miles. Special monitoring is desirable for islands within 200 miles downwind. Contaminated water leaving the lagoon will not set up hazards at a distance beyond 50 miles. It is believed that projectiles will not create a hazard beyond a distance of 10 miles from point of detonation.

7. **ESTIMATE OF RADIOACTIVE HAZARDS IN RELATION TO OPERATIONS**

**A. SELECTION OF A DAY TO SHOOT**

If the winds at all altitudes below 25,000 feet are within a sector no greater than 5°, and if this sector lies within 45° and 135°T, the most suitable conditions will exist with regard to radiological safety. Winds from the southeast will not be as desirable as those from the east or northeast due to the greater likelihood of upwelling of contaminated water in the lagoon near the entrance to Emu Channel.
B. SAFETY OF SHIPS OF FORCE

(1) If at the time of detonation all ships of the Force are stationed upwind of the detonation and not closer than 10 nautical miles to the central target area, they will be safe from any effects of the explosion.

(2) Subsequent to the detonation the radioactivity that is airborne will be carried downwind and away from the areas to which the ships have been assigned. By the time reentry can be attempted, no danger from particles falling out of the air will exist within the lagoon.

(3) During reentry, it will be necessary for the radiological reconnaissance of the lagoon to establish the distribution and characteristics of the radioactive contamination within the lagoon before any ships may be permitted more than limited entry. It may be possible to have ships essential to the early reentry and safety reconnaissance operations approach within the entrance to the lagoon where they may be safe until the termination of that working day. This possibility seems likely due to the fact that diffusion and dispersion of the radioactive products within the water is expected to be slow enough on BAKER Day to safely permit essential ships to enter just inside the lagoon, but prepared to withdraw on an hours notice and planning to withdraw from the lagoon before dark. By BAKER plus one day, it is expected that the contamination within the water may have spread in such a manner as to constitute a hazard that can be determined only by radiological safety reconnaissance. During the first few days following BAKER Day it will be necessary each day to conduct a cautious safety reconnaissance and limited reentry operation. It is likely that ships not essential to the early reentry phase and to the safety reconnaissance cannot reenter the lagoon for five or more days. Hazards that may be anticipated in connection with boating and with the operation of the ships may make such reentry of other ships impracticable if not actually unsafe.

C. AIR OPERATIONS

(1) PERIOD MIKE TO MIKE PLUS 30 minutes

There is strong evidence to indicate that the hazard from blast, heat, and light will be essentially negligible. There is also good evidence to believe that during the first six minutes that the radiological hazard will be confined to a cylinder not to exceed 5 miles in radius and extending vertically upward. After 6 minutes the hazard tends to move downwind as the spray and mist are carried by the wind. Operations outside the prescribed RADEX will be safe provided that the visible cloud of mist or shower of water (if any) is avoided at a minimum distance of 5 nautical miles and that the intensity of radioactivity does not exceed 0.1 roentgen per 24 hours. While the intensity of the radioactivity during this period is believed to be high, its distribution will probably be quite localized and limited to the area to be designated as RADEX. Operations within this area would be dangerous during this 30-minute period.
(2) PERIOD AFTER MIKE PLUS 30 minutes

(a) PBM CHARLIE

It is unlikely that there will be any hazard from mist or fallout after Mike plus 30 minutes, but it must be anticipated as the central target array is approached. The contours of radioactivity from the surface of the lagoon will be approached cautiously in the same manner as in Test ABLE. It is not known whether this will be observed at greater altitudes. This information will be ascertained by this reconnaissance. The intensity of the radiation given off from the water surface will be greater at lower levels, i.e., from surface up to 4,000 feet.

(b) PBM DOG

It is unlikely that any radioactivity will be encountered in the air over the ships of the force. Reconnaissance of the air over the lagoon will be detected as in Test ABLE.

(c) Personnel in helicopters, if operating over contaminated areas of the lagoon, would be in danger of falling into dangerous water in case of engine failure.

(e) Planes operating in the air over the lagoon will be exposed to radioactive effects, if they enter those areas that PBM Charlie and PBM Dog ascertain to present a radioactive hazard. The day-to-day changes in these areas can be determined only by the reconnaissance of these areas on successive days by PBM Charlie and PBM Dog. Surface reconnaissance may assist in localization of these hazards in the air over the lagoon. This hazard may not be important after BAKER plus one day.

(e) Planes operating near the lagoon after Mike plus 30 minutes will not be exposed to radioactive hazard if they avoid the downwind sector provided by an extension of the radial boundaries of the RADEX. In general, this area in Test BAKER will be similar to the Surface Survey Sector. It will extend for 150 miles from the central target area.

(f) Air-sea rescue planes cannot operate within the lagoon until the water is safe radiologically.

(g) PBM planes of Bikini-Kwajalein air shuttle will not be able to operate from the lagoon until a suitably safe anchorage for the seaplane tender can be provided. This is unlikely before Mike plus 5 days.

D. DRONE BOAT OPERATIONS

The operation of BEGOR and the TBM planes will be in safe area; hazard of this operation lies in the handling of the radioactive water samples. Adequate protection can be provided in the manner planned. This may be accomplished by using several persons for short times, i.e., still within the period required to give no more exposure than .01 roentgen.
E. LAGOON PATROL

The PGMs and LCPLs will commence operations within the lagoon at a time when there is no danger of fallout from the air. Initially they will probably be able to advance well within the entrance to the lagoon and with safety detect and outline the contaminated surface layers and the deeper layer, which may upwell in unexpected places. It appears to be likely that this phase of the operation can be successfully conducted on BAKER Day. The operation on BAKER Day plus one will have to be initiated more cautiously than on BAKER Day due to this uncertainty of the spread of the contamination within the water of the lagoon. It is possible that the reconnaissance of the waters of the surface layers of the lagoon and of the lower layers may be required beyond five days. During this operation the air within 3 feet of the surface of the water will contain the most significant radioactivity. The methods of protection employed in Test ABLE will be equally successful in Test BAKER. "Hot" areas that upwell may "trap" PGMs or LCPLs, so this hazard will be anticipated. Destroyers operating within the lagoon would anticipate similar hazards as the small craft.

F. DESTROYERS

The likelihood of a serious radioactive hazard within 50 miles of the lagoon on the downwind side will be much more likely than in Test ABLE. Within 20 miles of the lagoon, this will probably be confined to the Surface Safety Sector. The intensity of the contamination due to fallout on the surface of the ocean cannot be predicted with accuracy, but it is probable that it would fall quickly due to dilution and dispersion within the water. A cautious approach to the boundaries of the Surface Safety Sector will be required. The methods employed in Test ABLE will provide ample protection to personnel in the destroyers. Instructions from Radiological Safety Control will assist, during the operation, the destroyer units in locating and avoiding dangerous areas. Contaminated water from the lagoon will probably not be found until BAKER Day plus one. The movement from the lagoon can be tracked with safety, employing methods employed by the Destroyers on ABLE day.

G. REBOARDING OF TARGET SHIPS

(1) It is likely that the water of the lagoon may be radiologically safe for Initial Boarding Teams to traverse prior to the time that they may attempt to board the ships.

(2) Initial Boarding Teams will encounter a variety of hazards of radioactivity. While this is due primarily to the high intensity of radiological contamination of the water of the lagoon, the next important factor will be the probable irregularities of areas of hazard within the target ships. This will require a more cautious and probably slower topside reconnaissance than in Test ABLE. Exterior surfaces may be contaminated with radioactive particles that adhere to the surface after contaminated water evaporates and leave a persistent deposit.

(3) Inspection Teams A and B will encounter hazards not encountered in Test ABLE. Compartments that are flooded or to which radioactive water gains access may be hazardous. The prevention of
dilution and the retention of highly contaminated water in this manner will constitute a serious hazard. The intensity and the duration of this form of hazard cannot be predicted. The special preparation and training of monitors in this aspect of the operation will facilitate the movement within the ships and provide adequate safety.

(4) Instrument Teams reboarding target ships will encounter the hazards characteristic of the phase at which they board the target ship, namely Initial Boarding Team or Inspection Team phase.

H. FIREFIGHTING AND SALVAGE

Firefighting and salvage operations will be limited in the early phases by the intensity and distribution of the contamination of the water and by the radioactivity of the target ship, or ships, involved. It is unlikely that such operations can be conducted prior to BAKER Day plus two, probably later. Monitors specially trained to assist in the conduct of such operations will be necessary.

I. DIVING OPERATIONS

Diving operations will be hazardous as long as the water in the lagoon is radioactive. Water at all depths must be monitored. It is impossible to predict just what radioactive hazards may exist in or near sunken ships. Methods employed in later phases of Test ABLE will be equally successful in ascertaining the presence, intensity, and distribution of such hazards.

J. REENTRY OF SHIPS OF THE FORCE

Reentry of ships of the Force will probably be delayed beyond BAKER Day plus four. Until the water of the lagoon is radiologically safe from the standpoint of small boating and from the standpoint of operating evaporators and condensers it will probably be impracticable to have the ships of the Force reenter the lagoon and take up permanent anchorages.

K. REOCCUPATION OF TARGET SHIPS BY SHIPS’ CREWS

Reoccupation of target ships by ships’ crews will be delayed. The time at which this may take place can only be determined by the situations encountered by the Reboarding Teams. Careful monitoring will be required until it can be shown that habitation within the ship is safe and the conditions required for the normal operation of the ships are known to be safe.

8. FACTORS TENDING TO REDUCE DANGERS FROM PREDICTED RADIOACTIVE HAZARDS

A. FROM GAMMA RADIATION

Despite the fact that enormous quantities of high-energy radiations may emanate from the contaminated water and cloud there are certain physical facts that will make it possible to approach and delineate such areas without excessive danger. They may be listed as follows:

(i) The intensity of radiation will diminish with the distance from the source.
(2) There will be considerable absorption in the intervening air between observer and source.

(3) The geometric consideration will also influence the distance of approach to the contaminated area. Since the source will be spread over a wide area. Flights over the area will be subject to radiation at various angles from the entire source. On the surface, however, the subtended angle will be so small, an individual will be affected only by material on the near side of the contaminated area.

E. FROM BETA RADIATION

To receive excessive amounts of beta radiation in a situation such as Test BAKER, it would be necessary to come in very close contact with the contaminated material. Protection from this will be unnecessary if the gamma radiation intensities are low.

C. The radioactive materials in the air and the water of the lagoon will become less in quantity and concentration with time. The factors that tend to bring about this diminution are as follows:

(1) DECAY WITH TIDE

The mixture of fission products is known to decay inversely with time, in hours.

(2) DILUTION AND DISPERSION

There will be slow but appreciable dilution with the surrounding media (air and water). Mixing will occur in both vertical and horizontal planes.

(3) TRANSFERRENCE

There will be gradual transfer of materials away from the test site by wind movement in the air and by currents in the water.
From: Commander Task Group One Point Two, JTF-1
To: All CROSSROADS Activities on Kwajalein -- Bikini Area
Subject: Safety Precautions Incident to Boarding Target Vessels Laid-Up at Kwajalein and Bikini

1. Boarding of the target vessels now laid up at Kwajalein and Bikini will be necessary from time to time during the coming months in connection with such work as ammunition inspection and disposal, scientific investigation, inspection and maintenance of watertight integrity and structural safety, etc. These vessels, in addition to the hazards which are inherent in any uninhabited ship which has been closed up and laid up for a long period of time, present certain other peculiar hazards which are the direct consequences of the participation of the ships as targets in the two atomic bomb tests of the past summer. These hazards, to which all personnel boarding these ships will be subjected, fall into four general categories as follows:

(a) Radiological hazards
(b) Explosive hazards
(c) Hazards due to concentration of poisonous or noxious gases and vapors in enclosed spaces
(d) Structural hazards.

2. The purpose of this letter is to summarize in convenient form the hazards to be expected and the safety precautions to be observed when boarding the target ships. It is not intended to be a treatise on the subject. All responsible officers are expected to read and familiarize themselves with [sources of safety information cited but not reproduced herein], and by appropriate instruction and indoctrination of their men, familiarize them with the dangers of the job in hand in order that their own ignorance will not lead them into danger or disaster.

It is emphasized that all possible dangers and emergencies which may arise cannot be covered in this letter, and that responsible officers are expected to exercise prudence and sound judgment in dealing with any situation not specifically covered herein.

3. GENERAL RULES
(a) All target ships, regardless of their previous radiological history, or the amount of CROSSROADS work previously expended on them must be assumed to be radiologically hazardous. Parties boarding them will invariably be accompanied by radiological monitors, and all radiological safety precautions will be scrupulously observed.
(b) The predominance of one type of hazard in any particular job to be done must not be allowed to prevent consideration of other types of hazards which may be simultaneously present, even though in lesser or supposedly negligible degrees.

(c) Safety of personnel shall be the governing consideration at all times. No job is of sufficient urgency or importance to justify departure from this guiding principle.

