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Operation UPSHOT-KNOTHOLE

NEVADA PROVING GROUNDS

March - June 1953

AD A995148

RADIOLOGICAL SAFETY OPERATION

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No. 3 of 17 copies, Series A

Report to the Test Director

RADIOLOGICAL SAFETY OPERATION

By

Tom D. Collison
Lieutenant Colonel, U. S. Army

Classification (Cancelled) (~~Changed to~~) JT RIV DOE/DOC FDOO/DNA
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Field Command
Armed Forces Special Weapons Project
Albuquerque, New Mexico
June 1953

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ACKNOWLEDGMENTS

The advice and assistance of Col Clinton S. Maupin, Medical Corps, Field Command, AFSWP, as Radiological Safety Staff Officer, contributed greatly to the success of the radiological safety mission during the Upshot-Knothole continental atomic test series reported herein.

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Chapter 1

INTRODUCTION

1.1 GENERAL

1.1.1 The Atomic Energy Commission, in addition to its other functions, has been given the responsibility of controlling the health hazard produced by radioactivity in all phases of the Atomic Energy Program. Thus, when atomic devices are tested at the Nevada Proving Grounds, the AEC must take action to provide radiological control and protection for the personnel involved in such tests as well as protection for residents located in the nearby vicinity and elsewhere in the United States.

1.1.2 In order to carry out the requirement outlined above, the AEC requested that the DOD furnish an organization capable of providing the necessary radiological control and presenting the necessary data to evaluate the radiological hazards involved.

1.2 HISTORY

1.2.1 Operation Buster-Jangle, fall 1951, saw the first military participation in the continental tests being held in Nevada; prior to this time only one test had been conducted in Nevada, Operation Ranger. The Rad-Safe organization for Buster-Jangle was organized and manned by H-Division of LASL and was augmented by a group of military personnel originally scheduled for the Windstorm operation, which had been canceled. This group, consisting of approximately 30 officers from all three services, assisted in the Rad-Safe portion of the operation. At the conclusion of this operation, the Chief, Chemical Corps, was given the responsibility of furnishing the trained Rad-Safe personnel for the following operation, Tumbler-Snapper, spring 1952. The Tumbler-Snapper operation was the first continental test in which a full scale military Rad-Safe organization was used. The 216th Chemical Service Company from Rocky Mountain Arsenal formed the greater portion of this organization. The 216th was augmented by personnel, in small numbers, from the Signal Corps, other Chemical Service Companies, and the Air Force and Navy.

1.2.2 Upon completion of the Tumbler-Snapper operation, plans for a new type of organization to facilitate handling of this type of operation were formulated. A special Rad-Safe Support Unit was to be formed for Operation Upshot-Knothole. This unit was to be activated and manned at the Training Center, Fort McClellan, Alabama, and would consist mostly of Chemical Corps personnel who would be augmented by 10 personnel from each of the other two services, Air Force and Navy. In addition to the above personnel, an Off-Site Rad-Safe group was to be organized to consist of civilian Public Health Service personnel, with augmentation by military personnel from the Rad-Safe Support Unit. All the above were to be under the command of an officer appointed by AFSWP.

1.3 ORGANIZATION OF REPORT

1.3.1 This report itself is divided into separate chapters for each shot with the period running from D – 1 of one shot to D – 1 of the following shot. Each chapter has a separate section for On-Site Operations, Off-Site Operations, Air Participation, Logistics and Supply, and General Comments. Chapter 13 contains an account of the roll-up of the Rad-Safe Unit and miscellaneous items that were not covered in the previous chapters. Chapter 14 contains a general account of the operation and function of the Rad-Safe Unit and the major sections.

1.4 ORGANIZATION AND PERSONNEL OF RAD-SAFE UNIT

1.4.1 The functional organization of the Rad-Safe Unit for Upshot-Knothole, the missions of the subsections of the Unit, and their procedure of operation are shown in the Rad-Safe Unit Operation Order, Incl. 1.

1.4.2 A listing of personnel of the Rad-Safe Unit with their assignments appears as Incl. 2. The majority of the personnel were provided by the Chemical Corps Training Command with the temporary assignment to Mercury of the 9778 TSU as the Rad-Safe Support Unit, with an approximate strength of 26 officers and 144 enlisted men. Five Navy officers and 5 Navy enlisted men, 5 Air Force officers and 13 airmen were on TDY to Mercury, to augment the unit. The Off-Site group, headed by a LASL civilian, consisted of 15 PHS officers, 2 LASL civilians, 1 Chemical Corps officer, and approximately 10 enlisted personnel from the support unit and augmentation personnel. The instrument repair section of On-Site Operations was supported by personnel of Project 6.8.

1.4.3 All the above personnel functioned as an integrated unit under the direction of the Head of the Rad-Safe Branch, P and O Division, DWET, who was designated as the Rad-Safe Officer, for Test Director, at the Nevada Proving Grounds.

1.4.4 As the burnout problem for monitors for this operation would be greater than that for previous operations, arrangements were made with the Chemical Corps Training Center to keep a reserve group of monitors, approximately 20, at Fort McClellan. These would be available to the Rad-Safe Unit at any time during the operation. In addition to this, arrangements were made for four members of the Passive Defense Group at Sandia Base for use during the latter half of the operation. These four would generally be used as monitors and would be given as much experience as possible during this phase of the operation.

1.5 AIR SUPPORT

1.5.1 Air support for the Rad-Safe Unit was provided by the 4925th Test Group (Atomic) of AFSWC. It consisted of two B-29's and one B-25 used for cloud tracking, one C-47 and t[illegible] L-20's used for the low level terrain survey, and two helicopters to be used for on-site su[illegible]. All the above planes were controlled by the Control Officer of the Rad-Safe Unit through the Air Control Officer of the 4925th Test Group (Atomic).

1.6 SUPPLIES

1.6.1 All supplies needed for the operation, which were not already on hand from previous operations, were purchased by the AEC. Many critical items did not arrive until just prior to the first shot; and, although this caused some difficulty, everything except communications checked out satisfactorily before the first shot. A check on communications was not possible as the vehicles arrived late and some radios were not installed until the day before shot time. The radios installed in military vehicles were not satisfactory. The new military vehicles had a 24-volt ignition system. The radios operated on a 6-volt system. This problem was not satisfactorily solved by the Las Vegas Field Office prior to the first shot. In addition, the repeater station could not be relied upon. A dry run, scheduled at 0500 two days before the first shot, was completed without communications because the repeater station was not functioning that morning.

1.6.2 The 35,000 film badges for the operation were arranged for through H-Division, LASL, and the Division of Biology and Medicine. They were made by Du Pont and consisted of a 502 and a 606 film, the 502 being the more sensitive. The films were to be covered by a lead shield on each side 0.72 mm thick and ½ in. wide by 1 in. long. They were received from the manufacturer with ½ in. lead coverage on one side and 1 in. of lead on the other. Arrangements were made through the Purchasing Department of LASL to have a portion of them returned to Du Pont for correction. So as not to delay the operation, this was done in increments of 5,000 badges. In all, 28,000 were corrected.

1.7 PROGRAM MONITORS

1.7.1 Project requirements were to be met by appointing an officer monitor for each program. This program monitor would generally coordinate the needs of his particular program, would monitor for that program whenever possible, and would arrange for the additional monitors needed for the program. Program monitors would attend all rehearsals of their programs. A letter, Incl. 3, was sent to each program, project, and contractor, to introduce the Rad-Safe Unit and the program monitor and to briefly introduce the Rad-Safe requirements to test personnel.

1.8 CALIBRATION OF INSTRUMENTS AND DOSIMETERS

1.8.1 The instrument repair section mechanically calibrated all survey instruments between each shot period. Instruments were assigned to active monitors by the week. Monitors were then required to check calibration of their individual instrument on the calibration range before each monitoring assignment. Frequent checks were made by the On-Site Operations Officer to see that the calibration checks were thorough. A 1 curie Co^{60} source obtained from Oak Ridge was calibrated against sources at Los Alamos by the officer in charge of the Dosimetry and Records Section, to be used as a source for calibration of the survey meters.

1.8.2 All dosimeters were calibrated against a known Co^{60} source. Those pocket dosimeters not meeting a 10 per cent tolerance or considered unsatisfactory for another reason were segregated for return to the manufacturer. Calibration curves were run on film badges to be used during the operation both at the Nevada Proving Grounds and at Los Alamos. The two curves checked excellently.

Inclosure 1

RADIOLOGICAL SAFETY OPERATION ORDER NO. 1-53 (UPSHOT-KNOTHOLE)

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2 – Off-Site Operations
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1 – Rad-Safe Officer, NPG
1 – Rad-Safe Control Officer
1 – J-3
1 – Test Director
1 – DWET

RADIOLOGICAL SAFETY OPERATION ORDER NO. 1-53 (UPSHOT/KNOTHOLE)

1. Purpose

The purpose of this radiological safety plan is to provide for the protection of all persons at or within a radius of 200 miles of the Nevada Proving Grounds, for the maintenance of operational efficiency of personnel involved in Operation Upshot/Knothole in the presence of radiological hazards, and for the collection and dissemination of radiological safety information.

2. Organization and Personnel

a. The Radiological Safety Organization is shown in Annex A to this order.

b. Personnel of the Rad-Safe Organization will consist of a Rad-Safe Support Unit organized and trained by the Chemical Corps Training Command. This unit will be supported by LASL civilians, U. S. Public Health Service Officers, and selected Armed Forces Advisory personnel.

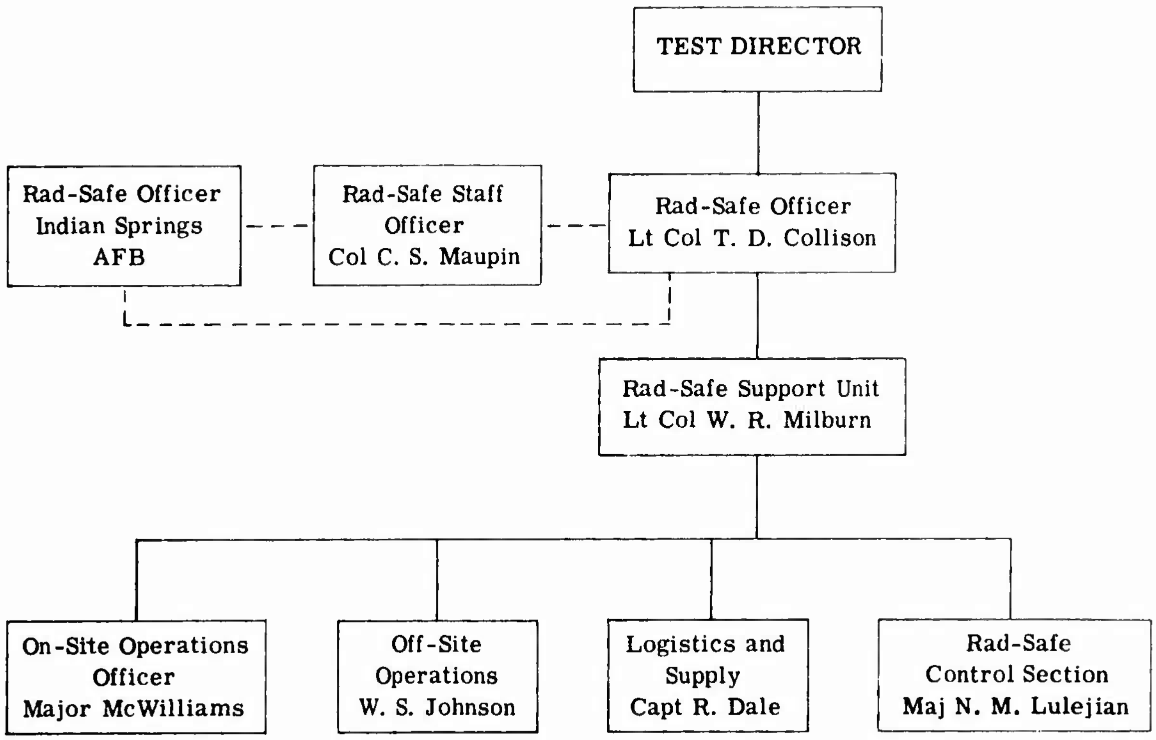
3. Responsibilities

a. The Radiological Safety Officer is responsible for carrying out the Rad-Safe policies of the Test Director. He is responsible for keeping the Test Director informed of the radiological status at the Nevada Proving Grounds and within a radius of 200 miles of the target areas. To fulfill these responsibilities he will supervise and coordinate all activities of the Rad-Safe Organization. He is responsible for furnishing all ground monitoring services required for scientific programs and for radiological safety in areas within a radius of 200 miles from NPG. He is responsible for providing the Test Director with up-to-date situation charts and maps showing on-site and off-site data and with plotting data provided by cloud tracking and terrain survey aircraft. He is responsible for coordination with the Indian Springs AFB Rad-Safe Officer in handling certain Rad-Safe requirements.

b. The Rad-Safe Staff Officer will act as advisor to the Test Director on general medical matters and on all radiological safety matters affecting health and welfare of personnel at NPG or having implications external to NPG. He will work closely with the Rad-Safe Officer, and is to advise on technical medical matters. He will act as liaison officer for and advisor to the Test Director in connection with radiological safety of aircraft crews, sample handling personnel, and plane decontamination at Indian Springs.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Annex A, Organization Chart



——, Supervisory responsibility. -----, liaison and advisory.

Annex B, Radiological Safety Regulations

1. The total permissible dose for personnel involved in this operation is 3.9 roentgens, gamma only, unless reduced by the Test Director because of previous or anticipated future exposure. No limitation is placed on the rate of accumulation of the total dose.

2. The arrival and proposed use of radioactive sources at Nevada Proving Grounds will be reported to the Radiological Safety Officer.

3. All samples of radioactive materials which are removed from the test site will be packaged and loaded so as to reduce radiation to a minimum and will be cleared by the Rad-Safe On-Site Operations Officer.

4. Contaminated containers for radioactive materials and equipment, other than those couriered, leaving the test site will be decontaminated, packaged, monitored, and labeled in such a manner as to satisfy the requirements of the Interstate Commerce Commission for transportation of same. This information will be furnished by the Rad-Safe Officer upon request.

5. All samples of radioactive material which are couriered in aircraft will be packaged and loaded so as to reduce radiation to a minimum. The Rad-Safe Officer at Indian Springs AFB will have a survey made of the package to determine if adequate precautions have been taken. The following criteria will determine space and packaging requirements:

a. Prior exposure of aircraft and courier personnel.
b. Anticipated future exposures on trip.
c. Length of time of exposure on trip.
d. In all cases crew members will be limited to dosage rates of less than 20 mr/hr.

6. Each area in which a detonation takes place will be considered contaminated until cleared for operations by the Test Director.

7. Entry to and exit from contaminated areas will be via Rad-Safe check points only.

8. Contaminated areas of intensities greater than 100 mr/hr will be delineated as such; personnel entering these areas must be accompanied by a monitor and will be subject to clearances by the On-Site Rad-Safe Operations Officer. Rad-Safe clothing and equipment will be issued to the personnel.

9. Areas of intensities less than 100 mr/hr and greater than 10 mr/hr will be controlled areas; personnel entering these areas will be subject to clearance by the On-Site Rad-Safe Operations Officer. Monitors are not required for entry into these controlled areas.

10. Areas of intensities less than 10 mr/hr are unrestricted from a Rad-Safe standpoint.

11. Rad-Safe monitors assigned to individuals or groups working in contaminated areas, or with contaminated equipment during recovery operations will act in an advisory capacity to keep the recovery party leader informed of radiation intensities at all times. The recovery party leader is expected to accept this advice and act accordingly. It is the responsibility of both the leader and the members of the recovery party to adhere to the limits established in these regulations.

12. Film badges, dosimeters, and protective clothing (coveralls, booties, caps, gloves, dust respirators, etc.) as deemed necessary will be issued to personnel entering contaminated areas by Rad-Safe Supply in the Rad-Safe Building.

13. When eating or smoking in any contaminated area, sensible sanitary precautions will be taken.

14. Prior to each shot a schedule of events for the first day after the shot will be published by the Test Director. This schedule will be followed explicitly for entry times until such time as the area is declared clear.

15. All projects will submit as soon as possible, and at least 24 hours prior to entry time, to the On-Site Operations Officer, a list showing personnel by full name, project, work area, estimated duration of stay, and desired time of entry. The On-Site Operations Officer will use this information in providing film badges, dosimeters, and clothing, and in assigning the necessary monitors.

16. There will be no change of itinerary or area to be covered after entry into a controlled or contaminated area without authorization from the On-Site Rad-Safe Operations Officer.

17. All vehicles used in contaminated areas will be checked through the vehicle decontamination section before return to Camp Mercury or re-entry into contaminated areas. Users of privately-owned or AEC rented vehicles are advised that contaminated vehicles will be held at the decontamination station until decontamination is completed.

18. All southbound vehicles will be monitored at the junction of the main road and the access road to the Rad-Safe Building. Clearance through this monitor station is mandatory prior to departure for Camp Mercury. (After completion of tests in Yucca Flat, a station will be placed in a corresponding point in the Frenchman Flat area.)

19. Current radiological situation maps of the test areas will be maintained in the briefing room of the Rad-Safe Building, in the Rad-Safe Control Office in Building No. 1 at the CP, and in the orderly room at the Rad-Safe Support Unit, Building No. 200.

20. Current air and surface radexes and radiological situation maps of peripheral areas will be maintained in the Rad-Safe Control Office in Building No. 1, CP.

21. All personnel within viewing distance of an atomic detonation who are not supplied with protective goggles will turn away from the detonation point and close or cover their eyes during the time of burst.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Annex C, Permissible Contamination Levels

1. The contamination levels listed hereon are to be regarded as advisory limits for control of contamination under average conditions.

2. All readings of surface contamination are to be made with side window type geiger counters, with tube walls not substantially in excess of 30 mg/cm square with shield open. The surface of the probe should be held one (1) inch to two (2) inches from the surface that is under observation unless otherwise specified.

3. Personnel and clothing tolerances are as follows:

a. Skin readings should not be in excess of 1 mr/hr. Complete decontamination by bathing is to be attempted.

b. Underclothing and body equipment, such as the internal surfaces of respirators, should be reduced to 2 mr/hr.

c. Outer clothing should be reduced to 7 mr/hr.

4. The interior surfaces and occupied sections of aircraft and vehicles should be reduced to 7 mr/hr. The outside surfaces of vehicles should be reduced to less than 7 mr/hr gamma only at five (5) or six (6) inches from the surface.

5. In air and water the following continuous levels of radioisotope are considered safe:

	Beta or gamma emitter	Long-lived alpha emitters
Water	10^{-7} $\mu c/cc$	10^{-7} $\mu c/cc$
Air	10^{-9} $\mu c/cc$	5×10^{-12} $\mu c/cc$

In air for any 24-hr period after a shot, 10^{-4} $\mu c/cc$, of which particles less than 5μ shall not exceed 10^{-6} $\mu c/cc$.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Annex D, Responsibilities of Subsections

1. The missions of the support elements of the Rad-Safe Unit are listed hereon.

2. The Rad-Safe Support Unit Commanding Officer:

a. Will be responsible to the Rad-Safe Officer, Nevada Proving Grounds for:

(1) The accomplishment of the missions assigned to the subsections of the Rad-Safe Support Unit.

(2) Maintaining the Rad-Safe Support Unit at a state of maximum effectiveness for requirements at the Nevada Proving Grounds.

(3) Assigning of his personnel to various sections and their training and education preparatory for their assignments.

(4) Necessary inspections, musters, and inventories of equipment to insure readiness to carry out assigned missions.

(5) Requiring that records, relative to personnel, material, and operations are maintained, the consolidation of all journals and recommended changes to SOP's and section procedures.

(6) The operational administration pertaining to the Radiological Safety Unit.

(7) Upon the completion of the operation he will submit a complete operations report with recommendations for future organization or changes in his present organization. This recommendation will include a complete table of distribution with a view toward the establishment of a Rad-Safe Unit for the Nevada Proving Grounds that will be able to fill all Rad-Safe requirements exclusive of Desert Rock and Indian Springs Air Force Base.

b. He will generally be responsible as a Unit Commander for:

(1) Administration, pay, housing, and recreational facilities for personnel in his command.

(2) Promoting and preserving morale, state of health, physical fitness, and the welfare of his command, and seeing that appropriate recognition is made of noteworthy performance.

(3) Appropriate disciplinary control of personnel within his command, including recommendations for courts and boards.

(4) In case of accident or death of service personnel assigned to the provisional unit, he will comply with required procedures and regulations.

3. Off-Site Operations Officer: The Off-Site Operations Officer will be responsible for:

a. Off-Site personnel, Off-Site surveys, air sampling, and a counting room.

b. The Off-Site radiological situation maps in the Rad-Safe Control Room, and through it he will keep the Control Officer informed of the general off-site picture.

c. Directing any survey required by low level liaison planes or helicopters.

d. An area of responsibility generally including the area within a 200-mile radius of the Nevada Proving Grounds, with particular consideration for inhabited areas.

e. Maintaining a journal of each day's activities and maintaining a record of the size, shape, and duration of the fall-out pattern.

f. Making and recording particle size measurements, decay characteristics, and absorption data on the beta component of gross fission products, and determining, where possible, the specific activity per particle.

4. On-Site Operations Officer: The On Site Operations Officer will be responsible for:

a. All activities and personnel of On-Site operations including:

(1) Initial surveys.

(2) Project monitors.

(3) Briefing of monitor and project personnel.

(4) Vehicle and equipment decontamination.

(5) Records and film badges to include the maintenance of adequate personnel records to denote total dosage received by each individual.

(6) Personnel decontamination.

b. Consulting the Rad-Safe Officer as to each day's requirement.

c. Consulting Scientific Program Directors and J-3 as to requirements for the following day, while recovery and re-entry programs are in effect.

d. Posting a schedule of operations for the following day on the On-Site operations center bulletin board.

e. Briefing responsible officers and senior monitors in his section as to the situation for the day and recommending safety requirements for parties entering contaminated areas.

f. Maintaining a log or journal which shall describe briefly in chronological order all events of importance to his section.

g. Supervising the assignment and scheduling of program monitors and project monitors, including those necessary for construction purposes in contaminated areas.

h. Establishing vehicular controls when necessary.

i. Maintaining an On-Site radiological situation map, where he will delineate and post the 10 mr/hr and 100 mr/hr, 1 r/hr and 10 r/hr isointensity lines in the target area.

j. Controlling entry into contaminated areas and making recommendations for non-entry, limited access, or full access areas, and prescribing as required, monitors, film badges, and Rad-Safe clothing and equipment to be worn in these areas.

k. Admitting parties into test areas. He will follow the radiation levels in the general regulations as a guide and will consider that no limitation is placed on the rate of accumulation, as long as the rate is sufficiently low as to permit adequate control.

l. Issuing clearances for removal of radioactive material from the test site.

m. Providing Rad-Safe check points as required for each target area.

n. Reporting to the Rad-Safe Officer all violations of the Radiological Safety Regulations.

o. Informing Logistics and Supply Officer as to anticipated future demands.

p. Keeping the On-Site situation map in the Rad-Safe Room posted for the Control Officer.

q. Scheduling duty officers who will be responsible for up-to-date maintenance of information concerning the radiological situation, and be responsible to him for On-Site requirements.

5. Logistics and Supply Officer: The Logistics and Supply Officer will be responsible for:

a. Transportation:

(1) Dispatch and control of all vehicles assigned to the Rad-Safe Group.

(2) Daily records of vehicle assignments and usage.

b. Supply:

(1) Maintain a stock of general expendable and nonexpendable supplies as required to support the Rad-Safe Group in fulfillment of its functions.

(2) Issue the above supplies as required to authorized personnel employed in test operations.

(3) Daily records of all supplies and equipment requisitioned, issued, expended, or turned in, in support of test operations.

c. Instruments:

(1) Maintain a stock of approved radiological safety type survey instruments and associated equipment for issue to Rad-Safe monitors.

(2) Establish and operate an electronics and electrical equipment repair shop in the basement of the Rad-Safe building which will be capable of repair and maintenance of all radiological detecting equipment.