(d) The Pensacola, because of the presence on board of dangerously unstable 8-inch powder, is out of bounds to all personnel. No one shall be permitted to board this vessel without the express authority of SOPA in each instance.

Due to the unusual character of the conditions existing in the Pensacola, special instructions with regard to this ship will be issued at a later date.

4. RADIOLOGICAL HAZARDS

(a) [CTG 1.2 Serial 699, 17 Aug 1946] will be the governing directive for radiological safety of personnel working on target vessels. Salient points of this directive, as well as additional precautions pertinent to the nature of the work to be done, are set forth in the following subparagraph.

(b) While on the job, personnel will wear only the work clothing which is specifically issued to them for that purpose on the APL-27.

(c) Despite consideration of physical comfort, sleeves will be rolled down and gloves and proper footgear will be worn while working on target ships.

(d) All individuals while on the job will wear film badges, which will be issued, collected and processed in accordance with existing instructions.

(e) Monitors will invariably be procured and clearance obtained from RadSafe prior to boarding. Required advance notice will be given in so far as practicable.

(f) All personnel will be processed through the APL-27 for issue of clothing and for radiological decontamination on the way to and from work on the target ships. Since this activity is well established and familiar to all concerned, detailed instructions for its operation are not repeated here. The activity will be administered by the Commanding Officer of the Geneva and subsequently by the Commanding Officers of such vessels as may successively relieve and take over the functions of station ship and hotel ship now being performed by the Geneva.

(g) With the decontamination center on the APL-27 in operation and the use of "sour" boats, it is not believed that the prevention of contamination of non-target ships will present a serious problem. RadSafe will make periodic surveys of non-target ships and will issue such instructions from time to time as are deemed necessary.
(h) Boats used for carrying working personnel back and forth between
the APL-27 and the target ships will be monitored and scrubbed
when necessary as described in [CTG 1.2 Serial 699].

(i) With the possible exception of ammunition disposal, the remaining
work to be done on the target vessels will not involve the same
degree of intimate contact with sources of contamination as did
the earlier decontamination work on these ships. Nevertheless,
the same dangers still exist, and the same precautions will be
exercised.

(j) Working parties will be kept concentrated as much as possible and
men will not be permitted to roam about the ship at random.

(k) All hands should be warned that standing pools of water about the
decks, even in supposedly uncontaminated parts of the ship, are
potentially serious radiological hazards. The reason for this is
that during rain squalls water may enter a contaminated part
of the ship's structure and then be carried through the drainage
system and deposited in a clean part of the ship.

(l) Ship's blowers will not be operated except when necessary, and
then only when the ventilation system has been checked by RadSafe
and cleared for operation.

(m) Due to the danger of inhaling radioactive dust, no dry sweeping
or dusting will be done on any part of the target vessel. It is
not considered likely that any work of this nature will be re-
quired. If accumulation of dirt or trash interferes with efficient
working, it will be removed by hosing down, if practicable, other-
wise by wet brushing or wet swabbing. Swabs if used will never be
wring out by hand but will be taken topside and placed in a bucket
of water. If available, otherwise hung on the life lines to dry.

(n) The danger of ingestion of radioactive material by the mouth must
always be borne in mind. All working personnel must be made con-
scious of this danger and instructed not to eat or smoke or other-
wise place contaminated hands in, on, or near the mouth. Lunches
will under no circumstances be served to men on the target vessels
and working parties will not be fed until they have been processed
through the decontamination center on the APL-27.

(o) No men with open wounds not securely covered and protected by
bandages will be permitted to perform work on target vessels, and
officers in charge of working parties will be vigilant to detect
and eliminate men with such wounds. This precaution particularly
applies to wounds on the hands, which should not only be bandaged
but also protected by rubber gloves while working. Any wound,
however small, received while working aboard target vessels should
be immediately scrubbed well with soap and clean water. The in-
jured man will then be processed through the decontamination cen-
ter and taken to sick bay on the Haven where surgical debridement
may be performed.

(p) Handling of objects on board target vessels will be reduced to
the minimum required by the nature of the work to be done. The
practice of taking objects as souvenirs from target ships will be vigorously guarded against and sternly suppressed.

(q) No personnel shall go below decks on target vessels unless wearing oxygen rescue breathing apparatus or positive pressure mask.

(r) An additional inhalation hazard exists in connection with mechanical operations as cutting and chipping. Personnel performing such work will wear rescue breathing apparatus or positive pressure masks.

(s) If evaporators are opened for any purpose, such as removal of tubes or scale, all personnel on the job will wear rescue breathing apparatus or positive pressure masks. Shirt sleeves will be rolled down and rubber gloves will be worn. A radiological safety monitor will also be in attendance.

(t) Any articles or materials to be removed from target vessels will be monitored in an area where no contamination exists prior to being taken aboard any non-target vessel or sent to any shore installation.

5. EXPLOSIVE HAZARDS [not reproduced]

6. HAZARDS DUE TO NOXIOUS OR POISONOUS GASES OR VAPORS [not reproduced]

7. STRUCTURAL HAZARDS [not reproduced]
I. ORGANIZATION

A. Radiological Health Section
   1. Evaluation of radiological hazards and recommendations for safety procedures
   2. Photographic dosimetry

B. Radiological Safety Section
   1. Monitoring operations
   2. Decontamination "change stations"

C. Radiological Health Advisory Board
   1. This Board will consist of the Radiological Health and Safety Officers and such scientific personnel as may be appointed by the Project Officer of the resurvey. It will advise, evaluate, and make recommendations in writing to the Radiological Health Officer in special radiological health matters not covered in BuMed directives; i.e., radiological clearance of questionable areas.

II. STAFF

A. Radiological Health Officer
B. Radiological Safety Officer
C. Radiological Health Advisory Board

III. MISSION

The mission of the Radiological Health and Safety organization will be to protect personnel from radiological health hazards that may be encountered in the Bikini Scientific Resurvey operations.

IV. TASKS

A. The Radiological Health Officer and the Radiological Safety Officer will prepare the Health and Safety Plans to be followed in this operation, and will be responsible for the execution of radiological health and safety directives. They will organize and direct all medical and technical elements of the operation required to execute this plan.

B. The Radiological Health and Radiological Safety Plans are attached hereto as Appendixes I and II, respectively.
Appendix I
Radiological Health Plan

I. RECOGNIZED RADIOLOGICAL HAZARDS

A. Two types of radiological hazards are recognized: "external radiation" and "internal radiation." The former is the type received when standing in the path of a powerful X-ray beam. The latter produces an effect similar to that resulting from the ingestion of radium or the inhalation of radioactive dust.

B. Because of the natural radioactive decay that has taken place since Test A and Test B, the "external radiation" hazard is of lesser importance, but in some localities may prove to be dangerous.

C. The "internal radiation" hazard, however, may still be important. It is characterized by the fact that the injurious material produces damage only when it gains access to the body through ingestion, inhalation, or through breaks in the skin. It may best be visualized on the one hand as comparable to the hazard present in the mining of radioactive materials (inhalation), and on the other to that encountered in the painting of radium dials (ingestion). Even in cases of extreme exposure, characteristic clinical findings may not appear for several years. Even when the exposure is not sufficient to cause death, it may produce tumors in various tissues.

II. ESTIMATE OF CURRENT RADIOLOGICAL HAZARDS

A. General Information

1. The detonation of an atomic bomb liberates an enormous quantity of electromagnetic radiations and neutrons. The electromagnetic radiations include infrared, visible light, ultra-violet light, X-rays, and gamma radiation.

2. Thereafter, the products formed during the fission process emit gamma rays and beta particles, constituting the "external radiation" hazard.

3. The bomb also releases other products that constitute an "internal radiation" hazard.

B. Present Hazards as a Result of Test A (airblast)

1. None.

C. Present Hazards as a Result of Test B (underwater blast)

1. In an underwater burst such as Test B, the radiation resulting from residual radioactive products still may be of considerable magnitude.

2. The products of fission sometimes are absorbed and concentrated in and on ships, corals, algae, and animals. At the present time, radiation hazards of this sort seem remote.
3. However, the highly dangerous unfissioned material producing alpha radiation has a half-life of several thousand years, and will be practically undiminished in intensity due to decay. It was more or less concentrated immediately following Test B, but probably will not be more widely distributed within the atoll area.

4. These unfissioned alpha emitters, together with the fissioned beta- and gamma-radiating products, will occur in greatest concentrations in the area of the coral crater produced by the underwater blast.

5. The sunken ships in this area can be considered contaminated to a relatively high degree, and other areas throughout the lagoon will be considered dangerous until radiologically cleared.

6. Algae, fish, and other marine organisms may contain relatively high concentrations of both fissioned and unfissioned materials.

III. PERSONNEL PRE-EXAMINATION

A. All personnel, both military and civilian, who are to participate in the Bikini Scientific Resurvey will be required to have a special physical examination prior to entering upon such duty.

B. Special medical records, separate from the individual's health records, will be set up under the cognizance of the Radiological Health Officer, and will be classified Confidential.

C. Particular attention will be given to a history of skin sensitivity and respiratory allergy, and it will be necessary to eliminate from contact with radioactive material personnel who have chronic infections or chronic conditions of any nature, particularly skin or respiratory infections, blood dyscrasias, extensive fungus infections of the skin and scalp, precancerous lesions, and all open wounds on the hands.

D. The clinical laboratory examination will include, in addition to a complete blood count, an erythrocyte sedimentation rate, and X-ray of the chest, and a complete urinalysis. Beta counts will be made on the urine when indicated, and if necessary, more extensive radiochemical analysis will be completed. The X-ray of the chest is considered important for future reference, and will be made on full-sized film and filed in the "special medical record."

E. These examinations must be completed before personnel will be given medical clearance to engage in the Bikini Scientific Resurvey.

IV. PERSONNEL FOLLOW-UP EXAMINATIONS

A. All personnel will be given a follow-up medical examination upon completion of the Bikini Scientific Resurvey, even though it is unlikely that any evidence of overexposure will be encountered if safety regulations are followed.

B. Particular attention will be given to the hands for any signs of radiation effects, such as reddening of the skin around the nails or
changes in the fingerprints. These observations will be used as a screening method to select those who should be referred to a Medical Advisory Board for more careful evaluation.

C. The urine will be carefully studied in case of accidental overexposure to radiation or radioactive materials. Beta counts will be made, and if twice background or higher is found in any urine sample, more extensive radiological tests will be carried out.

D. The follow-up examination will include complete blood counts, and an erythrocyte sedimentation rate. All blood samples should be obtained under similar technique, and at the same time of day for each individual. Since a variety of changes is possible in the blood picture after exposure to radiation, all blood counts will require interpretation by a medical officer trained in the special problems of hematology in radiation sickness. In cases suspected of overexposure, or when unexplained laboratory findings occur, total erythrocyte and leucocyte counts will be made, and urine beta counts repeated. Individuals presenting these findings, and individuals known to have received overexposure to external radiation, as shown by photographic dosimetry, will be eliminated from further possible exposure pending the outcome of these studies.

V. PERSONNEL PROTECTION

A. General Information

1. All personnel will be issued protective clothing consisting of caps, green work pants and shirts, canvas gloves, and work shoes.

2. This uniform will be worn by all personnel working at tasks or in areas considered dangerously radiologically contaminated.

3. The wearing of protective clothing and the use of other designated protective measures must be rigidly followed until the radiological situation has been evaluated by the Radiological Safety and Health Sections.

4. Navy Gas Masks with B-2 canisters will be made available for use in situations where radioactive dust is found present in hazardous amounts.

5. The Radiological Health Officer will make recommendations as to changes in safety regulations as the situation may require.

B. Beach Working Parties:

1. Initial beach working parties will be accompanied or preceded by a Radiological Safety Officer, and all members of each party will wear the prescribed protective clothing.

2. The Radiological Safety Officer will determine if any contamination exists, and will collect suitable samples of materials for laboratory examination aboard ship.

3. Great care shall be taken to avoid eating or drinking with, drinking or eating with, any materials found on the islands until radiological clearance has been given. In most cases this
clearance will require shipboard laboratory tests of the materials in question. (There shall be no swimming in lagoon waters until clearance has been given by the Radiological Health Officer.)

C. Scientific Expeditions to Beaches and Reefs
1. A Radiological Safety Officer will accompany all initial expeditions to reefs and beaches.
2. All protective measures will be executed until the radiological situation has been fully determined and clearance given by Radiological Health Officer.
3. Care must be exercised to avoid cuts and scratches from sharp coral, as open wounds are extremely hazardous when handling materials contaminated with radioactive fission products and un-fissioned materials. If any such wounds occur accidentally, the Radiological Health Officer will be notified immediately.