(3) Maintain daily records of all equipment and supplies required to accomplish the above functions.

d. Exercising supervision over laundry facilities.

6. Control Section. The Control Section will consist of the Control Officer and personnel furnished by the Rad-Safe Support Unit with a representative from the Off-Site and On-Site Sections and an Air Liaison Officer. The Control Officer will be responsible for:

a. Maintaining all pertinent radiological data and coordinating all Rad-Safe activities and operations.

b. Maintaining complete up-to-date situation charts and maps showing Off-Site, On-Site, weather and air data.

c. Supervising the preparation of a predicted fall-out map prior to each operation.

d. Knowing the location of all working parties and monitoring groups and control of them through the On-Site Operations Officer.

e. Receiving and plotting data from the Air Participation Unit and coordinating with J-3 and CAA representatives with a view to returning airways to normal traffic operation.

f. Maintaining a journal of each day's activities.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Annex E, Employment of B-29 and B-25 Aircraft for Cloud Tracking

1. The control and responsibility for operation of the two B-29 and one B-25 aircraft for cloud tracking will be a function of the Commanding General, Air Force Special Weapons Center.

2. The general procedure for tracking will be as follows:

a. The Rad-Safe Officer, Nevada Proving Grounds, will forward data on the predicted cloud movement to the Special Weapons Center Control Point.

b. One B-29 will track the cloud at 25,000 ft msl, the other B-29 will track the cloud at 18,000 ft msl, and the B-25 will track the cloud at 12,000 ft msl. In the initial stages the cloud will be visible; tracking aircraft will take advantage of this and will generally stay clear of the cloud. However, at intervals, the trackers will approach the edge of the cloud up to the 5 mr/hr line, and the position of the aircraft at this point will be radioed to the Control Point in accordance with the message form indicated in paragraph c below. The leading edge of the cloud will be tracked and reports will be made once every fifteen minutes.

c. The following report will be radioed to the Control Point from the B-29 and B-25 trackers:

Able	(A/C call sign)
Baker	(Message No.)
Charlie	(Position grid)
Dog	(Time, PST)
Easy	(Altitude, msl)
Fox	(Direction of cloud from A/C)
George	(Meter reading) Black (MX-5 mr) White (T1B mr)
How	(Remarks)

3. Personnel within the tracker will wear dosimeters and film badges. The monitor will be equipped with two T1B and two MX-5 radiac survey instruments.

4. Tracking of the cloud will continue (within limitations of the aircraft concerned) until it is determined by Rad-Safe Officer, Nevada Proving Grounds, and Special Weapons Center representative at the Control Point that the cloud is not hazardous or until the New York Operations Office, Atomic Energy Commission, aircraft assumes this responsibility.

N. M. LULEJIAN
Major, USAF
Control Officer

Annex F, Delineation of Fall-out Pattern

1. Purpose: The purpose of this annex is to outline the procedure to be followed in determining the ground contamination pattern after each shot by the use of aircraft.

2. General: The general outline of the ground contamination and any specific "hot spots" in the area will be determined by low level aerial surveys utilizing L-20 and C-47 type aircraft The aerial terrain survey pattern to be flown for each shot will be prepared by the Rad-Safe Officer and forwarded to the AFSWC Air Control Office for transmission to the pilots and monitors prior to each shot. Aerial readings will be extrapolated to ground readings and plotted in a prominent manner in the control room.

3. Equipment and Personnel:

a. Two L-20's equipped with MX-5, T1B, and "Scintelog" survey meters will be employed. AFSWC will furnish pilots for these planes. The Rad-Safe Officer, NPG, will furnish the necessary trained monitors and survey equipment.

b. One C-47, equipped by the AFSWC with a C-1 air foil, will be employed. Survey instruments, consisting of a "Scintelog" with recorder, and two MX-5's, two T1B's, and two monitors will be provided by the Rad-Safe Officer, NPG.

4. Detailed Survey: The determination of the contamination pattern will be considered in two phases; first the close-in and second the extended. The L-20 will make the close-in survey of approximately a 20-mile radius around ground zero. The C-47 will make the extended survey out to approximately a 200-mile radius. The detailed pattern to be followed by each plane will be determined by the Rad-Safe Officer, NPG, prior to each shot, and may be changed during the course of the survey, if the Rad-Safe Officer deems a change necessary. However, the pattern to be flown will generally follow the course and sequence indicated below.

a. The first L-20 will take off from Indian Springs AFB (time to be determined by the Rad-Safe Officer, NPG, but approximately 1 hr after H hour), proceed to the shot area, and fly the prescribed survey pattern. Data will be collected by a monitor aboard the plane using a T1B and an MX-5 survey instrument. Readings will be reported periodically and will follow the form indicated in paragraph 5 below. This survey will be flown as near as possible to within 500 ft of the ground, provided it is safe to do so. Details of the survey will be coordinated with AFSWC representative.

b. The second L-20 will perform a terrain survey pattern indicated by the Rad-Safe Officer at approximately H+3 hr.

c. The C-47 will take off from Indian Springs AFB (time to be determined by the Rad-Safe Officer at NPG, but approximately 1 hr after H hour). The C-47 will fly at an altitude of approximately 500 ft above terrain whenever it is safe to do so. In the event that it is not safe to fly at 500 ft, the pilot will fly at the lowest altitude commensurate with safety. The details of the flight pattern will be coordinated with AFSWC to assure safety and feasibility commensurate with the terrain and type of aircraft used. Data will be reported as indicated in paragraph 5 below.

5. Data will be reported using the following form:

MESSAGE FORM
TERRAIN SURVEY (C47, L20's)

(Rag Mop)
1. Call Sign (Ever Ready)________________
2. Message No. RS________________
3. Position (Grid)________________
4. Time (Local)________________
(Above)
5. Altitude (Ground)________________
6. Meter Reading
(MX5) Black – (mr)________________
(T1B) White – (mr)________________
(Scintelog) Red – (Scale)________________
(Reading)
(C-1 Foil) Green – (MX5)________________
(1-inch)
(w-open)
7. REMARKS:________________

6. Brief aerial surveys will be repeated on subsequent days after each shot as deemed necessary by the Rad-Safe Officer, NPG.

N. M. LULEJIAN
Major, USAF
Control Officer

Annex G, On-Site Operations

1. Mission

The On-Site Operations Section, together with its subordinate sections, will be responsible for all On-Site radiological safety activities and other activities as determined by the Radiological Safety Officer, NPG. This will include

a. Initial and daily surveys of test areas as required.
b. A complete monitoring program.
c. Issue and processing of all personnel dosage devices.
d. Radiological Safety records administration.
e. Control and operation of personnel and equipment decontamination stations.
f. Record and control all radioactive material entering or leaving the Proving Grounds.

2. Organization (See Incl. 1.)

3. Duties and Procedures

a. On-Site Operations Officer. The On-Site Operations Officer will

(1) Be responsible for those duties listed in paragraph 4, Annex D, of the Radiological Safety Operation Order.

(2) Supervise and coordinate the activities of all sections under his control, as indicated in Incl. 1.

(3) Maintain a journal in the On-Site Operations Office, which will include all incidents and operations in sufficient detail to serve as a guide for preparation of an after operations report.

(4) Require all subordinate section chiefs to maintain a journal of their section activities.

(5) Maintain his office in the Rad-Safe Building, and insure that an Operations Officer is present for duty in this office continually, except as authorized otherwise by the Rad-Safe Officer, NPG.

(6) Maintain in the On-Site Operations Office a schedule of operations for each day.

(7) Establish vehicle and personnel check points to control access to all contaminated areas.

(8) Issue an "Area Access Clearance" form to the foreman or monitor of any group requiring entrance to any area within the 10 mr/hr line. This form is attached as Incl. 2.

(9) Publish weekly and distribute to the Rad-Safe Officer, J-3, and Project Directors concerned a list of all personnel who have accumulated an integrated dose of 2 r or greater during this operation. Lists will be cumulative. Personnel will be included on this report by name, project number, and organization.

(10) Notify the Rad-Safe Officer and Project Director concerned of all personnel who have exceeded the 3.9 r exposure limit.

(11) Furnish personnel as required by the Rad-Safe Officer to assist in the operation of the Rad-Safe Control Center.

b. Plotting and Briefing Officer. The Plotting and Briefing Officer will

(1) Receive, record, and plot on the situation map in the Briefing Room of the Rad-Safe Building all results of surveys made in the test area. Maintain an up-to-date map showing the 10 mr/hr, 100 mr/hr, 1 r/hr, and 10 r/hr iso-intensity lines.

(2) Furnish data required by the Rad-Safe Control Officer. This will include a daily overlay of the local situation map, including all iso-intensity lines.

(3) Post a copy of this map on Building No. 200 in the Quonset Area at Camp Mercury where it will be available to all authorized parties.

(4) Brief the leader and monitor of each party prior to departure of the party for entry into any contaminated area. This briefing will include an explanation of the radiological situation in the area concerned as indicated on the situation map, route of entry and exit, location of check points, and any other pertinent information including current Rad-Safe regulations for contaminated areas. Upon completion of the briefing, the Area Access Clearance will be issued to the party.

c. Monitor Section Chief. The Monitor Section Chief will

(1) Supervise all activities of the Monitor Section.

(2) Furnish properly trained and oriented personnel to fill all the daily monitor requirements prescribed by the On-Site Operations Officer.

(3) Assign permanent program monitors, with the concurrence of the On-Site Operations Officer, to those programs having sufficient activities to make such an assignment economical and of material benefit to the program.

(4) Operate check points as directed by the On-Site Operations Officer (see Incl. 3).

(5) Insure that all program and project monitors are thoroughly indoctrinated in their relationship with the personnel they support (see Incl. 4).

(6) Furnish vehicle monitors for fixed decontamination station near the Rad-Safe Building or any mobile station established in the field (see Incl. 5).

(7) Operate the personnel decontamination station in the Rad-Safe Building (see Incl. 6).

(8) Coordinate with Dosimetry and Records Section so that maximum utilization of personnel can be made without exceeding the Maximum Permissible Exposure.

(9) Posting of Contaminated Areas (see Incl. 7).

d. Decontamination Section. The Decontamination Section Chief will

(1) Supervise all activities of the Decontamination Unit.

(2) Operate the fixed vehicle decontamination station at the Rad-Safe Building, plus all mobile stations, using the 400-gal decontaminating apparatus, as specified by the On-Site Operations Officer (see Incl. 8).

(3) Be present or insure that a commissioned assistant is present at the fixed vehicle decontamination station at all times it is in operation.

(4) Establish and control the hot park area.

(5) Operate a vehicle check point north of the junction of Mercury Highway and the access road to CP No. 1 to insure that all vehicles proceeding south from the test area are not contaminated above tolerance levels specified in Incl. 5. When contaminated areas exist in Frenchman Flat, a similar check point will operate south of the Frenchman Flat Area on Mercury Highway.

e. Dosimetry and Records. The Dosimetry and Records Chief will be responsible for

(1) Providing indi idual dosimeters (see Incl. 9).

(2) Calibration of film badges and pocket dosimeters (see Incl. 10).

(3) Processing all film badges (see Incl. 11).

(4) Interpreting all dosimeter readings.

(5) Maintaining permanent records of cumulative individual radiation dosages (see Incl. 12).

(6) Preparation and submission of cumulative radiation dosage reports (see Incl. 13).

(7) Compiling and submission to the appropriate agencies the total cumulative dosage reports, records of radiation dosage, and exposed films (see Incl. 14).

(8) Storage of film badges and pocket dosimeters. The film badges will be stored in their original containers under refrigeration at a temperature of 40°F. Pocket dosimeters will be stored in an atmosphere as free from dust as possible.

W. R. MILBURN
Lt Col, Cml C
On-Site Operations Officer

Inclosures:

1 – On-Site Organization
2 – Area Access Clearance Form
3 – "Check Point Monitors"
4 – "Relationship Between Monitors and Personnel They Support"
5 – "Vehicle Monitors"
6 – "Personnel Decontamination Station"
7 – "Posting of Contaminated Areas"
8 – "Vehicle Decontamination Station"
9 – "Personal Dosimetry" w/Forms R101 and R111
10 – "Calibration of Film Badges and Pocket Dosimeters"
11 – "Film Badge Processing and Recording"
12 – "Maintaining Permanent Records of Cumulative Individual Radiation Dosages" w/Form 102R
13 – "Preparation and Submission of Cumulative Dosage Reports"
14 – "Disposition of Radiation Dosage Records and Exposed Film Badges Following the Test Operation"

Annex G: Inclosure 1

ON-SITE OPERATIONS

1 Major	7330
1 Capt	2162
2 Lt	2162

MONITOR SECTION		DOSIMETRY AND RECORDS SECTION		PLOTTING AND BRIEFING SECTION		DECON. SECTION	
1 Capt	7314	1 Lt	7314	1 Capt	7314	2 Lt	1414
15 Lt	N/S	3 Lt	Dosimeter Officer *	1 Lt	2162	2 Sgt	1809
7 Sgt	N/S	3 Sgt	Chief Dos. Tech. *	2 Sgt	1870	1 Cpl	1809
11 Pfc	N/S	1 Sgt	4405	2 Cpl	Voice radio op. *	1 Pfc	4345
73 Pvt	N/S	12 Pvt	Dos. Tech. *			4 Pvt	1809

* No MOS code number assigned at present; these positions are listed by job title.

Annex G: Inclosure 2

Form R110

AREA ACCESS CLEARANCE

DATE:__________ CHECK POINT:__________
Project No.__________ Time of Entry:__________
Foreman:__________ Checked in by:__________
Monitor:__________ Time of Exit:__________
No. in the Party:__________ Checked out by:__________
Briefed by:__________

Protective Clothing and Equipment Required:

☐ Protective Clothing ☐ Film Badges/man ☐ G-M Survey Meter ☐ Other (Specify)

☐ Respirators ☐ Pocket Dosimeter Range:___ No.___ ☐ I-C Survey Meter __________

Cleared for entry at__________hours to Area__________Recommended Time of Stay__________

REMARKS: (See Reverse Side) BY:__________
(Signature)

Annex G: Inclosure 3

Check Point Monitors

Check point monitors will be responsible for ascertaining that each party checked into the controlled area has a properly authenticated Area Access Clearance and that the composition of the party and protective equipment carried agree with the entries on the clearance form. The check point monitor will receive and retain the clearance form when the party enters the area and will fill in the appropriate entries on the form. When a party checks through the check point on exit from the controlled area, the monitor will make the appropriate entries on the clearance form for the party and retain the form. Completed forms will be turned in to the On-Site Operations Center by the Monitor Unit for filing and retention. When the requirement is indicated, check point monitors will be supplied with brooms and will require personnel and equipment to be swept off when parties clear the test area, to prevent possible accumulation of contaminated dust in the vicinity of the Rad-Safe Building. Check point personnel will be equipped with T1B Survey Instruments.

Annex G: Inclosure 4

Relationship Between Monitors and Personnel They Support

Monitors are not policemen, but are technical advisors whose job is to assist operating personnel to meet radiological safety requirements. The monitor advises but does not direct. Monitors will report all violations of radiological safety regulations to the Monitor Section Chief.

Annex G: Inclosure 5

Vehicle Monitors

The vehicle monitors will operate in conjunction with the decontamination unit, both in the fixed decontamination station near the Rad-Safe Building and in any mobile vehicle decontamination stations established in the field. To clear vehicles for return to Camp Mercury, the vehicles must read less than 7 mr/hr gamma only at any outside point at 5 in. from the surface and less than 7 mr/hr beta plus gamma at any point inside. The MX-5 survey instrument will be used for their readings.

Annex G: Inclosure 6

Personnel Decontamination Station

The operation of the Personnel Decontamination Station requires a minimum of six persons, with location and responsibilities as follows:

1. One monitor will be stationed outside the hot entrance to the station with a supply of clean booties and work gloves and receptacles for dirty booties, gloves, and used masking tape. This man will require all persons processing to take off their tape, booties, and gloves in that order and deposit them in the contaminated receptacles provided. All gloves and booties will be considered contaminated and will be turned in for clean ones at this point, without monitoring.

2. Two monitors will be stationed in the check room equipped with MX-5's. These men will monitor all personnel processing through the station.

3. One supply man will be stationed at the counter in the check room, who will receive and deposit in the contaminated bin any articles of clothing which are contaminated above the

tolerance levels listed below. This man will issue a credit slip for any contaminated clothing received. This credit slip may be presented at the supply issue counter for clean replacement articles or credit on hand receipts outstanding.

4. Tolerance levels for clothing and equipment are as follows, using the MX-5 with window open at $\frac{1}{2}$ in. from the surface:

a. Outer-garments and equipment, 7 mr/hr.

b. Under-garments and internal surfaces of respirators, 2 mr/hr.

5. One monitor will be stationed on the cold end of the shower to make a final check on personnel requiring skin decontamination by washing. He will require personnel who show signs of any contamination above background to return to the showers. If body level of radiation cannot be reduced to background after three attempts, the On-Site Operations Officer will be notified.

6. One supply man will be stationed in the laundry sorting room to issue towels across the Dutch door. Towels will be issued singly only, and only to personnel who have showered. The cold end monitor will assist the towel issue man in ascertaining that personnel do not misappropriate towels.

Annex G: Inclosure 7

Posting of Contaminated Areas

A sign detail, 1 officer and 4 EM, will be responsible for posting of signs and road barricades in contaminated areas. Signs on barricades will be posted daily at the 10 mr/hr line on all main and secondary access roads to indicate contaminated areas. The signs officer will also be responsible for posting 100 mr/hr iso-intensity line.

Annex G: Inclosure 8

Vehicle Decontamination Station

1. It will be the responsibility of the Decontamination Section Chief to determine:

a. Whether or not a vehicle should be decontaminated. This will depend on the information furnished by the vehicle monitor and the officer's knowledge of future requirements for the vehicle, based on information received from the party leader.

b. To what extent decontamination will be pursued on any vehicle. Vehicles which cannot be practically decontaminated to the clearance levels specified in Incl. 5, consistent with work-load requirements and consideration of wear and tear on the vehicle, will be moved to the vehicle hot park for aging or later decontamination efforts.

2. He will require that vehicles normally used for hot area work be decontaminated only to levels which will not present a hazard to operating personnel and see that these vehicles are retained in the hot park area.

Annex G: Inclosure 9

Personal Dosimetry

The Dosimetry and Records Section will provide each individual going into a radiologically controlled area with film badge, Du Pont type 5J2606, and self reading pocket dosimeters (one or more if applicable) of the appropriate range. Pocket dosimeters will be available in the following ranges: 0–200 milliroentgens, 0–1 roentgen, 0–10 roentgens, and 0–50 roentgens. The following procedure will be used in the issue and receipt of film badges and dosimeters:

1. Daily requirements for film badge and dosimeter support will be received from the Operations Section broken down by parties. Information on the appropriate parties will contain the

names, rank, and service number (if appropriate), project, and parent organization. These data, the appropriate film badge numbers, and the size and serial number of appropriate pocket dosimeters (where applicable) will be entered on Form R101, "Daily Record of Radiation Exposure," accomplished in duplicate for each party requiring this dosimeter support (Sample copy attached).

2. The film badges and dosimeters, together with the duplicate executed copy of Form R101, will be issued in a manila envelope to the monitor accompanying the party or to otherwise responsible personnel of the party in the event a monitor is not required. The original copy of Form R101 will be retained in the Dosimetry and Records Section pending the receipt of the film and dosimeters at the completion of the mission. At the completion of the mission, the monitor or other responsible person of the party will collect the film badges and dosimeters, place them in the manila envelope together with the duplicate copy of Form R101, and return them to the issue window. In the event a film badge is lost, the monitor or other responsible person will ascertain this fact and obtain from the personnel at the issue window a copy of Form R111 (sample copy attached), upon which he will enter the circumstances surrounding the loss of this film badge. Individuals who have lost a film badge on a mission will be credited with an exposure equal to the highest received by any member of that party on that particular mission.

In the event a pocket dosimeter only is lost, the monitor and/or responsible person of the party will execute Form R111 and turn it in. Under this set of circumstances, however, only the indication of the lost dosimeter will be made on Form R101 with no entries as to a possible reading.

3. Upon the receipt of the pocket dosimeters, they are immediately read and indicated as "raw" readings on both copies of Form R101 in the appropriate spaces. This "raw" reading is then multiplied by the appropriate "CF" (see Incl. 11) and the corrected value entered in its appropriate space.

Form R111

CERTIFICATION OF LOST DOSAGE DEVICE

DATE ______________________

I, the undersigned certify that the (film badge)(dosimeter) No.______________________
(strike out one)

issued to me on ______________ for the purpose of determining the radiation dosage received
(date of issue)

by me, was lost in Area ____________ between the hours of ____________ and ____________

while working on Project Number ____________.

FOR LOST FILM BADGE ONLY: I realize that I will be credited with the same radiation dosage as received by that member of my party who received the highest radiation dosage during this mission.

SIGNED: ______________________
(First Name, Middle Initial, Last Name)

____
(Grade, if applicable, and ID No.)

____
(Home Organization)

FORM R101—10M—3-53—[illegible]

Page ______ of ______

DAILY RECORD OF RADIATION EXPOSURE

Date:

Group: Series:

INIT. ISSUE	NAME (LAST, FIRST, MIDDLE INITIAL) RANK, FILE NUMBER OR ASN ORGANIZATION PROJECT	FILM BADGE NUMBER	POCKET DOSIMETER SIZE & NUMBER	FILM BADGE DENSITY		FILM BADGE MR		POCKET DOSIMETER	
				W	S	W	S	RR	MR

INIT ISSUE	NAME (LAST, FIRST, MIDDLE INITIAL) RANK, FILE NUMBER OR ASN ORGANIZATION PRO[illegible]T	FILM BADGE NUMBER	POCKET DOSIMETER SIZE & NUMBER	FILM BADGE				POCKET DOSIMETER	
				DENSITY		MR			
				W	S	W	S	RR	MR

Control Film No._________ Received: _________Film Badges Issued By_________Time:________

Standard Film No._________ ________Pocket Dosimeters Returned: _________Time:________

____

(Signature)

Remarks:

Annex G: Inclosure 10

Calibration of Film Badges and Pocket Dosimeters

1. Film badges will be calibrated against standard radium sources or standard Co^{60} sources expressed in terms of milligram-equivalents. The following relation will be used to determine the dosage in milliroentgens:

$$D = \frac{\text{mg Ra or mg } Ra_2 \text{ equiv}}{\text{(yards)}} \times \text{time (hours)}$$

In the actual calibration, the time factor will be pre-determined and held constant. The distance from the source will be varied to give the desired dosage value. Dosage values will be selected to give a good "spread" of values over the range of each type of film utilized in the film badge.

The film will then be processed as outlined in Incl. 12 and the calibration curves drawn by plotting the net optical density of each film against the known dosage exposure.

This procedure will be accomplished each time film from another emulsion or lot number is put into use.

2. Pocket dosimeters will be calibrated against the same sources. The same relation as outlined above will be used. The dosage values will be determined for each type of pocket dosimeter to reflect a theoretical $^3/_4$ scale reading (e.g., a 10 r dosimeter will be exposed to a dosage of 7.5 r.) At the completion of the exposure, the dosimeters will be read and a correction factor "CF" determined as follows:

$$CF = \frac{\text{calculated dosage}}{\text{recorded dosage}}$$

Each dosimeter will then be marked with its appropriate CF. Each time a dosimeter is read, the value read will be multiplied by the CF to reflect the actual dosage.

Dosimeters will be checked monthly to determine the correct CF. Supply permitting, dosimeters with unstable CF values will be withdrawn from issue and returned through supply channels to the manufacturer. In addition to the weekly checks, the CF values will be re-evaluated each time a large unexplainable variance appears between the dosimeter indicated dosage and that indicated by the film badge of the wearer.