D. Camps Ashore
1. All new camp sites and existing camps, buildings, and other materials which may be utilized as a shore-based camp for living purposes, will be checked by monitors before use, and laboratory analyses of samples will be made, when and if indicated.
2. Particular attention will be given to drinking water in tanks and service pipes. Water analysis will be made before such facilities are rehabilitated for use.
3. All gear that is found on Bikini Island associated with the preparation of, and handling of food and drink, must be thoroughly scrubbed clean, and radiologically cleared before being returned to such service.
4. Rusty or corroded materials must not be allowed to come in contact with food or drink.
5. The north end of Bikini Island was the most heavily contaminated, and special precautions must be taken if camp sites are required in this area. Under no circumstances will marine life of any type (found within or about the atoll) be eaten, unless prior radiological health clearance has been given.

E. Diving Operations
1. The deep-water diving operations for the inspection of the sunken target ships probably will constitute the greatest radiological hazard to Resurvey personnel. Most of these operations will be within or about the coral crater formed by the underwater blast. The coral and sediment, as well as the ships in this sector, were highly radioactive following Test B of last year. Allowing for natural decay, there still will be considerable radiation present, together with hazardous quantities of fissioned and un-fissioned material.
2. All protective measures will be adhered to by personnel engaged and assisting in those operations.
3. Radiological Safety Officers will determine the extent of the radiation, and safe working period with deep-water survey probes, at the site and prior to the diver's descent.

4. All diving clothing, gear, and associated equipment that has been submerged will be washed off with a stream of water as it is hoisted, carefully monitored, and further decontaminated if necessary.

5. Divers will be monitored, and will proceed through the "change station," if necessary, for decontamination prior to being re-monitored. If any part of the body exceeds twice background count, showering or scrubbing with soap and water must be repeated until this level has been attained.

6. All personnel handling diving gear and associated equipment that comes in contact with radioactive materials will be processed in the same manner as divers.

7. While it is anticipated that radiological hazards in connection with shallow-water diving along atoll reefs will be minor, all diving areas will be initially checked by monitors with under-water probes, and laboratory samples will be taken for analysis if necessary. Based upon the monitoring reports and laboratory findings, and Radiological Health Officer will determine the protective measures necessary.

VI. PROTECTIVE PROCEDURES AND EQUIPMENT

A. Monitoring Instruments

1. For general field and personnel monitoring, the type 263 Geiger tube survey meter will be used. This instrument can detect both beta and gamma radiation in a range from less than 0.001 R/24 hr. In addition, by use of earphones, background counts can be determined.

2. For alpha detection in the field, the portable "Zeuto" nylon window ionization chamber will be used. Since this instrument requires the presence of considerable alpha activity in order to respond, a negative indication does not signify complete absence of alpha emitters. Laboratory analysis of suspected samples will be required.

3. For gamma radiation measurements in the vicinity of sunken ships and bomb crater coral, the Type 235 survey meter with an ionization chamber in an extended probe will be used. This instrument has a gamma range of from 0.001 R/24 hr to 0.6 R/24 hr, but will not detect the presence of alpha or beta radiation.

4. For supplementing film badges, the pencil type quartz fiber dosimeter will be used. This pocket type instrument depends upon the ionizing discharge of gamma radiation. It has a range from 0 to 2.0 R. Pencil dosimeters will be worn by all deep-water divers and by others as conditions indicate.
B. Photographic Dosimetry

1. A photographic dosimetry unit will be set up to issue, receive, and process film badges. The Radiological Health Officer will have cognizance of this unit. The Type K film badges used will totalize the amount of general body radiation received. They have a gamma range from 0 to 2.0 R.

2. Film badges will be worn by all deep-water divers, and all others contacting significant radiation, and will be processed daily for divers, and for others at intervals dictated by the radiation contacted.

3. Complete records will be kept of name, badge numbers, date, and hours of exposure. The exposure will be totalized for each individual concerned, and entered into the total dosage record for the operation.

4. As a general rule, an individual will be permitted to reengage in the same operation the following day only if the tolerance limit of total body radiation of 0.1 R per day has not been exceeded.

C. Decontamination "Change Stations"

1. Personnel decontamination or "change stations" will be established aboard Chilton (APA-38), Coucal (ASR-8), and on LCI(L)-615, if necessary.

2. All personnel returning to these ships who have been engaged in operations resulting in contamination to clothing or body will proceed through the "change station."

3. A special compartment will be provided for the removal of contaminated clothing; handwashing facilities, including brushes for scrubbing the nails, will be provided separate from the showers.

4. After gross dirt and contamination are removed from the hands by repeated scrubbing with soap and water, personnel will proceed to the shower and wash the body, repeatedly soaping and rinsing. They will then dry themselves in the shower room and reenter the noncontaminated dressing room, where they will be completely monitored, with special attention being given to the hair, hands, and feet. A Type 263 survey meter with earphones shall be used for personnel monitoring.

5. If any part of the body reads above twice background count, a second scrubbing and shower must be taken, and the decontamination process repeated until this level is attained, prior to donning clean clothing.

6. Contaminated clothing will be laundered in a special-purpose laundry, which will be used exclusively for such purposes. The wastewater from the portable laundry equipment will be pumped over the side and not connected to the ship's sanitary system. Monitors will inspect the laundry equipment from time to time to make sure that it is not accumulating any contamination. Clothing
that exceeds twice background gamma plus beta after repeated laundering will be discarded and disposed of in a safe manner.

D. Radiological Sample Handling and Storage

1. Care will be exercised in handling and storing radioactive samples to prevent the spilling and spreading of contaminated material about the ship.

2. All samples must be placed in covered bottles or jars wherever practicable before being brought aboard ship and well-packaged or placed in leakproof containers in such a manner that no wet or dry material can escape.

3. Special storage spaces will be designated and properly marked for the storage of "hot" samples. These spaces shall be so located that no personnel can receive more than 0.1 R/24 hours radiation from them.

4. Shelves in sample rooms shall be lined with paper or other suitable disposable material to protect against or pick up any accidental spills.

5. Scientific laboratory work tables used for contaminated material likewise shall be covered with disposable paper to prevent the accumulation of radioactive materials. This is important both as a health measure and as an aid in keeping laboratory background counts low.

6. Suitable, well-marked disposal cans shall be provided in sample sorting rooms and technical laboratories for the disposal of discarded radioactive specimens and wastes. No radioactive wastes will be discarded in the ship's sanitary system, since radioactivity will accumulate and may later present a difficult decontamination problem.

7. Monitors will be assigned to make periodic inspections of sample rooms and technical laboratories.

Appendix II
Radiological Safety Plan

I. ORGANIZATION

Chief of Section and Radiological Safety Officers. The Radiological Safety Section will be based aboard USS Chilton (APA-38).

II. GENERAL INFORMATION

Appendix I to this Annex contains general information relative to the radiological situation expected to be encountered by personnel engaged in the operations to be undertaken by the Bikini Scientific Resurvey.
III. MISSION

To determine the magnitude of the radiological hazards existing within the operational area, and to furnish the Radiological Health Officer with such data and reports as may be required to permit an accurate evaluation of the radiological situation, and the formulation of policies and procedures necessary for the protection of personnel engaged in the operation.

IV. TASKS

A. Monitoring Operations

1. Preliminary Survey of Bikini Island

Radiological Safety Officers will accompany the initial parties ashore on Bikini Island, and will begin a preliminary radiological survey thereof. This preliminary survey will be completed as soon as practicable, and particular emphasis will be placed upon the monitoring of all existent buildings or structures on the island.

2. Diving Operations

a. Deep Water

Two (2) Radiological Safety Officers will be aboard USS Coucal (ASR-8) during all deep-water diving operations conducted from that vessel. One (1) Radiological Safety Officer will operate the deep-water probe during such operations, and one (1) Radiological Safety Officer will be responsible for the monitoring of all divers returning aboard Coucal, together with the monitoring of all samples brought to the surface by the divers.

Detailed instructions as to precautionary measures to be taken in connection with deep-water diving are contained in paragraph V.(E) of Appendix I to this Annex.

3. Core Sampling

One (1) Radiological Safety Officer will be aboard LCI(L)-615 during all core-sampling operations conducted from that ship. The Radiological Safety Officer will be responsible for the monitoring of all samples and personnel engaged in the work on the vessel.

4. Accompaniment of Beach and Boat Parties

Radiological Safety Officers will accompany all beach and boat parties working within the operational area until such time as specific localities have been determined to be free from radiation hazards and properly cleared by the Radiological Health Officer.

5. Periodic Inspections

Radiological Safety Officers will periodically check various parts of the ships for radioactivity. Such checks will include condensers, evaporators, fire mains, flushing systems, etc.
there may be a concentration of deposition of radioactive mate-
rials from contaminated water.

6. Special Radiological Reconnaissance

   Special radiological reconnaissance, not essential to safety, may be conducted by the Radiological Safety Section when safety requirements are not overriding.

V. PROTECTION OF PERSONNEL

A. Film Badges

Radiological Safety Officers will issue film badges daily to individuals entering hazardous areas, and will collect these badges at the end of each day for delivery to the Photographic Dosimetry Unit. This procedure will be followed until such time as radiological reconnaissance indicates that it may be modified in specific instances. All exceptions to this procedure will be cleared and announced by the Radiological Health Officer.

B. Protective Clothing

1. General

Radiological Safety Officers will insure that members of all scientific work parties are equipped with the following items of protective clothing:

- Cap, "baseball type"
- Shirt, working, green twill
- Trousers, working, green twill
- Shoes, field
- Gloves, canvas (will be issued whenever radiological conditions warrant).

C. Clothing for Divers

Personnel engaged in shallow-diving operations in areas presenting a radiological hazard will be provided with the following items of protective equipment in addition to their normal diving gear:

- Gloves, canvas
- Coveralls.

D. Decontamination

1. Decontamination, or "change stations," will be established aboard Chilton, Coucal, and LCI(L)-615, if required.

2. Radiological Safety Officers will monitor all personnel upon the completion of personnel decontamination procedures, and each individual will be responsible for reporting to the Radiological Safety Officer in attendance for such monitoring prior to donning his clean clothing.
3. Detailed instructions as to the decontamination procedures to be followed is contained in paragraph VI.(C) of Appendix I to this Annex.

E. Technical Reports and Data

1. The Radiological Safety Section will receive and maintain files of monitoring reports compiled during the operation, will maintain the "radiological situation map," and will compile such additional data as may be required by the Project Officer, Bikini Scientific Resurvey.

2. The Radiological Safety Officer will cooperate with the Radiological Health Officer, and will submit all data pertaining to the existent radiological situation to him for review and evaluation.
16 July [1947]

MEMORANDUM:

From: Radiological Safety Officer
To: Project Officer
Subj: Radiological Reconnaissance of Bikini Island and Prayer Eneman Island

1. In compliance with instructions contained in Project Officer Memorandum No. 3-47, dated 14 July 1947, the Radiological Safety Officer, together with three officer monitors, accompanied the Project Officer and Technical Director ashore in the advance landing party at approximately 1200 hours, 15 July 1947, for the purpose of making a radiological survey of those areas of Bikini Island that may be occupied during the initial phases of the Resurvey Operation.

2. Since a preliminary survey of the beach in the vicinity of the initial landing site northwest of Beacon D indicated that existent radiation intensities were of the order of 0.004 R/24 hours and well below the established tolerance, four additional monitors were brought ashore, and a general survey of the northwestern tip (map reference 2406) and central sector (map reference 2605, 2606, 2704, 2706) of Bikini Island were initiated.

3. Shortly after the initial landing on Bikini, the Technical Director and one officer monitor reembarked and proceeded to Prayer Island (map reference 0690) to make a radiological reconnaissance of that area.

4. The general reconnaissance referred to in paragraph 2 above indicated that all of the low-intensity radiation encountered on the central sector of Bikini was confined to the sand beaches along the lagoon side of the island and to debris (life rafts, fenders, lines, etc.) that had washed up on the beach. The survey of the northwestern tip of Bikini indicated intensities of approximately 0.03 R/24 hours in algal beds and other scattered localities throughout that sector. Throughout the remainder of the surveyed areas, only background counts were observed.

5. Observed intensities on Prayer Island were not above background, except for scattered pieces of debris, which produced readings somewhat above background count.

6. Representative samples of sand, soil, or coral were taken from each sector of the islands surveyed, and have been turned over to the laboratory for analysis and evaluation.
A. Statement of the General Radiological Situation

1. The radiological survey of Bikini Atoll conducted by personnel of the Radiological Safety Section during the period 15 July 1947 through 26 August 1947 indicated that while certain isolated areas and accumulations of debris washed ashore on the lagoon beaches continued to produce beta and gamma radiation in excess of the tolerance of 0.1 roentgen per 24 hours, as outlined in Paragraph 8(f) of letter, Bureau of Medicine and Surgery, Navy Department, EN10/Radsafe P2-4, dated 31 January 1947, the residual beta and gamma radiation present throughout the land, beach, and exposed reef areas of the atoll was well within this same tolerance limit.

2. The maximum activity observed by radiological safety officers during the course of this survey was obtained on a deposit of tarry material on a ledge of rock located on the sand spit extending west of Bikini Island. This localized area produced a beta plus gamma reading of 0.6 roentgens per 24 hours, and a gamma reading of 0.18 roentgens per 24 hours.

B. Summary of Radiological Safety and Health Precautions

1. The radiological safety and health precautions prescribed in the Radiological Safety and Health Annex to the Resurvey Operation Plan were observed throughout the course of the operation.

2. Radiological safety officers accompanied all scientific work parties during the initial landings on islands or areas within the lagoon, and continued to accompany these groups until such time as it had been determined that the area in question was free from any hazardous concentrations of radioactive materials. These officers were equipped with Model 263 Survey Meters, manufactured by the Victoreen Instrument Company, and carried pocket electrosopes or dosimeters to record the accumulative external radiation to which the group was being exposed.

3. Each deep-sea diver returning aboard USS COUCAL (ASR-8) was thoroughly hosed down with a stream of saltwater while still on the stage and prior to being taken aboard to insure that all radioactive materials adhering to his suit and associated gear were washed off. Following the removal of his diving suit, each diver and his gear was monitored with a Model 263 Survey Meter by one of the two radiological safety officers stationed aboard this ship to detect the presence of any beta or gamma radiation on either his person or his equipment. Personnel monitoring was carried out aboard USS CHILTON (APA-38) until such time as it had been determined that this procedure was no longer required. Personnel decontamination or "change" stations were established in both COUCAL and CHILTON for the use of personnel in the event that monitoring indicated the presence of excessive radiation on either their persons or their clothing.
4. All members of scientific work parties wore individual film badges during the initial stages of the operation and until such time as it had been determined that this procedure could be modified, or dispensed with entirely in the instance of areas that had been radiologically cleared. In view of the fact that the deep-sea diving and underwater inspection operations conducted on the sunken ships within the target area were considered to be the most hazardous from the standpoint of exposure to radiation, film badges and pocket dosimeters were carried by each diver throughout the course of this work. Three film badges, each enclosed in a waterproof rubber covering, were attached to the inner clothing of each diver prior to his descent to the bottom; one at chest height, one at waist height, and one in his shoe. These film badges were delivered to the Photodosimetry Unit for developing and analysis at the conclusion of each dive during the early phases of the work, and later at weekly intervals when it had been determined that hazardous concentrations of radioactive materials were not being encountered.

5. Of the total of 517 film badges processed by the Photodosimetry Unit of the Radiological Health Section, no badge carried during the course of the resurvey operations gave evidence of exposure to beta or gamma radiation in excess of the tolerance limits referred to in Paragraph A.1 above.

C. Summary of Chemical and Biological Studies

1. Biological studies and investigations carried out during the course of the resurvey operations indicated the presence of varying amounts of radioactivity in the marine life of Bikini Lagoon, though not in sufficient concentrations to afford an external radiation hazard. Instructions issued by the Task Group Commander, upon the recommendation of the Radiological Health Advisory Board, directed that no marine life whatsoever would be eaten by personnel attached to the expedition.

2. Recreational swimming at certain designated beach areas on Bikini Island was permitted only after a chemical analysis of the lagoon water indicated a plutonium content of less than $10^{-11}$ grams per liter of water. A gross analysis of the fission products present in the water indicated a content of less than $10^{-12}$ curies per liter of water.

3. On the basis of the radiochemical analysis of edible fruits taken from Bikini Island, the original ban against the eating of such fruits obtained on Bikini Island was lifted on 24 July 1947 by the Task Group Commander upon the recommendation of the Radiological Health Advisory Board.

Statement of Findings of the Board

1. In view of the data obtained and the observations made during the period 15 July 1947 through 26 August 1947, the undersigned members of the Medical Legal Board, Bikini Scientific Resurvey, attest, that to the best of their knowledge and belief, no individual assigned to, attached to, or participating in the Bikini Scientific Resurvey operations during this same period of time was exposed to radiation in excess of the established standards.
APPENDIX C

INSTRUMENTATION DIVISION PROJECTS
# APPENDIX C

**Instrumentation Division Projects**

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AAAF Instrumentation

AAAF Instrumentation
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APPENDIX D

BIKINI ATOLL ISLAND SYNONYMS
### APPENDIX D

#### ISLAND SYNONYMS

**BIKINI ATOLL**

Underscored entries are the names of the islands as used in this report. Island names enclosed in quotation marks were used by Joint Task Force 1 for the islands of Bikini. CAPITALIZED entries are the code names used by later joint task forces. All other entries are spellings of the islands that may appear in other literature.

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<td>“Airy”</td>
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| **ALFA** | Boketoktok | Bokaetokutoku | “Boku” |
| **“Amen”** | GEORGE | Aomen | “Amen” |
| **Aomen** | GEORGE | Aomen | “Amen” |
| **“Aran”** | YOKE | Adrielkan | Arrielkan |
| **Arrielkan** | YOKE | Adrielkan | Arrielkan |

| **BAKER** | Bokonellen | “Bone” |
| **Bigiren** | ROGER | Bikdrin | “Biren” |
| **Bikdrin** | ROGER | Bigiren | “Biren” |
| **Bikini** | HOW | “Biren” |
| **“Biren”** | ROGER | Bikdrin | Bigiren |
| **“Boby”** | ABLE | Bokbata | Bokobyada |
| **Bokaetoktok** | ALFA | Bokaetokutoku | “Boku” |
| **Bokbata** | ABLE | Bokobyada | “Boby” |
| **Bokdrolul** | BRAVO | Bokororyuru | “Boro” |
| **Bokaetokutoku** | ALFA | Bokaetoktok | “Boku” |
| **Bokobyada** | ABLE | Bokbata | “Boby” |
| **Bokoneilen** | BAKER | “Bone” |
| **Bokonfaaku** | ITEM | “Bokon” |
| **Bokororyuru** | BRAVO | Bokdrolul | “Boro” |
| **“Boku”** | ALFA | Bokaetoktok | Bokaetokutoku |
| **“Bokon”** | ITEM | Bokonfaaku |
| **“Bone”** | BAKER | Bokoneilen |
| **“Boro”** | BRAVO | Bokdrolul | Bokororyuru |
| **BRAVO** | Bokdrolul | Bokororyuru | “Boro” |

<p>| <strong>CHARLIE</strong> | Nam | Namu |
| <strong>“Cherry”</strong> | WILLIAM | Jelete | Chleerete |
| <strong>Chleerete</strong> | WILLIAM | Jelete | “Cherry” |
| <strong>Coca</strong> | (Bikini Atoll) | | |</p>
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APPENDIX E
GLOSSARY OF TERMS

Many of the definitions in this glossary relating to nuclear device and radiation phenomena have been quoted or extracted from *The Effects of Nuclear Weapons* (3rd edition), S. Glasstone and P.J. Dolan, 1977.

**accelerometer.** An instrument for determining the acceleration of the system with which it moves.

**activation products.** Radioactive nuclides produced by the irradiation of a stable nuclide, usually with neutrons.

**AD.** Destroyer tender (Navy).

**AEC.** Atomic Energy Commission, Washington, D.C. Independent agency of the Federal government with statutory responsibilities for atomic energy matters. No longer exists; its functions have been assumed by the Department of Energy and the Nuclear Regulatory Commission.

**AF.** Store ship (Navy); also Air Force.

**AFSPWP.** Armed Forces Special Weapons Project.

**AG.** Miscellaneous auxiliary ship (Navy).

**AGC.** Amphibious force flagship (Navy).

**AGS.** Surveying ship (Navy).

**AH.** Hospital ship (Navy).

**airburst.** The detonation of a nuclear device in the air at a height such that the expanding fireball does not touch the Earth's surface when the luminosity (emission of light) is at a maximum.

**air particle trajectory.** The velocity and rate of descent of windblown radioactive particles.

**AK.** Cargo ship (Navy).

**AKA.** Attack cargo ship (Navy).

**AKS.** Stores issue ship (Navy).

**allowable dose.** See MPL.

**alpha emitter.** A radionuclide that undergoes transformation by alpha-particle emission.

**alpha particle.** A charged particle emitted spontaneously from the nucleus of some radioactive elements. It is identical with a helium nucleus, having a mass of 4 units and an electric charge of 2 positive units. See also radioactivity.

**alpha rays.** A stream of alpha particles. Loosely, a synonym for alpha particles.

**AMS.** Army Map Service, Washington, D.C.

**AN.** Net laying ship (Navy).

**AO.** Oilier (Navy).

**AOC.** Air Operations Center.

**AG.** Gasoline tanker (Navy).

**AP.** Transport ship (Navy).

**APA.** Attack transport (Navy).

**APD.** High speed transport (Navy).

**ARG.** Airborne repair ship (Navy).

**ARCG.** Auxilary floating drydock (Navy).

**ARM.** Auxiliary floating drydock, concrete (Navy).

**ARS.** Internal combustion engine repair ship (Navy).

**ARR.** Battle damage repair ship (Navy).

**ARS.** Landing craft repair ship (Navy).

**arming.** The changing of a nuclear device from a safe condition (that is, a condition in which it cannot be detonated without intent) to a state of readiness for detonation.

**ARS.** Salvage ship (Navy).
**ARSD**

**Salvage lifting ship (Navy).**

**AVP.** Smallest seaplane tender (Navy).

**ATN.** Rescue ocean tug (Navy).

Atoll. A ring of coral reefs, usually with small islands that surrounds a lagoon. Most are isolated reefs rising from the deep sea that have built up on submerged volcanoes. They vary considerably in size; the largest atoll, Kwajalein in the Marshall Islands, has an irregular shape that extends for 84 miles (135 km). See also coral reef.

**Atomic bomb (or weapon).** A term sometimes applied to a nuclear weapon utilizing fission energy only. See also nuclear device.

**Atomizer.** See nuclear explosion.

**Background radiation.** The radiation of man's natural environment, consisting of that which comes from cosmic rays and from the naturally radioactive elements of the Earth, including that from within man's body. The term may also mean radiation extraneous to an experiment.

**Blast.** The detonation of a nuclear device, like the detonation of a high explosive such as TNT, results in the sudden formation of a pressure or shock wave, called a blast wave in the air and a shock wave when the energy is imparted to water or Earth.

**Blast wave.** An air pulse propagated from an explosion in which the pressure increases sharply at the front and then decreases, followed by winds.

**Blast yield.** That portion of the total energy of a nuclear explosion that manifests itself as blast and shock waves.

**Boiler compound.** A chemical in powder form that is inserted into boiler water to decrease the formation of scale in boiler tubes.

**Bomb debris.** See weapon debris.

**B-17.** Four engine, propeller-driven bomber developed by Boeing Airplane Co. and widely used in World War II. Used as a radio-controlled, unmanned drone cloud sampler in atmospheric nuclear weapon tests.

**B-29.** A four engine, propeller driven bomber developed by Boeing, used for weather reconnaissance, cloud tracking, aerial sampling and photography, and aerial refueling at the POG. These versions designated MB-75, WB-29, and MB-29.

**Bromide.** Anions containing the Br-atom.

**Bureau of Medicine and Surgery (Navy).**

**BuShips.** Bureau of Ships (Navy).

**Bathythermograph (B/T).** A device for obtaining a record of temperature with depth in the upper 1,000 feet (300 meters) of the ocean from a ship underway.

**Bu.** Battleship (Navy).

**Beta.** See curie (C).  

**Beta burns.** Beta-emitting particles that come into contact with the skin and remain for an appreciable time can cause a form of radiation injury sometimes referred to as "beta burn." In an area of extensive early fallout, the whole surface of the body may be exposed to beta particles.

**Beta emitter.** A radionuclide that disintegrates by beta particle emission. All beta-active elements existing in nature expel negative particles. i.e., electrons or, more exactly, negative beta-particles. Beta-emitting particles are harmful if inhaled or ingested or remain on the skin.

**Beta particle (ray).** A charged particle of very small mass, emitted spontaneously from the nuclei of certain radioactive elements. Most, if not all, of the direct fission products emit negative beta-particles (neutrons). Physically, the beta particle is identical to an electron moving at high velocity.

**Bhysnrometer.** A device that measures bomb yield based on light generated by the explosion.

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C-46. A twin-engine transport plane developed and manufactured for the Army Air Forces by Curtiss-Wright Aircraft Company.

C-47. A twin-engine transport aircraft manufactured by Douglas Aircraft Company (Army Air Forces version of the DC-3).

C-54. A 4-engine military cargo and personnel transport manufactured by Douglas Aircraft Company (Army Air Forces version of the DC-4).

CA. Heavy cruiser (Navy).

cab. The shelter that covers a nuclear device being prepared for test. May be located on a tower, on the Earth’s surface, or on a barge.

cathode-ray tube. A vacuum tube in which cathode rays (electrons) are beamed upon a fluorescent screen to produce a luminous image. The character of this image is related to, and controlled by, one or more electrical signals applied to the cathode-ray beam as input information. The tubes are used in measuring instruments such as oscilloscopes and in radar and television displays.

cave. A heavily shielded enclosure in which radioactive materials can be remotely manipulated to avoid radiation exposure of personnel.