Annex G: Inclosure 11

Film Badge Processing and Recording

All returned film badges, together with their appropriate Forms R101 (in duplicate), will be forwarded to the Film Badge Processing Laboratory in the Rad-Safe Building. Film badges will be processed as recommended by the Chief, H-Division, LASL. Processed film will then be delivered to the Densitometer Reading Room to have the optical densities determined. Readings will be taken in the shielded portions of the film only. Net density readings will be recorded in the appropriate spaces of the corresponding Forms R101. Radiation dosages will then be determined from the appropriate calibration curve. Determined dosages will be recorded in their proper places on the original of Form R101. After the necessary data have been obtained from each processed film, the films will be placed in small paper envelopes, which will be filed alphabetically by individual. The following data will be included on the paper envelope:

Name of individual

Date worn, badge number, and control film number for each film filed

Annex G: Inclosure 12

Maintaining Permanent Records of Cumulative Individual Radiation Dosages

The permanent record of cumulative exposures will be kept as follows:

1. A Form R102 will be kept on each individual as a permanent radiological dosage record of the individual throughout his participation in current operations. At the completion of each day's processing, data will be transferred from Forms R101 to the "Individual Accumulative Radiation Exposure Record," Form R102 (see sample copy attached), of each individual concerned.

2. As the posting of the daily and cumulative exposures is accomplished on the Forms R102. forms showing cumulative dosages in excess of 2 r will be marked with a yellow tab, and those showing dosages in excess of 3.9 r will be marked with a red tab. Upon the completion of the transfer of dosage information from Forms R101 to Forms R102, the Forms R101 will be appropriately stamped and filed in chronological order for each day's activities.

FORM 102R INDIVIDUAL ACCUMULATIVE RADIATION EXPOSURE RECORD

DATE		FILM BADGE					DOSIMETER		REMARKS
19_____	Number	Density		Milliroentgens			(mr)		
		W	S	W	S	Cum	Day	Cum	

NAME: (Last, First, Middle Initial) RANK: ASN: HOME ORG:

Annex G: Inclosure 13

Preparation and Submission of Cumulative Dosage Reports

The Dosimetry and Records Section will prepare and submit the following cumulative radiation dosage reports:

1. A daily report of the cumulative dosage of gamma radiation received by each individual assigned to the On-Site Monitoring Section will be prepared in triplicate and submitted to the On-Site Operations Office prior to 0730 hours for distribution to the Radiological Safety Officer, Monitoring Section, and On-Site Operations Section.

2. A cumulative radiation dosage report showing all personnel who have exceeded 2000 milliroentgens of gamma radiation will be prepared and submitted to the Radiological Safety Officer, NPG, on "Shot Day" plus three days. This report will be prepared on a stencil for the signature of the Radiological Safety Officer, NPG, and will be broken down by programs and alphabetical order within the program. Those personnel who have received in excess of 1900 milliroentgens of gamma radiation will be shown in a separate paragraph at the end of the report.

3. A cumulative radiation dosage report of gamma radiation received by each individual in the Off-Site Section will be prepared and submitted to the Radiological Safety Officer, NPG, on "Shot Day" plus three days. Information copies of this report will go to On-Site Operations Section and Off-Site Section.

Annex G: Inclosure 14

Disposition of Radiation Dosage Records and Exposed Film Badges Following the Test Operation

At the end of the test operation, the Dosimetry and Records Section will compile all records of individual cumulative radiation dosage received during the operation and prepare a report on same. Copies of the report will be forwarded to the Director, Division of Biology and Medicine, Atomic Energy Commission, Washington, D. C., and to the Surgeon, AFSWP, Washington, D. C. Military installations and home offices of civilian personnel having permanently assigned personnel participating in the operation will be sent extracts of that portion of the complete report which is applicable.

Exposed film badges which were worn by Department of Defense personnel will be forwarded to the Surgeon, AFSWP, along with the Individual Accumulative Radiation Exposure Record for each individual. Those film badges worn by non-Department of Defense personnel will be forwarded to the Test Director, Mercury, Nevada, along with the Individual Accumulative Radiation Exposure Record for each individual. All films will be accompanied by the appropriate "Control" films.

All copies of the Daily Record of Radiation Exposure (Form R101) will be filed by date and forwarded to the Test Director, Mercury, Nevada.

Annex H, Off-Site Operations

1. General

The general sphere of responsibility of the Off-Site Rad-Safe Group will be that area within a 200-mile radius of the Nevada Proving Grounds with particular interest in the populated communities. A series of fixed stations augmented by mobile surface and aerial units will be operated to collect the necessary information of Rad-Safe interest within these boundaries. Equipment will be selected and personnel trained and located so as to provide a measurement of the internal and external hazards associated with an atomic detonation as they apply to this region. In so doing, it will be necessary to determine airborne and surface concentrations; to make particle size and activity measurements; to measure fission product decay and absorption characteristics; to record the size, shape and duration of the fall-out pattern; to maintain current radiological situation plots; and to maintain a journal of each day's activities to provide a history of the Group's participation.

The following breakdown of the Off-Site Group has been formulated to provide an organized approach toward fulfilling the assigned objectives.

2. Personnel

The Off-Site Rad-Safe Group will consist of 15 monitors, 2 radio operators, an Off-Site Operations Officer, an assistant, and a secretary.

3. Organization

Organization of the unit is shown in Incl. 1.

4. Vehicles and Communication

Vehicle and communication requirements of the section are as follows:

a. Seven 1/4-ton trucks (Jeeps)

b. Two 1/2-ton pickups

c. Eight sedans

d. One 3/4-ton truck (weapons carrier)

All vehicles will be radio-equipped. The Off-Site Group will use a high frequency network. There will be a control unit in CP No. 1 and in the Rad-Safe Building.

5. Monitor Stations

a. Sixteen (16) fixed stations will be located at the CP, Mercury, Indian Springs, Las Vegas, Nellis AFB, Glendale Junction, St. George, Utah, Alamo, Crystal Springs, Caliente, Pioche, Currant, Warm Springs, Tonopah, Beatty, and Groom Mine. These 16 stations will cover the town concerned and the area surrounding that community. See Incl. 2.

b. The equipment provided for these stations will be

(1) Hi-volume air sampler

(2) Casella cascade impactor and pump

(3) Fall-out collection trays

(4) MX-5 (or equivalent) survey meter

(5) T1B (SU-10) survey meter

(6) AN/PDR-34 survey meter

(7) Background recording equipment will be located at the CP, Mercury, Las Vegas, St. George, Caliente, Pioche, Ely, and Lincoln Mine.

c. The stations contemplated at Lincoln Mine and Ely will be supplied with counting equipment as well as the material listed above.

d. There will be two (2) mobile units provided with the above equipment plus a portable mobile generator.

e. In addition to the above, there will be two (2) completely mobile monitoring teams provided with two (2) MX-5 and two (2) T1B survey instruments.

6. Personnel Assignments and Responsibilities

The personnel assignments and responsibilities are given in the attached organizational chart, and more specific descriptions are provided below. It is to be understood that some deviations from these assignments may be necessary, particularly in emergency situations where a concentration of personnel and equipment would be required.

a. Off-Site Operations Officer (LASL civilian). This officer will exercise general supervision over the entire Off-Site program to insure the adequate collection and transmission of information of a Rad-Safe nature within the 200-mile region as requested by the Rad-Safe Officer.

b. Senior Officer (U.S.P.H.S.). This officer will

(1) Assist with the general supervision of the Off-Site Section.

(2) Serve as U.S.P.H.S. liaison officer for the Group on matters of U.S.P.H.S. policy as they apply to its assignees.

(3) Assist in the training of personnel with emphasis on the instrumentation provided for air sampling and calibration and use of field survey instruments.

(4) Submit reports as required concerning the above responsibilities.

c. Administrative Assistant (LASL civilian). The Administrative Assistant will

(1) Maintain supervision over matters pertaining to logistics and supply of the Off-Site Group in cooperation with the Supply Section of the Rad-Safe Unit.

(2) Maintain current situation maps of the Off-Site region in the Rad-Safe plotting room for the first 24 hr and as long as advisable after each detonation.

(3) Assist in the drafting of Group reports.

(4) Assist in the training of personnel assigned to the Group.

(5) Supervise the administration of clerical assistance for the Group and matters pertaining to security.

(6) Submit reports as required concerning the above responsibilities.

d. Military Deputy. The Military Deputy will

(1) Serve as military liaison officer for the Group on matters of military policy as they apply to assignees from the Support Unit.

(2) Act as communications officer of the Group in organizing and maintaining the high frequency radio network and all matters pertaining thereto.

(3) Assume monitor duties as required.

(4) Submit reports as required concerning the above responsibilities.

e. Laboratory Officer (U.S.P.H.S.). The Laboratory Officer for the Group will

(1) Exercise general supervision over the counting laboratory in the Mercury area to insure rapid evaluation and reporting of the data collected.

(2) Operate the fixed stations at Mercury and Indian Springs as directed.

(3) Assist in the training of personnel with particular emphasis on counting techniques and calculation procedures.

(4) Submit reports as required concerning the above responsibilities.

f. N.P.G. Area Officer (U.S.P.H.S.). The N.P.G. Area Officer will

(1) Operate the fixed station at CP as directed.

(2) On particular occasions perform air sampling assignments in the immediate shot area.

(3) Maintain a sufficient knowledge of the Laboratory Program to relieve the Laboratory Officer should the need arise.

(4) When No. 2 above is not required, be available for general relief within the Off-Site office as necessary.

(5) Submit reports as required concerning the above responsibilities.

7. General Responsibilities of Personnel Assigned Stations

The following responsibilities are common to personnel assigned to stations at Las Vegas-Nellis AFB (1 U.S.P.H.S.), Glendale Junction-Saint George (1 U.S.P.H.S. and 1 EM), Warm Springs-Tonopah (1 U.S.P.H.S. and 1 EM), Beatty (1 U.S.P.H.S.), and Groom Mine (1 U.S.P.H.S.).

a. Operate the fixed station(s) at the location(s) as directed.

b. Be familiar with the planned emergency procedures for each location should it be necessary to institute them, if so directed.

c. Be prepared to perform routine ground monitoring surveys in the general area surrounding each location extending to approximately 25 miles, if so directed.

d. Become familiar with counting and calculation procedures to process samples and data collected.

e. Submit reports as required concerning the above responsibilities.

8. Mobile Air Sampling Team

Each mobile air sampling team will

a. Develop a sufficient knowledge of the road network within the 200-mile region to permit the utilization of their equipment at points other than community station locations.

b. For the period and location prescribed for each occasion, operate an air sampling station much in the same manner as the fixed stations.

c. Be prepared to perform routine ground monitoring surveys in the general area surrounding each location extending to approximately 25 miles, if so directed.

d. Become familiar with counting and calculation procedures to process samples and data collected.

e. Submit reports as required concerning the above responsibilities.

9. Mobile Surface Monitoring Teams

Each mobile team will

a. Develop a sufficient knowledge of the road network within the 200-mile region to permit effective monitoring of any assigned area therein.

b. Develop a familiarity with the operation of fixed stations and with the general emergency procedures for the region of responsibility to be able to provide assistance should the need arise.

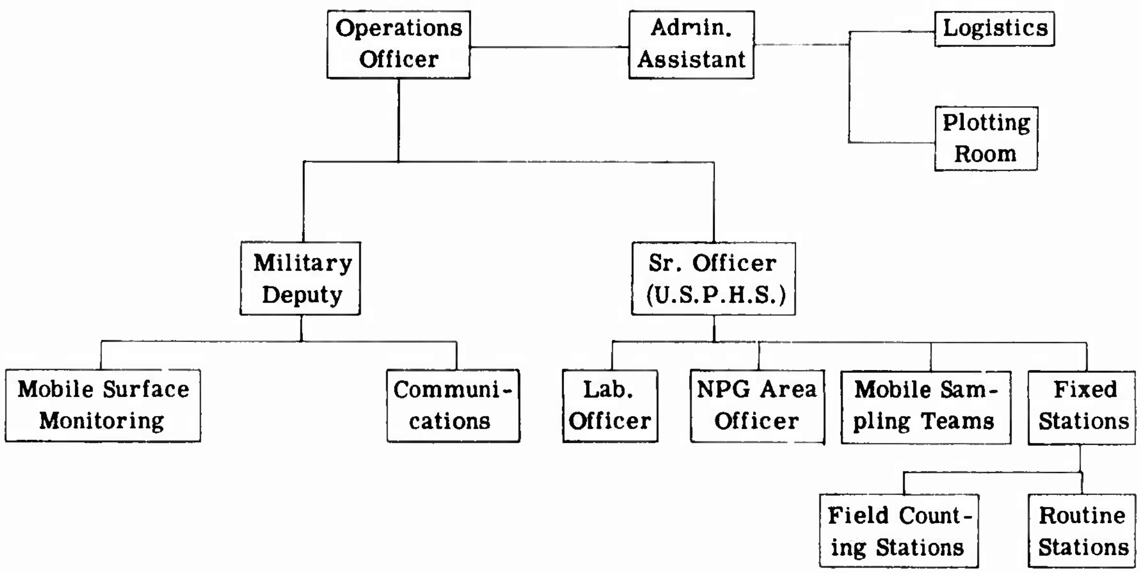
c. Submit reports as required concerning the above responsibilities.

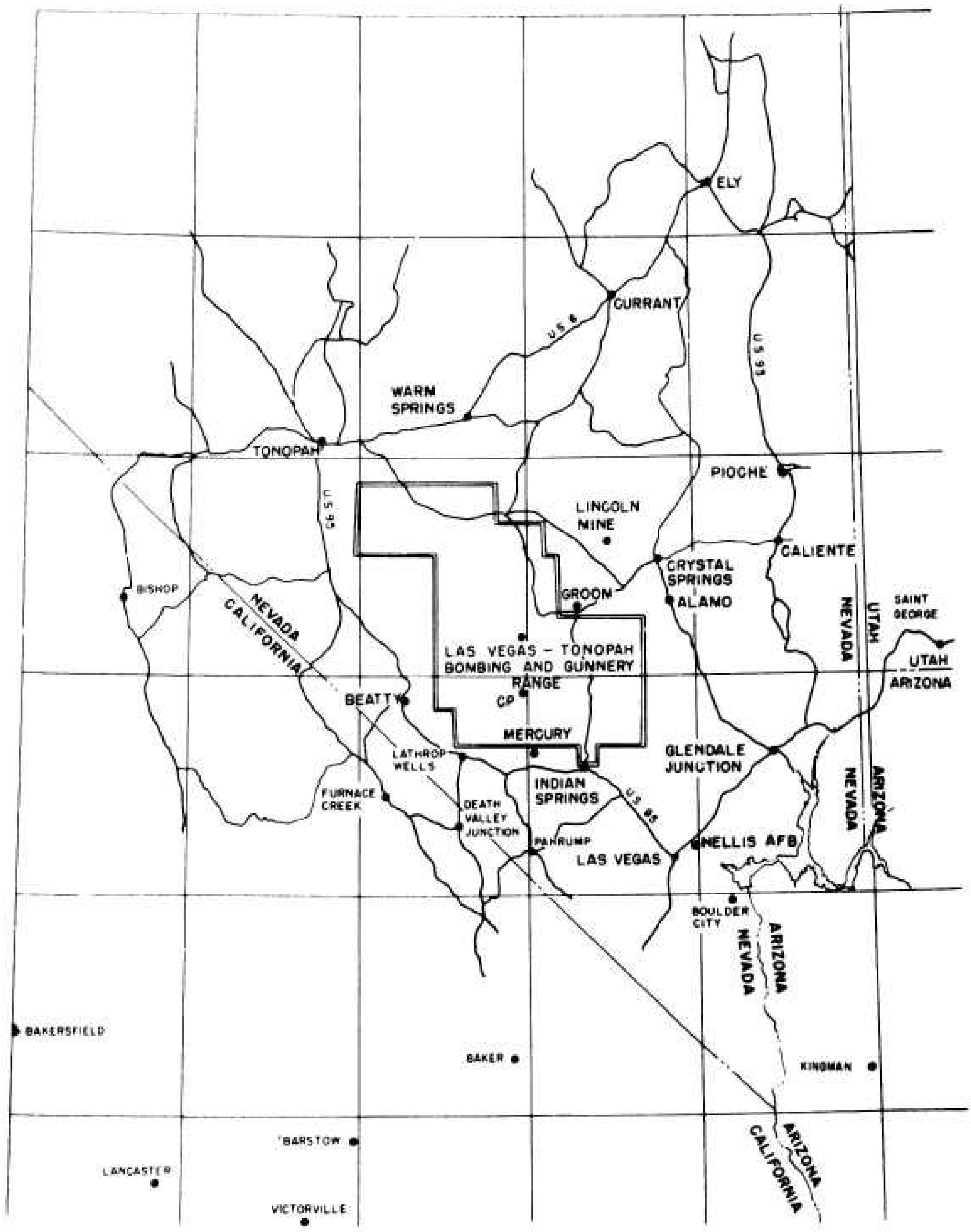
10. Radio Operators (2 Support Unit EM)

The designated radio operators will maintain headquarters in the Rad-Safe Plotting Room and conform to such procedures as may be directed by the Communications Officer.

W. S. JOHNSON
Off-Site Operations Officer

Annex H: Inclosure 1





Annex H: Inclosure 2—Monitor stations.

Annex I, Logistics and Supply

1. Purpose

a. This Annex is to prescribe the over-all organization, operation, and functioning of subsections under the control of the Logistics and Supply Section.

b. To familiarize other sections as to proper supply channels and procedures to be followed and to expedite the constant flow of equipment and supplies so that the mission can be accomplished with minimum delay.

2. Mission

a. To furnish the Rad-Safe Unit, NPG, with up-to-date data on transportation, communication, supplies, and equipment.

b. To outline the procedures for procurement and maintenance of stock levels for equipment and supplies as required by the Rad-Safe Unit for the operation.

c. To make recommendation for the improvement and functioning of the Logistics and Supply Section at the completion of the mission.

3. Organization

a. The Logistics and Supply Section consists of the following subsections, with personnel as listed:

(1) Logistics and Supply Office
1 Officer
2 EM

(2) Unit Supply and Laundry
1 Warrant Officer (Property Officer)
12 EM

(3) Instrument Repair
2 EM (Signal Corps Personnel furnished by AFSWP)
2 EM (Instrument Issue Clerks)

(4) Motor Maintenance
1 Warrant Officer (Motor Officer)
4 EM (Mechanics)

4. Responsibilities

a. Logistics and Supply Officer

(1) Responsible for the over-all supervision, operation, and proper functioning of subsections as listed in paragraph 3 above.

(2) To prepare and forward equipment purchase requests to Rad-Safe Officer, NPG, for approval, prior to submitting to the proper Supply Agent for procurement.

(3) Consolidates required work orders for supplies and submits them to J-6, AEC.

(4) Procures necessary civilian and military type motor transportation as required for the operation. Civilian type vehicles are procured from AEC Transportation Coordinator, and military vehicles are procured from DOD, AFSWP.

(5) Coordinates, allocates, and follows through on equipment, transportation, communication, and storage space requirements for sections of this unit.

(6) Maintains contact with the following Supply Agencies for required supplies or equipment: S-4, AFSWP; J-6, AEC; Supply Agent, Reynolds Electrical and Engineering Co; Property Accountable Officer, Nevada Proving Grounds.

(7) Furnishes necessary data pertaining to status of supplies, transportation and communications, etc., to the Rad-Safe Officer, NPG.

(8) Makes supply economy spot · ections and checks to see that supplies are being utilized economically.

(9) To maintain an up-to-dat   ıı ·ournal of Activities and to submit a summary of activities covering the period D-1   ɔ- .o On-Site Operations Officer.

b. Rad-Safe Supply

(1) The Rad-Safe Protective Clothing and Equipment Supply is located on the first floor of the Rad-Safe Building (CP No. 2). This subsection will maintain a twenty-four (24) hr shift. Only one (1) issue clerk will be on duty after regular duty hours.

(2) Issue protective clothing and equipment to personnel going into a contaminated area on a hand receipt. The following items may be issued on a five (5) day basis: 1 pair shoe covers, 1 each protective cap, 1 suit coveralls, 1 pair gloves, cotton, and 1 each respirator.

(3) Maintain up-to-date records of stocks on hand.

(4) Mark sizes where obliterated on items of protective clothing.

(5) Issue other supplies and equipment stored in the Supply Room as required.

ke replenishment requests for stocks to the Logistics and Supply Officer.

(7) Forward the Daily Activities Report to the Logistics Office by 1500 hours daily.

c. Unit Supply

(1) This subsection is located in the rear area, Building No. 200. The operating hours are regular duty hours. The subsection will issue unit property on a hand receipt on a daily basis.

(2) The subsection will prepare Status of Equipment reports on unit equipment only, as required by current AR's and SR's.

(3) The subsection will assist the forward supply in pickup of supplies from warehouses at Camp Mercury

d. Instrument Repair

(1) The Instrument Issue and Repair subsection is located in the basement of the Rad-Safe Building (CP No. 2).

(2) This subsection consists of two (2) instrument repair enlisted personnel (supplied by AFSWP) and two (2) radiac instrument issue clerks (Rad-Safe Unit). The issue and repair are on shift during regular duty hours, and on shot days the subsection is operational.

(3) Instruments are issued on a hand receipt basis for a period of seven (7) days only. On the expiration date, a replacement instrument will be issued and the returned instrument will be repaired.

(4) Maintain stock levels on spare parts for all instruments, and prepare replenishment spare parts requests and forward to Logistics and Supply Officer.

(5) Repair and calibrate instruments.

(6) Maintain emergency alpha counters on a readiness basis.

e. Motor Maintenance

(1) The motor pool is located in the wired-in, fenced area east of CP No. 1.

(2) This subsection operates on a twenty-four (24) hr schedule. One (1) mechanic is on duty after regular duty hours and is located in the Rad-Safe Building.

(3) Military vehicles only are maintained by this subsection. Maintenance of civilian type vehicles will be performed by the AEC motor pool. The DOD motor section will supply necessary spare parts for first and second echelon repairs on military vehicles. Higher echelon repairs will be made by the DOD pool.

(4) Maintain daily or weekly dispatch records on all military vehicles.

(5) Forward requirements for spare parts to the Logistics Office.

(6) Forward the Daily Activities Report to the Logistics Office by 1500 hours daily.

f. Laundry

(1) This activity is located in the south side of the Rad-Safe Building (CP No. 2).

(2) This subsection operates on a two (2) shift schedule.

(3) Launders all contaminated coveralls, protective caps, gloves, turned in by Personnel Decon Station.

(4) Segregates and resizes clothing and turns laundered items over to Supply for stockage and reissue.

(5) Submits a daily activity report to the Supply Officer.

RAYMOND DALE
Captain, Cml C
Logistics and Supply Officer

Annex J, Communications

1. General

Communication in the field with the various units and teams of the Radiological Safety Unit will be accomplished by means of voice radio. For this purpose two radio nets have been assigned, one a VHF-FM circuit for On-Site Operations, and the other an HF circuit for Off-Site Operations. One stand-by VHF station is maintained by the Off-Site Operations Section on the same frequency as the On-Site VHF net. Communication with aircraft assigned to Rad-Safe will be through the usual aircraft operational channels.

2. Call Signs

The unit has been assigned the call sign "Hickory" for use on all voice radio nets for ground survey teams. The word Hickory will be followed by suitable letters and/or digits to designate the various broadcasting stations on the nets. The Plotting and Briefing Officer will assign call numbers for the VHF circuit (On-Site) using numbers from 1 to 49. The Off-Site Operations Officer will assign the call letters and numbers for the HF circuit (Off-Site) using numbers from 50 up. Lists of call signs are attached as Incls. 1 and 2.

3. Procedure for Ground Survey Nets

a. Strict radio discipline will be maintained at all times. Net control station for the VHF net will be the Plotting and Briefing Section, and for the HF net, the Off-Site Operations Officer.

b. Standard voice radio procedure will be used at all times. Messages will be concise, and no broadcasts will be made that are not actually necessary. Operators will have a complete, concise message in mind before transmission is begun.

c. The Ten Code is a series of numbers to which special meanings are attached, and is used to abbreviate communications. Each number is prefaced by ten, such as 10-19 meaning, "Return to your station." The use of this code is not mandatory, but may be used by the individual operator as desired. A copy of the code will be kept with every RSSU fixed radio station or radio-equipped vehicle. A copy is attached as Incl. 3.

d. On-Site Messages (VHF): In order to transmit messages concerning iso-intensity lines the following code and format will be used:

(1) Code words will be used for all iso-intensity lines as indicated in the table below:

Iso-intensity Line	Code Word
10 mr/hr	White
100 mr/hr	Yellow
1000 mr/hr	Orange
10000 mr/hr	Red

(2) The following form message will be used:

Call	Hickory 1 (this is Hickory 13)
Message No.	RS 1*
Location	119.8†
Intensity	White
Time	0607
Remarks	

* The letters "RS" stand for Rad-Safe.