CDC. Centers for Disease Control.

Cl. Abbreviation for curie, which see. Cl is preferred now but c was the abbreviation used in the 1950s.

CIC. Counter-Intelligence Corps (Army); Combat Information Center (Navy).

CINC PAC. Commander in Chief, Pacific.

Circle William fittings. The closing of certain closures, designated “Circle William” fittings, hinders the movement of outside air into the interior spaces of naval ships. This sealed state is also called Circle William condition.


closed area. The land areas of Hikini and Pohutukawa and the water areas within 3 miles of them that the United States closed to unauthorized persons.

cloud chamber effect. See Wilson cloud.

cloud column (funnel). The visible column of weapon debris (and possibly dust or water droplets) extending upward from the point of a nuclear burst.

cloud phenomena. See fallout, fireball, radioactive cloud.

CNO. Chief of Naval Operations.

collimate. To align nuclear weapon radiant outputs within an assigned solid angle through the use of baffles in order to enhance measurements.

Co. Chemical symbol for cobalt.

cobalt. Metallic element with radium and radon.

60Co used as a calibration source for gamma instruments.

Commander Naval Air Forces Pacific (Navy).

Commander Service Forces Pacific (Navy).

Condition “Purple”. See Purple conditions.

contamination. The deposition of radioactive material on the surfaces of structures, areas, objects, and personnel following a nuclear detonation. This material generally consists of fallout in which fission products and other device debris have become incorporated with particles of dust, vaporized components of device platforms, etc. Contamination can also arise from the radioactivity induced in certain substances by the action of neutrons from a nuclear explosion. See also decontamination, fallout, weapon debris.

coral reef. A complex ecological association of bottom-living and attached shelled marine animal fossils that form fringing reefs, barrier reefs, and atolls. The lagoons of barrier reefs and atolls are important places for the deposition of fine-grained calcium carbonate mud.

CPM, or cpm. Counts per minute, a measure of radioactive material disintegration.

Cs. Chemical symbol for cesium.

CS. Chief of Staff.

CTG. Commander, Task Group.

curie (Ci). A unit of radioactivity: It is the activity of a quantity of any radioactive species in which 3.700 x 10^10 (37 billion) nuclear disintegrations occur per second (approximately the radioactivity of 1 gram of radium). The gamma curie is sometimes defined correspondingly as the activity of material in which this number of gamma ray photons is emitted per second. This unit is being replaced by the becquerel (Bq), which is equal to one disintegration per second.

CV. Aircraft carrier (Navy).

CVE. Escort aircraft carrier (Navy).

CVL. Small aircraft carrier (Navy).

D-day. The term used to designate the unnamed day on which a test takes place. The equivalent rule applies to H-hour (which see). Time in plans is indicated by a letter which shows the unit of time employed in figures, with a
DO. Destroyer (Navy).

DOE. Escort destroyer (Navy).

DE. Destroyer escort (Navy).

demolition doses and dose rates. It is concerned

decay (radioactive). The decrease in activity of

debris (radioactive). See weapon debris.

decontamination. The reduction or removal of con-
taminating radioactive material from a struc-
ture, area, object, or person. Decontamination
may be accomplished by (1) treating the sur-
face to remove or decrease the contamination;
(2) letting the material stand so that the
radioactivity is decreased as a result of nat-
ural decay; and (3) covering the contamination
in order to attenuate the radiation emitted.

device. Nuclear fission and fusion materials,


diagnostic measurements or experiments. Experi-

ments whose purpose is to study the explosive
disassembly of a nuclear device as opposed to
effects measurements (which see).

DM. Minelayer destroyer (Navy). Converted de-

stroyers designed to conduct high-speed mine-
laying operations.

dose. A general term denoting the quantity of
ionizing radiation energy absorbed. The unit of
absorbed dose is the rad (which see). In
soft body tissue the absorbed dose in rads is
esentially equal to the exposure in roentgens.
The biological dose (also called the RBE dose)
in rads is a measure of biological effective-
ness of the absorbed radiation. Dosage is used
in older literature as well as exposure dose
and simply exposure, and care should be exer-
cised in their use. See also exposure.

dose rate. As a general rule, the amount of ion-
izing (or nuclear) radiation energy that an
individual or material would receive per unit
of time. It is usually expressed as rads (or
rems) per hour or multiples or divisions of
these units such as millirads per hour. The
dose rate is commonly used to indicate the
level of radioactivity in a radioactive area.
See survey meter.

dosimeter. An instrument for measuring and reg-

istering the total accumulated dose of ion-

exposure to ionizing radiation. Instruments

worn or carried by individuals are called

personnel dosimeters.

dosimetry. The measurement and recording of ra-
diation doses and dose rates. It is concerned

with the use of various types of radiation
instruments with which measurements are made.
See also dosimeter, survey meter.

DPM, or dpm. Disintegrations per minute, a mea-
sure of radioactivity, literally atoms disin-
tegrating per minute. Difficult to directly
compare with roentgens per hour for unknown
mixtures of radionuclides.

DTMB. David Taylor Model Basin, Carderock, Mary-

land (Navy).

DUKW. Two-and-one-half-ton amphibious truck

(Navy).

dynamic pressure. Air pressure that results from
the mass air flow (or wind) behind the shock
front of a blast wave.

effects measurements or experiments. Experiments
whose purpose is to study what a nuclear ex-
plosion does to material, equipment and sys-
tems. Includes also measurement of the changes
in the environment caused by the detonation
such as increased air pressures (blast), ther-
mal and nuclear radiation, cratering, water
waves, etc.

electromagnetic radiation. Electromagnetic radia-
tions range from X-rays and gamma rays of short
wavelength (high frequency), through the ultra-
visible, visible, and infrared regions, to radar
and radio waves of relatively long wavelength.

electron. A particle of very small mass and elec-
trically charged. As usually defined, the elec-
tron's charge is negative. The term negatron
is also used for the negative electron and the
positively charged form is called a positron.
See also beta particles.

exposure. A measure expressed in roentgens of the
ionization produced by gamma rays or X-rays
in air. The exposure rate is the exposure per
unit time (e.g., roentgens per hour). See
dose, dose rate, roentgen.

exposure rate contours. Lines joining points that
have the same radiation intensity that define
a fallout pattern, represented in terms of
roentgens per hour.

F-13. Photo version of B-29 bomber.

F-6P. Single-engine propeller-driven fighter
developed for the Navy by Grumman Aircraft
Company.

fallout. The process or phenomenon of the descent
to the Earth's surface of particles contami-
nated with radioactive material from the radio-
active cloud. The term is also applied to a
fathometer

The depth of water is measured by noting the time the echo of a sound takes to return from the bottom.

film badges. Used for the indirect measurement of ionizing radiation. Generally contain two or three pieces of film of different radiation sensitivities. They are wrapped in paper (or other thin material) that blocks light but is readily penetrated by gamma rays. The films are developed and the degree of fogging (or blackening) observed is a measure of the gammaray exposure, from which the absorbed dose is calculated. Film badges can also measure beta and neutron radiation and x-rays.

fireball. The luminous sphere of hot gases that forms a few millionths of a second after a nuclear explosion as the result of the absorption even at a long distance from its source. The luminous shock front and later by the limits of the hot gases themselves.

fusion. The combination of two light nuclei to form a heavier nucleus, with the release of the energy of the fusion products and the sum of the binding energies of the two light nuclei.

gamma rays. Electromagnetic radiations of high photon energy originating in atomic nuclei and accompanying many nuclear reactions (e.g., fission, radioactivity, and neutron capture). Physically, gamma rays are identical with X-rays of high energy; the only essential difference is that X-rays do not originate from atomic nuclei of high energy. Gamma rays can travel great distances through air and can penetrate considerable thickness of material, although they can neither be seen nor felt by human beings except at very high intensities, which cause an itching and tingling sensation of the skin. They can produce harmful effects even at a long distance from their source.

GMC. Greenwich Mean Time.

grey (Gy). A recently introduced ICRP term; 1 Gy equals 100 rad.

ground zero (GZ). See surface zero.

quark. A viscous commercial preparation that is soluble both in water and petroleum derivatives. It acts as a wetting agent in removing grease and particulate matter from metal and other nonporous surfaces.

H-hour. Time zero, or time of detonation. When used in connection with planning operations it is the specific time at which the operation event commences. H-1 indicates 1 hour before the detonation, etc. Minutes and seconds may also be indicated using this system, but the units used must then be shown, e.g., H-30 minutes. H-05 seconds. See also P-day.

half-life. The time required for a radioactive material to lose half of its radioactivity due to decay. Each radionuclide has a unique half-life.

HE. High explosive.
hodograph: A common hodograph in meteorology represents the speed and direction of winds at different altitude increments.

hot spot: Commonly used colloquial term meaning a spot or area relatively more radioactive than some adjacent area.

ICRP: International Commission on Radiological Protection.

initial radiation: Nuclear radiations of high energy emitted from both the fireball and the radioactive cloud within the first minute after a detonation. It includes neutrons and gamma rays given off almost instantaneously (usually defined as prompt radiation, which see), as well as the gamma rays emitted by the fission products and other radioactive species in the rising cloud. Initial neutrons from ground or near-ground bursts react with both earth materials and device debris to create activation products.

inverse square law: The decrease in radiation intensity with distance from a single-point source is proportional to the square of the distance removed.

tron chamber type survey meter: A device for measuring the amount of ionizing radiation. Consists of a gas-filled chamber containing two electrodes (one of which may be the chamber wall) between which a potential voltage difference is maintained. The radiation ionizes gas in the chamber and an instrument connected to one electrode measures the ionization current produced.

ionization: The process of adding electrons to, or knocking electrons from, atoms or molecules, thereby creating ions. High temperatures, electrical discharges, and nuclear radiation can cause ionization.

ionizing radiation: Any particulate or electromagnetic radiation capable of producing ions, directly or indirectly, in its path through matter. Alpha and beta particles produce ion pairs directly, while gamma rays and X-rays liberate electrons as they traverse matter, which in turn produce ionization in their path.

ionosphere: The region of the atmosphere, extending from roughly 40 to 700 miles (about 65 to 400 km) above the Earth, in which there is appreciable ionization. The presence of charged particles in this region profoundly affects the propagation of radio and radar waves.

irradiation: Exposure of matter to radiation.

isodose line: Dose or dose-rate contours. In fallout, contours plotted on a radiation field at which the dose rate or the total accumulated dose is the same.

isotopes: Atoms with the same atomic number (same chemical element) but different atomic weight; i.e., the nucleus have the same number of protons but a different number of neutrons.

IX. Unclassified miscellaneous ship (Navy).

JTF I: Joint Task Force I was a combined force of personnel of the Department of Defense (Army, Navy, Marine Corps), the Manhattan Engineer District, and their contractors. JTF I was responsible for all aspects of nuclear weapon tests in the Pacific during 1946.

kiloton convention: Relates nuclear explosion energy to TNT explosion energy by using the approximate energy release of 1,000 tons of TNT as the measuring unit.

kinetic energy: Energy associated with the motion of matter.

LCI: Infantry landing craft (Navy).

LCIL: Infantry landing craft (large) (Navy).

LCM: Mechanized landing craft (Navy).

LCPL: Personnel landing craft (large) (Navy).

LCP(R): Personnel landing craft (ramp) (Navy).

LCT: Tank landing craft (Navy).

LCU: Utility landing craft (Navy).

LCVP: Vehicle and personnel landing craft (Navy).

LML: Lookout Mountain Laboratory, Hollywood, California (Air Force).

Loran: Long-range aid to navigation system. Loran stations were maintained by the U.S. Coast Guard Station on Eniwetok Island and Johnston Atoll.

LSD: Dock landing ship (Navy).

LSTL: Infantry landing ship (large) (Navy).

LM: Medium landing ship (Navy).

LST: Tank landing ship (Navy).

LSTL: Utility landing ship (Navy).

magnetometer: An instrument for measuring changes in the geomagnetic field.

megaton (energy): Approximately the amount of energy that would be released by the explosion of one million tons of TNT.

microcurie: One-millionth of a curie.

micro: One-millionth of a meter (i.e., $10^{-6}$ meter or $10^{-4}$ centimeter); it is roughly four one-hundred-thousandths ($4 \times 10^{-5}$) of an inch.

milliroentgen: One thousandth of a roentgen.
MPL. Maximum Permissible Limit. That amount of radioactive material in air, water, foodstuffs, etc., that is established by authorities as the maximum that would not create undue risk to human health.

mr. Abbreviation for milliroentgen.

mushroom cap. Top of the cloud formed from the fireball of a nuclear detonation.

MV. Motor vessel.

NAB. Naval Air Base.

NAS. Naval Air Station.

NBS. National Bureau of Standards.

NCO. Noncommissioned officer.

NCPR. National Committee on Radiation Protection and Measurements. Before 1956 simply the National Committee on Radiation Protection.

NEL. Naval Electronics Laboratory.

neutron. A neutral elementary particle (i.e., with neutral electrical charge) of approximately unit mass (i.e., the mass of a proton) that is present in all atomic nuclei, except those of ordinary (light) hydrogen. Neutrons are required to initiate the fission process, and large numbers of neutrons are produced by both fission and fusion reactions in nuclear explosions.

neutron flux. The intensity of neutron radiation. It is expressed as the number of neutrons passing through 1 cm² in 1 second.

NML. Naval Materials Laboratory.

NMRI. Naval Medical Research Institute.

NOP. Naval Operating Base.

NOL. Naval Ordnance Laboratory.

NRDL. Naval Radiological Defense Laboratory.

NRL. Naval Research Laboratory.

NTPR. Nuclear Test Personnel Review.

nuclear device (or weapon or bomb). Any device in which the explosion results from the energy released by reactions involving atomic nuclei, either fission or fusion, or both. Thus, the A- (or atomic) bomb and the H- (or hydrogen) bomb are both nuclear weapons. It would be equally true to call them atomic weapons, since the energy of atomic nuclei is involved in each case. However, it has become more or less customary, although it is not strictly accurate, to refer to weapons in which all the energy results from fission as A-bombs. In order to make a distinction, those weapons in which part of the energy results from thermonuclear (fusion) reactions of the isotopes of hydrogen have been called H-bombs or hydrogen bombs.

nuclear explosion. Explosive release of energy due to the splitting, or joining, of atoms. The explosion is observable by a violent emission of ultraviolet, visible, and infrared (heat) radiation, gamma rays, neutrons, and other particles. This is accompanied by the formation of a fireball. A large part of the energy from the explosion is emitted as blast and shock waves when detonated at the Earth's surface or in the atmosphere. The fireball produces a mushroom-shaped mass of hot gases and debris, the top of which rises rapidly. See also radiation, gamma rays, fireball, nuclear weapon, fission, fusion, blast.

nuclear fusion. See thermonuclear fusion.

nuclear fusion. Particulate and electromagnetic radiation emitted from atomic nuclei in various nuclear processes. The important nuclear radiations, from the weapons standpoint, are alpha and beta particles, gamma rays, and neutrons. All nuclear radiations are ionizing radiations, but the reverse is not true: X-rays, for example, are included among ionizing radiations, but they are not nuclear radiations since they do not originate from atomic nuclei.

nuclear tests. Tests carried out to supply information required for the design and improvement of nuclear weapons and to study the phenomena and effects associated with nuclear explosions.

nuclide. Any species of atom that exists for a measurable length of time. The term nuclide is used to describe any atomic species distinguished by the composition of its nucleus: i.e., by the number of protons and the number of neutrons. Isotopes of a given element are nuclides having the normal number of protons but different numbers of neutrons in these nuclei. A radionuclide is a radioactive nuclide.

off-scale. Radiation (or other physical phenomenon) greater than the capacity of a measuring device to measure.

ONR. Office of Naval Research, Washington, D.C.

ORNL. Oak Ridge National Laboratory, Tennessee.

oscilloscope. The name generally applied to a cathode-ray device.

overpressure. The transient pressure, usually expressed in pounds per square inch, exceeding the ambient pressure, manifested in the shock (or blast) wave from an explosion.

PBY-5. Four engine seaplane patrol bomber developed for the Navy by Consolidated Aircraft. Called the Coronado.
PB4Y-2. Four-engine patrol bomber developed by Consolidated Aircraft for the Navy by modifying the USAAF B-24. Called the Privateer.

PB4Y-2. Twin-engine, patrol-bomber flying boat, developed by Martin for the U.S. Navy.

PC. Patrol craft (Navy).

peak overpressure. The maximum value of the over-pressure (which see) at a given location.

permissible dose. That dose of ionizing radiation that is not expected to cause appreciable bodily injury to a person at any time during his lifetime. See also MLP.

PGM. Motor gunboat (Navy).

phantom. A volume of material closely approximating the density and effective atomic number of tissue. The phantom absorbs ionizing radiation in the same manner as tissue, thus radiation dose measurements made within the phantom provide a means of approximating the radiation dose within a human or animal body under similar exposure conditions. Materials commonly used for phantoms are water, masonite, pressed wood, beeswax, and Plexiglas.

PLG. A heavily shielded container (usually lead) used to ship or store radioactive materials.

POL. Petroleum, oil, and lubricants. The storage area for these products is referred to as a POL farm.

prompt radiation. Neutrons and gamma rays emitted almost instantaneously following a nuclear fission or fusion.

proton. A particle carrying a positive charge and physically identical to the nucleus of the ordinary hydrogen atom.

Purple conditions. A shipboard warning system used in radiological defense. Various numbered conditions were sounded when radioactive fallout was to be encountered. Responses to the sounded warnings included closing of various hatches and fittings, turning off parts of the ventilation system, and removing personnel from a ship's open decks. The higher the Purple condition number, the more severe the radiological situation.

QB-17. Radio-controlled version of the B-17.

R. Symbol for roentgen.

red. Chemical symbol for radium.

red. Radiation absorbed dose. A unit of absorbed dose of radiation energy. It represents the absorption of 100 ergs of ionizing radiation per gram (or 0.01 J/kg) of absorbing material. Such as body tissue. This unit is presently being replaced in scientific literature by the Gray (Gy), numerical equal to the absorption of 1 joule of energy per kilogram of matter.

Radex area. Radiological exclusion area. Following each detonation there were areas of surface radioactivity and areas of air radioactivity. These areas were designated as radex areas. Radex areas were used to chart actual or predicted fallout and also used for control of entry and exit.

radex. Radiological exclusion area.

radiation. The emission of any rays, electromagnetic waves, or particles (e.g., gamma rays, alpha particles, beta particles, neutrons) from a source.

radiation decay. See decay (radioactive).

radiation detectors. Any of a wide variety of materials or instruments that provide a signal or indication when stimulated by the passage of ionizing radiation; the sensitive element in radiation detection instruments. The most widely used media for the detection of ionizing radiation are photographic film and ionization of gases in detectors (e.g., Geiger counters), followed by materials in which radiation induces scintillation.

radiation exposure. Exposure to radiation may be described and modified by a number of terms. The type of radiation is important: alpha and beta particles, neutrons, gamma rays and X-rays, and cosmic radiation. Radiation exposure may be from an external radiation source, such as gamma rays, X-rays, or neutrons; or it may be from radionuclides retained within the body emitting alpha, beta, or gamma radiation. The exposure may result from penetrating or nonpenetrating radiation in relation to its ability to enter and pass through matter as alpha and beta particles being considered as nonpenetrating and other types of radiation as penetrating. Exposure may be related to a part of the body or to the whole body. See also whole body irradiation.

radiation intensity. Radiation rate. Measured and reported in roentgens (R), rads, rems, and multiples and divisions of these units as a function of exposure time (per hour, day, etc.).

radioactive cloud. An all-inclusive term for the cloud of hot gases, smoke, dust, and other particulate matter from the weapon itself and from the environment, which is carried aloft in conjunction with the rising fireball produced by the detonation of a nuclear device.

radioactive nuclide. See radionuclide.

radioactive particles. See radioactivity.
radioactivity

radioactivity, The spontaneous emission of nuclear radiation, generally alpha or beta particles, often accompanied by gamma rays, from the nucleus of an (unstable) nuclide. As a result of this emission the radioactive nuclide a different (daughter) element, which may (or may not) also be radioactive. Ultimately, as a result of one or more stages of radioactive decay, a stable (nonradioactive) end product is formed.

radiological survey. The directed effort to determine the distribution and exposure rate of radiation in an area.

radioisotope. A radioactive nuclide (or radioactive atomic species).

radiosonde. A balloon-borne instrument for the simultaneous measurement and transmission of meteorological data, consisting of transducers for the measurement of pressure, temperature, and humidity; a modulator for the conversion of the output of the transducers to a quantity that controls a property of the radiofrequency signal; a selector switch, which determines the sequence in which the parameters are to be transmitted; and a transmitter, which generates the radiofrequency carrier.

radiosonde balloon. A balloon used to carry a radiosonde aloft. These balloons have daytime launching altitudes of about 80,000 feet (25 km) above sea level. The balloon measures about 5 feet (1.5 meters) in diameter when first inflated and may expand to 20 feet (6 meters) or more before bursting at high altitude.

radium. An intensely radioactive metallic element. In nature, radium is found associated with uranium, which decays to radium by a series of alpha and beta emissions. Radium is used as a radiation source for instrument calibration.

radisafe. Radiological safety. General term used to cover the training, operations, and equipment used to protect personnel from unnecessary exposures to ionizing radiation.

radon. Removal of radioactive particles from a radioactive cloud by rain.

rain. Radar wind sounding tests that determine the wind aloft patterns by radar observation of a balloon.

rainsonde. Radar wind sounding and radiosonde (combined).

RBE. Relative biological effectiveness. A factor used to compare the biological effectiveness of absorbed radiation doses (i.e., rads) due to different types of ionizing radiation. For radiation protection the term has been superseded by Quality Factor.

rem. A special unit of biological radiation dose equivalent; the name is derived from the initial letters of the term roentgen equivalent man (or mammal)". The number of rads of radiation is equal to the number of rads absorbed multiplied by the RBE of the given radiation (for a specified effect). The rem is also the unit of dose equivalent, which is equal to the product of the number of rads absorbed multiplied by the "quality factor" and distribution factor for the radiation. The unit is presently being replaced by the sievert (Sv).

rep. An obsolete special unit of absorbed dose.

residual nuclear radiation. Nuclear radiation, chiefly beta particles and gamma rays, that persists after 1 minute following a nuclear explosion. The radiation is emitted mainly by the fission products and other bomb residues in the fallout, and to some extent by Earth and water constituents, and other materials, in which radioactivity has been induced by the capture of neutrons.

recovery or reentry hour.

roentgen. (R; r) A special unit of exposure to gamma (or X-) radiation. It is defined precisely as the quantity of gamma (or X-) rays that will produce electron (in ion pairs) with a total charge of 2.58 x 10^-4 coulombs in 1 kilogram of dry air under standard conditions. An exposure of 1 roentgen results in the deposition of about 94 ergs of energy in 1 gram of soft body tissue. Hence, an exposure of 1 roentgen is approximately equivalent to an absorbed dose of 1 rad in soft tissue.

roll-up. The process for orderly dismantling of facilities no longer required for nuclear test operations and their transfer to other areas.

sampler aircraft. Aircraft used for collection of gaseous and particulate samples from nuclear clouds to determine the level of radioactivity or the presence of radioactive substances.

SAR. Search and rescue operations.

SB-17. SAR version of the B-17.

scattering. The diversion of radiation (thermal, electromagnetic and nuclear) from its original path as a result of interaction (or collisions) with atoms, molecules, or larger particles in the atmosphere or other media between the source of the radiation (e.g., a nuclear explosion) and a point some distance away. As a result of scattering, radiation (especially gamma rays and neutrons) will be received at such a point from many directions instead of only from the direction of the source. See also skyshine.


scintillation. A flash of light produced by ionizing radiation in a fluor or a phosphor, which may be crystal, plastic, gas, or liquid.
seamount. A submarine mountain rising above the deep sea floor, commonly from 3,000 to 10,000 feet (1 to 3 km) and having the summit 1,000 to 6,000 feet (300 to 1,800 km) below sea level.

shear wind. Refers to differences in direction (directional shear) of wind at different altitudes.

shock. Term used to describe a destructive force moving in air, water, or earth caused by detonation of a nuclear detonation.

shock wave. A continuously propagated pressure pulse (or wave) in the surrounding medium, which may be air, water, or earth. Initiated by the expansion of the hot gases produced in an explosion.

gyrostat. A recently introduced ICRP measure of “dose equivalent” that takes into account the “quality factor” of different sources of ionizing radiation. One gray (Gy) equals 100 rem.

skyshine. Radiation, particularly gamma rays from a nuclear detonation, reaching a target from many directions as a result of scattering by the oxygen and nitrogen in the intervening atmosphere.

slant range. The straight line distance of an aircraft at any altitude from ground zero or the distance from an airburst to a location on the surface.

SS. Submarine (Navy).

stratosphere. Upper portion of the atmosphere, approximately 7 to 40 miles (11 to 64 km) above the earth's surface, in which temperature changes but little with altitude and cloud formations are rare.

streamline. In meteorology, the direction of the wind at any given time.

surface burst. A nuclear explosion on the land surface, an island surface or reef, or on a barge.

surface zero. The point on the ground or water surface directly above or below the detonation point of a nuclear device.

survey meters. Portable radiation detection instruments especially adapted for surveying or inspecting an area to establish the existence and amount of radiation present, usually from the standpoint of radiological protection.

Survey instruments are customarily powered by self-contained batteries and are designed to respond quickly and to indicate directly the exposure rate conditions at the point of interest. See Geiger-Müller counter and ion-chamber type survey meter.

survey, radiation. Evaluation of the radiation levels associated with radioactive materials or areas.