† The number 119.8 is a location by stake number.

(3) In transmitting the above type of message, only the information in the blanks need be transmitted on the radio. The words "Call," "Message No.," etc., will not be included in the message.

e. Off-Site Messages (HF): In order to transmit messages concerning intensity readings and other information, the following code and format will be used:

(1) Code words will be used to indicate various items of information as indicated in the table below:

Item	Code Word
Meter MX-5	Black
Meter T1B (SU-10)	White
Air Concentrations	Red

(2) The following form for messages will be used. A sample message blank is attached as Incl. 4.

Call sign
Time
Location
Appropriate instrument readings

4. Aerial Survey

The radio communications facilities for aircraft used in the aerial survey and identification call signs are as follows:

a. Helicopter, On-Site local survey: VHF channel E; call sign, Fire Fly 1.

b. L-20, low level terrain survey: VHF channel E; call sign, Ever Ready 4.

c. C-47, low level terrain survey: VHF channels H, F, and E; HF channels 20, 10, 30, and 50; call sign, Rag Mop.

d. B-25* and B-29, cloud tracking survey: VHF channels H, F, and E; HF channels 20, 10, 30, and 50*, call sign, Cook Book 1, 2, or 3.

e. Message forms for terrain survey and cloud tracking are attached as Incls. 5 and 6, respectively.

5. Special Precautions

a. Operators will not touch a radio antenna while broadcasting.

---

*B-25 has no high frequency equipment.

b. Operators will always run the engine of a radio vehicle at such a speed that the battery is on charge when receiving, and at a sufficient speed that the drain on the battery is minimized when transmitting. Failure to observe this precaution may result in discharging of the vehicle battery.

TOM D. COLLISON
Lt Col, Cml C (Arty)
Rad-Safe Officer, NPG

Inclosures:

1 and 2 – Lists of Call Signs
3 – Copy Ten Code
4 – Off-Site Message Form
5 and 6 – Aerial Terrain Survey and Cloud Tracking Message Forms, respectively.

Annex J: Inclosure 1

Rad-Safe Radio Calls (On-Site)

Plotting and briefing	Hickory 1
Rad-Safe Control Officer	Hickory 2
Sedan, Rad-Safe Officer, NPG	Hickory 3
Sedan, CO 9778 RSSU	Hickory 4
Truck, $\frac{3}{4}$ ton, No. 8	Hickory 11
Truck, $\frac{3}{4}$ ton, No. 9	Hickory 12
Truck, $\frac{3}{4}$ ton, No. 10	Hickory 13
Truck, $\frac{3}{4}$ ton, No. 11	Hickory 14
Truck, $\frac{3}{4}$ ton, No. 13	Hickory 15
Truck, $\frac{1}{2}$ ton, No. 245	Hickory 21
Truck, $\frac{1}{2}$ ton, No. 255	Hickory 22
Truck, $\frac{1}{2}$ ton, No. 257	Hickory 23
Truck, $\frac{1}{4}$ ton, No. 313	Hickory 31
Truck, $\frac{1}{4}$ ton, No. 314	Hickory 32
Truck, $\frac{1}{4}$ ton, No. 315	Hickory 33
Backpack No. 2023	Hickory 41
Backpack No. 2024	Hickory 42
Backpack No. 2025	Hickory 43
Backpack No. 2026	Hickory 44
Backpack No. 2027	Hickory 45
Backpack No. 2029	Hickory 46
Backpack No. 2030	Hickory 47
Backpack No. 2032	Hickory 48
Stationary (Off-Site) stations:	
Lincoln Mine	Hickory Love 51
Groom Mine	Hickory George 50

Annex J: Inclosure 2

Rad-Safe Radio Calls (Off-Site)

Radio call signs for all Rad-Safe radio stations will be prefaced by the word "Hickory." Each individual on the HF Off-Site net will be identified by one word and two digits following the word "Hickory."

The following is a list of the HF Off-Site call signs to be used by Rad-Safe:

Off-Site operations (CP)	Hickory Papa-98
Off-Site operations (Rad-Safe Bldg.)	Hickory Romeo-99
Sedan, No. R-23	Hickory Alpha-61
Sedan, No. R-41	Hickory Alpha-62
Sedan, No. R-42	Hickory Alpha-63
Sedan, No. R-58	Hickory Alpha-64
Sedan, No. R-88	Hickory Alpha-65
Sedan	Hickory Alpha-66
Sedan	Hickory Alpha-67
Truck, 1/2 ton	Hickory Bravo-71
Truck, 1/2 ton	Hickory Bravo-72
Truck, 1/4 ton, No. R.S.S.U.-2	Hickory Coca-81
Truck, 1/4 ton, No. R.S.S.U.-3	Hickory Coca-82
Truck, 1/4 ton, No. R.S.S.U.-4	Hickory Coca-83
Truck, 1/4 ton, No. R.S.S.U.-5	Hickory Coca-84
Truck, 1/4 ton, No. R.S.S.U.-6	Hickory Coca-85
Truck, 1/4 ton, No. R.S.S.U.-7	Hickory Coca-86
Truck, 3/4 ton, No. R.S.S.U.-12	Hickory Delta-91
Stationary stations:	
Groom Mine	Hickory George-50
Lincoln Mine	Hickory Love-51

Annex J: Inclosure 3

Ten Code

10-0	Operations normal at this station.
10-1	Receiving poorly.
10-2	Receiving well.
10-3	Stop transmitting.
10-4	O. K. message received.
10-5	Relay.
10-6	Busy.
10-7	Out of service.
10-8	In service.
10-9	Repeat—bad conditions.
10-10	Out of service—subject to call (give phone).
10-11	Talking too fast.
10-12	Officials or visitors present.
10-13	Advise weather and road conditions.

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~~CONFIDENTIAL~~

10-14	Convoy or escort.
10-19	Return to your station.
10-20	What is your location?
10-21	Call this station by telephone.
10-22	Take no further action.
10-23	Stand by—interference.
10-24	Trouble—all units report quickly.
10-27	Any answer to our last item?
10-33	Emergency traffic this station.
10-35	Confidential information.
10-36	Correct time.
10-37	Meet me at ______.
10-40	Advise if ______ available for radio call.
10-42	______ now at home.
10-81	He is at ______.
10-95	How do you read me?
10-97	Arrived at scene.
10-98	Finished with last assignment.
10-99	General emergency exists.

Extreme Emergency: the word "Broadcast" three times.

Annex J: Inclosure 4

Rad-Safe Off-Site Message Form

Call sign
Time Location
Black (MX-5) Level (in mr/hr)
White (T1B SU-10) Level (in mr/hr)
Red (air concentrations) (PDR-34) Level (in mc/M^3)

Call sign
Time Location
Black Level (in mr/hr)
White (T1B SU-10) Level (in mr/hr)
Red (air concentrations) (PDR-34) Level (in mc/M^3)

Call sign
Time Location
Black Level (in mr/hr)
White (T1B SU-10) Level (in mr/hr)
Red (air concentrations) (PDR-34) Level (in mr/M^3)

Annex J: Inclosure 5

MESSAGE FORM
TERRAIN SURVEY (C47, L20'S, AND HELICOPTER)

(Fire Fly)
(Rag Mop)
1. Call Sign (Ever Ready)

2. Message No. RS ____________________

3. Position (Grid) ____________________

4. Time ____________________

5. Altitude (Above Ground) ____________________

6. Meter Reading ____________________

(MX-5) Black – (mr) ____________________
(T1B) White – (mr) ____________________
(Scintelog) Red – (Scale Reading) ____________________
(C-1 Foil) Green – (MX-5) ____________________
(1-inch w-open)

7. REMARKS: ____________________

Annex J: Inclosure 6

Message Form for Cloud Tracking A/C

ABLE (A/C CALL SIGN) ____________________

BAKER (MESSAGE NO.) ____________________

CHARLIE (POSITION GRID) ____________________

DOG (TIME) ____________________

EASY (ALTITUDE msl) ____________________

FOX (DIRECTION OF CLOUD FROM A/C) ____________________

GEORGE (METER READING) BLACK (MX-5 mr) ____________
WHITE (T1B mr) ____________

HOW (REMARKS)

UNCLASSIFIED

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Annex K, Control Section

1. Purpose

The purpose of the Rad-Safe control section is to

a. Coordinate all Rad-Safe activities

b. Supervise air participation

(1) Terrain survey

(2) Cloud tracking

c. Assemble and present all Rad-Safe data in an appropriate form to the Test Director, Rad-Safe Officer, and other interested parties.

2. Organization

The Rad-Safe Control Officer, a Radiological Safety Engineer, will be chief of the Control Section. He will be assisted by the Air Liaison Officer, a pilot with Rad-Safe background, and augmentation personnel from On-Site and Off-Site on D-1 and D days.

3. Procedures

a. The On-Site radiological situation will be presented by the use of large scale maps of individual test areas and a 1:50000 scale map of the general test area.

The large scale map will cover the pertinent individual shot area in detail, showing the surface position of the 10 mr/hr, 100 mr/hr, 1000 mr/hr, and 10,000 mr/hr iso-intensity lines as indicated by the latest radiation survey. On D-Day radiological data will be posted on this map, as the radio reports of the survey teams are received; and iso-intensity lines will be drawn, as available information indicates. On subsequent resurveys the data will be plotted and iso-intensity lines drawn on acetate sheets by the plotting and briefing section to be used as overlays, for display in the control room.

The 1:50000 scale map of the test area will be used to show as specifically as practical the radiation intensity of the general area, using iso-intensity lines and individual readings at specific stations of interest. This map will reflect the latest available radiation survey data.

b. The aerial survey and cloud tracking data will be displayed in the control room on one map with a scale of 1:250000 and one map with a scale of 1:500000. These maps will have a grid coordinate system of location, common to both, using letters and numbers with a spacing of 10′ latitude and 10′ longitude.

The path of the terrain survey aircraft will be determined using the latest winds at shot time. These routes will be transmitted to Air Test Operations at least 1 hr prior to take-off if possible.

Fall-out data obtained from the low level terrain survey aircraft will be posted on the 1:250000 scale map, indicating individual readings, converted to ground level and expressed in infinite dose where possible. Iso-dose lines will be drawn to delineate the fall-out pattern.

Data obtained from cloud tracking aircraft will be posted on the 1:500000 scale map indicating the location and altitude of the radioactive cloud.

c. The Off-Site survey data will be presented in the control room by the use of a 1:500000 scale map and a status chart. The map will reflect the fall-out reports of the Off-Site monitors in a geographical location with respect to the test site. The chart will show successive readings at points of interest in the predicted and actual fall-out areas. The Off-Site data will also be posted on the Terrain Survey 1:250000 Scale Map to show correlation between the air and ground readings.

WILLIAM H. STEPHENS
Major, USAF
Control Officer

Inclosure 2

ROSTER OF PERSONNEL

The following is a roster of personnel of the Rad-Safe Unit for Operation UPSHOT/KNOTHOLE. This roster shows the position assignment and period this position was occupied. The augmentation personnel are indicated by an asterisk preceding their names. Personnel assigned to DWET are indicated by a double asterisk. All other personnel are from the 9778th Support Unit or as otherwise indicated.