T-AP. Personnel transport (Military Sea Transportation Service).

TBM. Single-engine torpedo bomber developed by Grumman Aircraft for the Navy but manufactured by Glenn L. Martin Company.

TDY. Temporary duty assignment.


TD. Task Detachment.

Thermal radiation. Electromagnetic radiation emitted in two pulses from a surface or airburst from the fireball as a consequence of its very high temperature. It consists essentially of ultraviolet, visible, and infrared radiation. In the first pulse, when the temperature of the fireball is extremely high, ultraviolet radiation predominates; in the second pulse, the temperatures are lower and most of the thermal radiation lies in the visible and infrared regions of the spectrum.

TNT equivalent. A measure of the energy released as the result of the detonation of a nuclear device or weapon, expressed in terms of the mass of TNT that would release the same amount of energy when exploded. The TNT equivalent is usually stated in kilotons (1,000 tons) or megatons (1 million tons). The basis of the TNT equivalence is that the explosion of 1 ton of TNT is assumed to release 1 billion calories of energy. See also megaton, yield.

Trapped radiation. Electrically charged particles moving back and forth in spirals along the north-south orientation of the Earth's magnetic field between mirror points, called conjugate points. Negatively charged particles drift eastward as they bounce between northern and southern conjugate points, and positively charged particles drift westward, thus forming shells or belts of radiation above the Earth. The source of the charged particles may be natural, from solar activity (often called Van Allen belts), or artificial, resulting from high-altitude nuclear detonations.

tropopause. The boundary dividing the stratosphere from the lower part of the atmosphere, the troposphere. The tropopause normally occurs at an altitude of about 25,000 to 45,000 feet (7.6 to 13.7 km) in polar and temperate zones, and at 55,000 feet (16.8 km) in the tropics. See also stratosphere, troposphere.
The region of the atmosphere immediately above the Earth's surface and up to the tropopause, in which the temperature falls fairly regularly with increasing altitude. Clouds form, convection is active, and mixing is continuous and more or less complete.

The Marshall Islands were included in the Trust Territory of the Pacific Islands under the jurisdiction of the United Nations. Assigned by the United Nations to the United States in trust for administration, development, and training.

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TU. Task Unit.

type commander. The officer or agency having cognizance over all Navy ships of a given type. This is in addition to the particular ship's operational assignment in a task force, fleet, or other tactical subdivision.

UCLA. University of California, Los Angeles.

UK. United Kingdom.

ultraviolet. Electromagnetic radiation of wavelengths between the shortest visible violet (about 3850 angstroms) and soft X-rays (about 100 angstroms).

USFS. U.S. Forest Service.

USNS. United States Navy Ship: vessels of this designation are manned by civilian crews.

VA. Veterans' Administration.

VF. Fleet composite squadron (formerly VU).

Versene. A detergent.

VR. Naval air transport squadron.

WADC. Wright Air Development Center, Wright-Patterson AFB, Ohio (Air Force).

warhead. The portion of the missile or bomb containing the nuclear device.

WB-29. Weather reconnaissance version of B-29 used for cloud tracking and sampling.

weapon debris. The radioactive residue of a nuclear device after it has been detonated, consisting of fission products, various products of neutron capture, weapon casing and other components, and uranium or plutonium that has escaped fission.

whole body irradiation. Exposure of the body to ionizing radiation from external radiation sources. Critical organs for the whole body are: the lens of the eye, the gonads, and the red-blood-forming marrow. As little as only 1 cm³ of bone marrow constitutes a whole-body exposure. Thus, the entire body need not be exposed to be classed as a whole-body exposure.

Wilson cloud. A mist of fog of minute water droplets that temporarily surrounds a fireball following a nuclear detonation in a humid atmosphere. This is caused by a sudden lowering of the pressure (and temperature) after the passing of the shock wave (cloud chamber effect) and quickly dissipates as temperatures and pressures return to normal.

worldwide fallout. Consists of the smaller radioactive nuclear detonation particles that ascend into the upper troposphere and the stratosphere and are carried by winds to all parts of the Earth. The delayed (or worldwide) fallout is brought to Earth mainly by rain and snow, over extended periods ranging from months to years.

WT. Prefix of Weapon Test (WT) report identification numbers. These reports were prepared to record the results of scientific experiments.

XRD. An abbreviation for X-ray diffraction.

YF. Covered lighter, self-propelled (Navy).

YFN. Covered lighter, nonself-propelled (Navy).

yield. The total effective energy released in a nuclear detonation. It is usually expressed in terms of the equivalent tonnage of TNT required to produce the same energy release in an explosion. The total energy yield is manifested as nuclear radiation (including residual radiation), thermal radiation, and blast and shock energy. The actual distribution depending upon the medium in which the explosion occurs and also upon the type of weapon. See TNT equivalent.

yield (blast). That portion of the total energy of a nuclear detonation that is identified as the blast or shock wave.

yield (fission). That portion of the total energy released by a nuclear explosion attributable to nuclear fission, as opposed to fusion. The interest in fission yield stems from the interest in fission product formation and its relationship to radioactive fallout.

YMS. Auxiliary motor minesweeper (Navy).


YR. Gasoline barge; self-propelled (Navy).

YXS. Gasoline barge; nonself-propelled (Navy).

YP. Patrol craft (Navy).

YW. Water barge, self-propelled (Navy).

Z1. Zone of Interior (conterminous United States).
APPENDIX F

RADIATION READINGS ABOARD TARGET VESSELS
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<th>Date</th>
<th>USS Barrier (APA-60)</th>
<th>USS Barrow (APA-61)</th>
<th>USS Bladen (APA-63)</th>
<th>USS Bracken (APA-64)</th>
<th>USS Briscoe (APA-65)</th>
<th>USS Brule (APA-66)</th>
<th>USS Carteret (APA-70)</th>
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*Shaded dates indicate some boarding activity either directly reported in logs or other reports, inferred from reports of towing, anchoring, etc., or indicates clearance for continuous habitation.

**BMIR** was detonated at 0835.

**Legend:** (A) Average, (BA) Below Deck Average, (BI) Below Tolerance, (E) Estimated, (M) Maximum, (TA) Topside Average.
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<th>USS Crittenden (APA-77)</th>
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**Notes:**
- Bolded dates indicate some boarding activity either directly reported in logs or other reports, inferred from reports of towing, anchoring, etc., or indicates clearance for continuous habitation.
- **S** was detonated at 0835.

**Legends:**
- (A) Average
- (B) Below Tolerance
- (E) Estimated
- (M) Maximum
- (TA) Topside Average
- (TM) Topside Maximum

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**NOTES:**

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- **BAKER** was detonated at 0835.

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2. BAKER was detonated at 0835.

LEGEND: (A) Average; (B1) Below Tolerance; (E) Estimated; (S) Sunk of Bikini Atoll; (TA) Topside Average.
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NOTES:

* Shaded dates indicate some boarding activity either directly reported in logs or other reports, inferred from reports of towing, anchoring, etc., or indicates clearance for continuous habitation.

* BOMER was detonated at 0835.

LEGEND: (A) Average, (E) Estimated; (F) Forecastle; (M) Maximum; (Q) Quarterdeck; (T) Topside; (TA) Topside Average; (TM) Topside Maximum.
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**NOTES:**
- Shaded dates indicate some boarding activity either directly reported in logs or other reports, inferred from reports of towing, anchoring, etc., or indicates clearance for continuous habitation.
- BAKER was detonated at 0835.

**LEGEND:** (A) Average; (BA) Below Decks Average; (BM) Below Decks; (E) Estimated; (M) Maximum; (T) Topside; (TA) Topside Average.
APPENDIX G
SAMPLE TARGET SHIP DOSE RECONSTRUCTION

Chapter 12 discusses the scientific dose reconstruction and lists the calculated film badge equivalent exposures for the crew members of the support and target ships. A sample target ship crew dose reconstruction is provided in this appendix. A detailed discussion of the reconstruction methodology is contained in Analysis of Radiation Exposure for Naval Units of Operation CROSSROADS, R. Weitz et al., Science Applications Inc., SAI 83-714-WR, DNA TR-82-5, 3 March 1982. Schematically, the reconstruction methodology is shown in Figure G-1.

Target ship crew dose reconstruction was chosen for this sample because target ship crew exposures typically were higher than support ship crew exposures, and their reconstruction involves all the elements of a support ship reconstruction as well as those unique to target ship crews. Target ship crews had the potential for receiving radiation exposures in the following radiological environments during CROSSROADS:

![Diagram of CROSSROADS ships' crew dose reconstruction methodology.](image)
Exposure to the low level of radioactivity in the lagoon water following Tests ABLE and BAKER

Exposure while reboarding target ships for inspection and salvage after Test ABLE

Exposure while living aboard those target ships that were remained after Tests ABLE and BAKER

Exposure while reboarding target ships for decontamination, inspection, and preparation for towing after Test BAKER

Exposure while living aboard support ships, which accumulated low-level radioactivity on their external hulls below the waterline and inside the saltwater piping systems after Test BAKER.

Each target ship requires individual research to determine the crew's activities. The primary sources of information are ship deck logs, decontamination reports, commanding officer damage reports, radiological safety (radsafe) monitor reports, participant letters and comments, dosimetry reports, and CROSSROADS historical and technical reports.

The potential radiation exposure while aboard target ships after BAKER is the major contributor to total dose for target ship crews. Fortunately, the radiation intensities aboard target ships after BAKER are well documented. Often, the names of personnel who actually boarded the target ships are listed in deck logs. In those cases where names are not available, it is assumed in these reconstructions that all crewmembers, normally divided into four reboarding teams, had an equal opportunity for exposure and that the teams rotated when the ship was not boarded by its full crew.

USS Independence (CVL-22) is used as a representative case because it had a relatively large crew, was significantly radioactive after Test BAKER, and clearly shows all the steps taken in calculating a reconstructed dose. After being evacuated just before ABLE, its crew was housed aboard USS Rockwall (APA-230) from 30 June through 12 August. Independence was first reboarded after Test ABLE on 4 July. It was reboarded daily from 5 to 11 July by several teams, and the entire crew worked aboard from 12 to 24 July. An unidentified number of personnel remained aboard at night except for the Test BAKER rehearsal on 18 July. From 13 to 23 August, the crew berthed aboard USS Ajax (AR-6). Independence was boarded between 18 and 21 August for some decontamination and inspection. Beginning on 17 August, the crew began to be transferred to other support ships for transport back to the United States. About half of the crew returned to the United States aboard USS Artemis (AKA-21), and this ship is the one on which the calculated exposure during the return trip is based. Each contribution to the total exposure in the reconstruction is discussed separately below.

POST-ABLE REBOARDING

The Independence crew commenced reboarding the ship on 4 July, after which the ship was boarded daily until 24 July. On 4 through 7 July, only two of the four reboarding teams came aboard. After 7 July, the number of teams reboarding
is not clear so it has been assumed the entire crew was aboard. Beginning on 11 July, a small security team remained aboard each night. Since they are not identified by name, the potential exposure has been assigned to the entire crew.

The calculation assumes that the radioactivity on board the target ships following ABLE was due almost entirely to neutron activation of ship materials themselves. Since the detected radioactivity levels were rather low, it was necessary to calculate the radiation environments aboard the ships. This involved the analysis of the composition of each ship type. The amount of iron, aluminum, magnesium, copper, etc. in each ship type was ascertained and was assumed to be in a homogeneous mixture. This mixture was then assumed to be subjected to the ABLE weapon neutron output. The radioactive isotopes produced by the neutrons were then determined. The radioactive environment was then assumed to be the sum of the radiation from these isotopes as they decayed with the passing of time. This environment was used to derive the doses for the post-ABLE Independence reboarding shown in Table G.1.

<table>
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<tr>
<th>Date</th>
<th>Parties Aboard</th>
<th>Calculated Intensity (R/24 hours)</th>
<th>Time Aboard (hours)</th>
<th>Percent of Day</th>
<th>Computed Dose (d) (rem gamma)</th>
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Note:
\(d\)Dose = percent of day \times Intensity \times 0.7 (film badge correction factor).

POST-BAKER REBOARDING

After Test BAKER, Independence was boarded on four days by the crew, 18 through 21 August. The names of all personnel who were in these boarding parties are contained in the Independence deck log. The number of Independence personnel aboard were 30, 44, 46, and 44, respectively, for each of the four days. There were two rad-safe monitors with them on 18 and 19 August, three on 20 August, and one on 21 August. The number of recorded film badges for each
day was 32, 44, 42, and 35, respectively; however, some of these badges were issued to non-Independence personnel. Therefore, a reconstructed dose was assigned to 24 personnel who were not badged on one or more of the boarding days. The contamination of most target ships following BAKER, including Independence, was extensive. For all target ships, detailed documentation of measured intensity levels was analyzed and summarized in the cited report and the results for Independence are shown in Figure G.2. This is the environment used to derive the doses shown in Table G.2. Table G.2 also shows the readings from the film badges issued to the reboarding parties.

Figure G.2. Gamma radiation intensity aboard USS Independence (CVL-22) following Test BAKER, CROSSROADS. Note that the scales of this chart are not linear but are logarithmic and each division represents a tenfold change. Linear interpolation between divisions shown is not possible. Use the dates shown and the values entered in the tables as a guide in interpolating.
Table G.2. Post-BAKER reboarding dose reconstruction, USS Independence (CVL-22) crew.

<table>
<thead>
<tr>
<th>Date</th>
<th>Teams</th>
<th>Hours Aboard (total)</th>
<th>Intensity from Figure G.2 (R/24 hours)</th>
<th>Percent of Day</th>
<th>Computed Dose(a) (rem gamma)</th>
<th>Issued Film Badge Readings</th>
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<tr>
<td>18 Aug</td>
<td>A</td>
<td>4.2</td>
<td>1.6</td>
<td>0.175</td>
<td>0.196</td>
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<td>A/B</td>
<td>3.9</td>
<td>1.5</td>
<td>0.162</td>
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<tr>
<td>21 Aug</td>
<td>Anchor Detail</td>
<td>4.0</td>
<td>1.3</td>
<td>0.166</td>
<td>0.151</td>
<td>35</td>
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Note:
\(a\) Dose = percent of day \times intensity \times 0.7 (film badge correction factor).

Calculated exposures are higher or about equal to maximum film badge exposure because all ship calculations use the topside intensity curves shown in Figure G.2. The ship inspections required personnel to be below deck much of the time, thereby resulting in lower film badge exposures. Exposures were individually assigned to the 24 personnel who were not badged.

SUPPORT SHIP DOSE

The Independence crew was evacuated to Rockwall on 30 June and continued to berth aboard this transport through 12 August. The crew transferred to Ajax for the period 13 through 23 August. There was no contribution to the total dose of the crew while on the support ships due to ABLE. However, the BAKER detonation contaminated portions of the Bikini Lagoon. Support ships returning to these areas became contaminated on their exterior hulls and internal water lines.

Modeling this environment was based on what information was available concerning the movement of the Red and Blue Lines (see main text) and other data about levels of lagoon water radioactivity. In developing the support ship model, time-dependent, external hull gamma intensities for all ships were derived from hull intensity readings taken on 12 of the support ships after departure from the lagoon, and from the individual ship movements in the contaminated water environment. The external hull gamma intensity was derived from measurements for 16 of the support ships and the geometric mean of this value was used for the remaining ships, including Rockwall and Ajax.

The external hull gamma environment and an additional gamma emission from interior piping were used in the cited report to calculate a dose for the crews while aboard the support ships. For the Independence crew while aboard Rockwall until 12 August, this amounted to 0.035 rem (gamma); and for their dose while aboard Ajax from 13 August to 23 August, it was 0.012 rem (gamma).
POST-BIKINI DOSE

The final portion of the calculated exposure covers the period of time personnel were aboard a support ship en route back to the United States. This resulted from the retention of low-level contamination on most support ships after Test BAKER.

The Independence crew was transferred to ten different ships between 17 and 28 August. About half the crew returned on Artemis and nearly a quarter on Ajax. This contribution was calculated based upon Artemis because the largest percentage of the crew was aboard it, and Artemis was more contaminated when it left Bikini Lagoon than was Ajax.

A number was determined for each support ship that characterized its radiological condition when it left Bikini. This number, called the ship departure factor, was based on the exposure history of each ship during its stay in the lagoon, and represents the hull intensity on the day of departure. For Artemis the number is 5. A nomogram (Figure G.3) is used to correct for the decrease in shipboard radiation because of decay of the radioactive emitters during the trip from Bikini and the observed decontamination effects of steaming in the open ocean. The nomogram is entered at the Bikini departure date (BAKER + 28 days) and read at the intersect with the San Francisco arrival date (BAKER + 43 days). The factor obtained (4) is multiplied by the ship departure factor (5) to determine the reconstructed badge exposure in millirem (20).

SUMMARY OF RECONSTRUCTION

These values were then used to assign uniquely determined, scientifically calculated doses for Independence personnel. Assignments were made to several clearly defined groups: those personnel who were at ABLE and BAKER but did not reboard Independence after BAKER, those personnel who did reboard after BAKER but were assessed for all four days, and those personnel who did reboard after BAKER but did not wear a film badge every day. The calculated exposures are in addition to any recorded film badges that were worn. The total calculated and recorded film badge exposures for the crewmembers of Independence ranged from 0.148 rem gamma to 0.448 rem gamma.
Figure G.3. Nomogram for reconstruction of dose for personnel returning from Bikini after CROSSROADS. Arrows illustrate example from text.
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Humboldt State College Library
ATTN: Documents Dept

Huntington Park Library
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Hutchinson Public Library
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Idaho Public Lib & Info Center
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Idaho State Library
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Idaho State University, Library
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University of Idaho
ATTN: Documents Sect
ATTN: Dir of Libraries

University of Illinois, Library
ATTN: Documents Section

Illinois State Library
ATTN: Government Documents Branch

Illinois Univ at Urbana Champaign
ATTN: R. Watson, Documents Library

Illinois Valley Comm Coll
ATTN: Library

Indiana State Lib, ATTN: Serial Section

Indiana State University
ATTN: Documents Libraries

Indiana University Lib, ATTN: Documents Department

Indianapolis, Marion City Pub Library
ATTN: Social Science Div

Iowa State University Library
ATTN: Govt Documents Dept

Iowa University Library
ATTN: Government Documents Dept

OTHER (Continued)

Butler University, Irwin Library
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Isaac Delgado College
ATTN: Librarian

James Madison University
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Jefferson County Public Lib
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Jersey City State College
ATTN: Librarian

Johns Hopkins University
ATTN: Documents Library

John J. Wright Library, La Roche College
ATTN: Librarian

Johnson Free Public Lib
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Kahului Library
ATTN: Librarian

Kalamazoo Public Library
ATTN: Documents Div

Kansas City Public Library
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Kansas State Library
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Kansas State Univ Library
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Kent State University Library
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Kentucky Dept of Library & Archives
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University of Kentucky
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ATTN: Director of Libraries

Kenyon College Library
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Lake Forest College
ATTN: Librarian

Lake Sumter Com Coll Lib
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Lawland Public Library
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OTHER (Continued)

Lancaster Regional Library
ATTN: Librarian

Lawrence University
ATTN: Documents Dept

Lee Library, Brigham Young University
ATTN: Documents & Map Section

Library & Statutory Distribution & Svc
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Little Rock Public Library
ATTN: Librarian

Long Beach Publ Library
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Los Angeles Public Library
ATTN: Serials Div U.S. Documents

Louisiana State University
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Louisville Univ Library
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Lyndon B. Johnson Sch of Pub Affairs Lib
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Maine Maritime Academy
ATTN: Librarian

Maine University at Orono
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University of Maine
ATTN: Librarian

Manchester City Library
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Mankato State College
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Mantor Library
Univ of Maine at Farmington
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Marathon County Public Library
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Marshall Brooks Library
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University of Maryland
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University of Maryland
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OTHER (Continued)

University of Massachusetts
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McNeese State Univ
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Memphis Shelby County Pub Lib & Info Ctr
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Memphis State University
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Mercer University
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Mesa County Public Library
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University of Miami, Library
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Miami Public Library
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Miami Univ Library
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Michel Cradare Library
University of Santa Clara
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Michigan State Library
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Michigan State University Library
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Michigan Tech University
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University of Michigan
ATTN: Acq Sec Documents Unit

Middlebury College Library
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Millersville State Coll
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Mills Library
State University of New York
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Milwaukee Pub Lib
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Minneapolis Public Lib
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Minnesota Pub Lib of Emergency Svcs
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Minot State College
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Mississippi State University
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University of Mississippi
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Missouri Univ at Kansas City Gen
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Mobile Public Library
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University of Montana
ATTN: Documents Div
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Murray State Univ Lib
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Mass Library System
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Univ, of Nebraska at Omaha
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Nebraska Western College Library
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Univ of Nebraska at Lincoln
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Univ of Nevada at Reno
ATTN: Government's Pub Dept
Univ of Nevada at Las Vegas
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New Hampshire University Lib
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New Hanover County Public Library
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Nebraska University Library
ATTN: Acquisitions Dept

New Mexico State Library
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University of New Mexico
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University of New Orleans Library
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New Orleans Public Lib
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State Univ of New York
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Newark Free Library
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Niagara Falls Pub Lib
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Nicholls State Univ Library
ATTN: Docs Div
Nieves M. Flores Memorial Lib
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Norfolk Public Library
ATTN: R. Parker
North Carolina Agri & Tech State Univ
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Univ of North Carolina at Charlotte
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Univ of North Carolina at Greensboro, Library
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University of Pennsylvania
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University of Denver
ATIN: Denver Library

Peoria Public Library
ATIN: Business, Sci. Tech Dept

Free Library of Philadelphia
ATIN: Govt Publications Dept

Philadelphia Free Library
ATIN: Library

Philadelphia Public Library
ATIN: Librarian

University of Pittsburgh
ATIN: Documents Office & C

Plainfield Public Library
ATIN: Librarian

Pocatac Library, Big Ed. Dist
ATIN: Librarian

Association of Portland Lib.
ATIN: Librarian

Portland Public Library
ATIN: Librarian

Portland State University Library
ATIN: Librarian

Presbyterian Hospital Lib.
ATIN: Librarian

Princeton University Library
ATIN: Librarian

Providence College
ATIN: Education Dept

Providence College Library
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Rhode Island College Library
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Rhode Island Public Library
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Rhode Island State University
ATIN: Librarian

Rutgers University
ATIN: Govt Publications Dept

Rutgers University Law Library
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San Diego State University
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San Francisco State University
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San Antonio Public Library
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| ATTN: Librarian |
| South Dakota State Library |
| ATTN: Federal Documents Department |
| University of South Dakota |
| ATTN: Documents Librarian |
| South Florida University Library |
| ATTN: Librarian |
| Southside-Brookline Area Library |
| ATTN: Government Documents |
| Southeast Missouri State University |
| ATTN: Librarian |
| Southeastern Massachusetts University Library |
| ATTN: Documents Dept |
| University of Southern Alabama |
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| ATTN: Librarian |
| Southern Illinois University |
| ATTN: Documents Ctrl |
| Southern Methodist University |
| ATTN: Librarian |
| University of Southern Mississippi |
| ATTN: Library |
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| Southern University at New Orleans Library |
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| ATTN: Documents Dept |
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| ATTN: Librarian |
| Southern Virginia College Library |
| ATTN: Librarian |
OTHER (Continued)

Spokane Public Library
ATTN: Reference Dept

Springfield City Library
ATTN: Documents Section

St. Bonaventure University
ATTN: Librarian

St. Joseph Public Library
ATTN: Librarian

St. Lawrence University
ATTN: Librarian

St. Louis Public Library
ATTN: Librarian

St. Paul Public Library
ATTN: Librarian

Stamford University Library
ATTN: Govt Documents Dept

State Historical Soc Lib
ATTN: Govt Docs Section

State Library of Massachusetts
ATTN: Librarian

State Library of New York
ATTN: Librarian

Stetson Univ
ATTN: Librarian

University of St. Thomas
ATTN: Librarian

Stockton A. San Joaquin Public Lib
ATTN: Librarian

Stockton State College Library
ATTN: Librarian

Swarthmore College Lib
ATTN: Reference Dept

Syracuse University Library
ATTN: Documents Section

Tallahassee Public Library
ATTN: Librarian

Tampa, Hillsborough County Public Lib,
ATTN: Librarian

Temple University
ATTN: Librarian

Tennessee Technological University
ATTN: Librarian

OTHER (Continued)

University of Tennessee
ATTN: Dir of Libraries

Tennessee Technological University
ATTN: Librarian

Texas A & M University Library
ATTN: Librarian

University of Texas at Austin
ATTN: Library Documents

University of Texas at San Antonio
ATTN: Library

Texas Christian University
ATTN: Librarian

Texas Tech University Library
ATTN: Govt Docs Dept

Texas University at Austin
ATTN: Documents Dept

Texas University at El Paso
ATTN: Documents and Maps Lib

University of Toledo Library
ATTN: Librarian

Toledo Public Library
ATTN: Social Science Dept

Torrance Civic Center Library
ATTN: Librarian

Traverse City Public Library
ATTN: Librarian

Trenton Free Public Library
ATTN: Librarian

Trinity College Library
ATTN: Librarian

Trinity University Library
ATTN: Documents Collection

Tufts University Library
ATTN: Documents Dept

Tulane University
ATTN: Documents Dept

University of Tulsa
ATTN: Librarian

USF Research Library
ATTN: Public Affairs Services Dept
OTHER (Continued)

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