Name	Assignment	Shot period
	Rad-Safe Control Center	
**Collison, Tom D., Lt Col	Rad-Safe Officer	1–11
*Lulejian, Norair M., Maj	Control Officer	1–2
*Stephens, William H., Maj	Asst. Control Officer	1–2
	Control Officer	3–10
*Bateman, B. G., Maj	Asst. Control Officer	1–10
	Control Officer	11
Beutler, Stanley A., Lt	Asst. Control Officer	5–11
Younger, Harold F., SFC	Radio Operator	1–11
*Boss, F. R., YN3 (USN)	Chief Clerk	1–11
Meharry, Mildred, Civilian	Stenographer	1–11
	On-Site Operations	
Milburn, William R., Lt Col	Commanding Officer Support Unit	1–11
	Operations Officer	4–11
MacWilliams, D. G., Maj	Operations Officer	1–3
*Satterfield, Olan D., Maj	Asst. Operations Officer	1–11
Townsend, G. F., Jr., Capt	Asst. Operations Officer	1–9
Buddee, R. S., Lt	Asst. Operations Officer	1–5
Ball, John J., Lt	Asst. Operations Officer	5–11
Kuykendall, W. C., Lt	Asst. Operations Officer	1–11
*Bond, William L., LT (USN)	Administrative Assistant and Program Monitor	1–9
McManus, C., SFC	Operations NCO	1–9
Crone, Herbert L., Pvt	Clerk typist	1–11
	Support Unit Headquarters Section	
Hunt, William H., Capt	Executive Officer	1–10
Salmons, Oren R., Capt	Adjutant	1–11
Lape, David C., M/Sgt	1st Sergeant	1–11
Dillard, Jimmie D., Sgt	Personnel Clerk	1–11
Miller, Arthur M., Cpl	Mail Clerk	1–11
Soine, Tyler S., Pfc	Company Clerk	1–11

Name	Assignment	Shot period
	Logistics and Supply	
Dale, Raymond, Capt	Logistics Officer	1–11
Smith, Vernon M., Cpl	Clerk Typist	1–11
Boni, Henry D., Pvt	Clerk Typist	1–11
	Unit Supply	
Johnson, James E., CWO	Supply Officer	1–11
	Motor Officer	1–11
Gill, Donald T., Sgt	Supply Sergeant	1–11
Hamilton, Ralph O., Sgt	Asst. Supply Sergeant	1–10
Leigh, David W., Sgt	Asst. Supply Sergeant	1–11
Lewis, Edward P., Pfc	Supply Handler	1–11
Pace, Merritt E., Pfc	Laundry	1–5
Wines, James B., Pfc	Laundry	1–5
Deck, Bobby L., Pvt	Supply Handler	1–11
Costabile, Eugene A., Pvt	Supply Handler	1–5
Escareno, Elias A., Pvt	Laundry	1–5
Hass, Roger F., Pvt	Supply Handler	1–11
Cox, Gordon, Pvt	Laundry	1–11
Jacobsen, Lyle, Pvt	Supply Handler	1–10
	Logistics and Supply Instrument Repair	
**Wilkerson, William H., SFC	Repair Technician	1–11
Kurten, David L., Cpl	Instrument Issue	1–11
**Fujii, Shoji, Pfc	Repair Technician	1–11
Brown, Floyd J., Pvt	Instrument Issue	1–11
	Logistics and Supply Motor Section	
Beegle, Richard E., SFC	Motor Sergeant	1–11
Powell, Arthur J., Sgt	Mechanic	1–11
Del Ricci, Louis J. Cpl	Mechanic	1–7
Marth, Robert H., Cpl	Dispatcher	1–3
	On-Site Dosimetry and Records	
Carroll, George, Lt	Chief, Dosimetry and Records Section	1–5
Pardee, Robert E., Lt	Chief, Dosimetry and Records Section	6–11
Thielicke, W. B., Lt	Asst. Chief, Dosimetry and Records Section	1–11
Buechele, John E., Lt	Asst. Chief, Dosimetry and Records Section	1–11
Vogler, August, Jr., Lt	Asst. Chief, Dosimetry and Records Section	1–10
Weimer, Wallace R., T/Sgt	Photo Lab Technician	1–11
*Brinson, John H., A/1C	Photo Lab Technician	1–11
*Konnan, George F., A/1C	Photo Lab Technician	1–11
Morgan, Robert D., Sgt	Clerk Typist	1–11

Name	Assignment	Shot period
Dart, William H., Pvt	Photo Lab Technician	1–11
Dwyer, Thomas S., Pvt	Photo Lab Technician	1–11
Jardine, Walter E., Pvt	Photo Lab Technician	1–11
Turcotte, Joseph A., Pvt	Photo Lab Technician	1–11
Ignatius, Dale R., Pvt	Photo Lab Technician	1–11
Miller, Robert N., Pvt	Photo Lab Technician	1–11
Raguso, Vincent J., Pvt	Photo Lab Technician	1–11
Sunshine, Saul, Pvt	Photo Lab Technician	1–11
Burg, Eugene G., Pvt	Photo Lab Technician	1–11
Delz, William R., Pvt	Photo Lab Technician	1–10
Felgenhauer, William, Pvt	Photo Lab Technician	1–11
Long, Jack E., Pvt	Photo Lab Technician	1–11
	On-Site Plotting and Briefing	
Wales, Charles C., LT (USN)	Chief, Plotting and Briefing Section	1–5
Allison, William B., Lt (USN)	Chief, Plotting and Briefing Section	5–11
Mitchell, Samuel, Lt	Asst. Chief, Plotting and Briefing	1–11
Page, Marshall, M/Sgt	NCOIC	1–11
Lanz, Leo R., SFC	Asst. NCOIC	1–9
Huffman, Orville B., Cpl	Radio Operator	1–11
Strayer, Paul L., Cpl	Radio Operator	1–11
	On-Site Monitoring Section	
Tomcheck, Clifford, Lt	Chief, Monitoring Section	1–11
Bivens, Hollis E., Lt	Program Monitor	1–5
Black, Garth W., Lt	Program Monitor	1–11
Calligan, Robert H., Lt	Program Monitor	1–11
Dean, Ronald R., Lt	Program Monitor	1–11
Flett, John G., Lt	Program Monitor, Plotting and Briefing	1–6 7–11
Landon, Raymond S., Lt	Asst. Chief, Monitoring Section	1–11
Morgan, John F., Lt	Program Monitor	1–10
Primavera, Donald, Lt	Program Monitor	1–11
Schuler, John L., Lt	Program Monitor	1–10
Stewart, Albert H., Lt	Program Monitor	1–11
Emanuel, Norbert T., SFC	Monitor NCOIC	1–9
Parra, Robert L., SFC	Monitor NCOIC	1–9
Wolfe, James A., SFC	Monitor NCOIC	1–10
Young, Harold F., SFC	Monitor NCOIC	1–11
Hobert, Clarence L., Sgt	Monitor NCOIC	1–11
Martin, Donald E., Sgt	Monitor NCOIC	1–6
Commissaris, Cliford, Cpl	Monitor NCOIC	1–11
Ducksworth, Elane, Cpl	Monitor NCOIC	1–7
Brant, Leroy E., Pfc	Monitor	1–10
Dore, Leo A., Pfc	Monitor	1–9
Frederickson, R. L., Pfc	Monitor	1–11

Name	Assignment	Shot period
Frith, Kenneth R., Pfc	Lineman	1–8
	Monitor	9–11
Locke, Norris R., Pfc	Monitor	1–11
Matzura, Joseph G., Pfc	Monitor	1–7
Moore, Raymond D., Pfc	Monitor	1–11
Parcell, Walter T., Pfc	Monitor	1–10
Punzel, Herbert H., Pfc	Monitor	1–10
Tabery, Stanley J., Pfc	Monitor	1–11
McCann, David H., Pfc	Monitor	8–11
Acup, Chester C., Pvt	Monitor	1–9
Antoine, Albert F., Pvt	Monitor	1–11
Barth, Asten M., Pvt	Monitor	1–10
Bombara, Mario, Pvt	Monitor	1–11
Brooks, Levi C., Pvt	Monitor	1–11
Coloma, Juan H., Pvt	Monitor	1–7
Dabbs, Val N., Pvt	Monitor	1–9
Damon, Charles F., Pvt	Monitor	1–9
Dauterman, Frederick, Pvt	Monitor	1–11
Davis, Duane E., Pvt	Monitor	1–9
Dean, Theodore F., Pvt	Monitor	1–9
DeAngelo, Anthony P., Pvt	Monitor	1–9
Eales, Francis R., Pvt	Monitor	1–9
Gansey, Steve A., Pvt	Monitor	1–7
Glanzer, Kenneth W., Pvt	Monitor	1–11
Graham, Thomas A., Pvt	Monitor	1–11
Gunnell, William R., Pvt	Monitor	1–7
Hall, Clarence J., Pvt	Monitor	1–10
Hall, Fred J., Pvt	Monitor	1–11
Hammel, Leo E., Pvt	Monitor	1–7
Handel, Charles J., Pvt	Monitor	1–11
Hein, Robert H., Pvt	Monitor	1–11
Houillon, Phillip L., Pvt	Monitor	1–7
Iwanski, Richard A., Pvt	Monitor	1–9
Jean, Duane B., Pvt	Monitor	1–9
Jelinek, Sylvester J., Pvt	Monitor	1–11
Johnson, Kenneth W., Pvt	Monitor	1–9
Jones, Gordon D., Pvt	Monitor	1–10
Jones, Phillip R., Pvt	Monitor	1–6
Keller, Raymond H., Pvt	Monitor	1–11
Lallow, Paul D., Pvt	Monitor	1–11
Lansford, Junior O., Pvt	Monitor	1–11
Lindsay, James L., Pvt	Monitor	1–11
Leone, Louie G., Pvt	Monitor	1–9
Lucas, Paul J., Pvt	Monitor	1–11
Macon, Robert L., Pvt	Monitor	1–10
Marcus, Lawrence D., Pvt	Monitor	1–6
Marion, John P., Pvt	Monitor	1–11
Meinson, Roy F., Pvt	Monitor	1–11
Miles, Richard K., Pvt	Monitor	1–10
Naprstek, Charles F., Pvt	Monitor	1–11
Nixon, Ora J., Pvt	Monitor	1–11

[redacted]

Name	Assignment	Shot period
O'Brey, James R., Pvt	Monitor	1–11
Pohon, George, Pvt	Monitor	1–7
Peichowski, Leonard J., Pvt	Monitor	1–11
Peterson, Richard A., Pvt	Monitor	1–7
Pirchner, Robert F., Pvt	Monitor	1–11
Pitts, James F., Pvt	Monitor	1–10
Quantromani, F. V., Pvt	Monitor	1–9
Rozek, Delbert L., Pvt	Monitor	1–10
Richardson, George W., Pvt	Monitor	1–7
Rusch, Richard D., Pvt	Monitor	1–10
Sausville, Joseph D.	Monitor	1–11
Schmidt, Bert W., Pvt	Monitor	1–11
Schnipper, Lawrence, Pvt	Monitor	1–6
Segars, Leon R., Pvt	Monitor	1–10
Smith, Kenneth, R., Pvt	Monitor	1–11
Smith, Norris D., Pvt	Monitor	1–11
Stachowski, Charles, Pvt	Monitor	1–11
Stillman, Gene A., Pvt	Monitor	1–11
Talmadge, Walker C., Pvt	Monitor	1–7
Tolli, Thomas A., Pvt	Monitor	1–11
Turner, Joseph A., Pvt	Monitor	1–11
Typanski, Leonard J., Pvt	Monitor	1–11
Wargo, Robert C., Pvt	Monitor	1–11
Watson, Arthur C., Pvt	Monitor	1–6
Watson, Melvin E., Pvt	Monitor	1–9
Weber, Robert N., Pvt	Monitor	1–11
Wood, Robert D., Pvt	Monitor	1–7
Whitton, Donald R., Pfc	Monitor	1–9
Simpson, William G., Pvt	Monitor	8–11
Mayer, Willian E., Pvt	Monitor	8–11
Wilson, John D., Pvt	Monitor	10–11
Thompson, Dale C., Pvt	Monitor	8–11
Wright, Benjamin, Pvt	Monitor	8–11
Van Erman, Gordon T., Pvt	Monitor	8–11
Walters, Robert L., Pvt	Monitor	8–11
*Gill, William L., LT (USN)	Program Monitor	1–9
*Honadle, Robert K., LT (USN)	Program Monitor	1–9
**Jones, Frank R., LT (USN)	Program Monitor	1–11
*Wise, Maurice H., LT (USN)	Program Monitor	1–10
*Reeb, Richard, Capt USAF	Air Monitor	1–5
*Mirgon, Curtis L., Capt USAF	Air Monitor	1–11
*Galloway, Charles, Lt	Air Monitor	5–10
*Plumb, Ralph E., Capt	Air Monitor	1–11
*Harper, Albert D., T/Sgt AF	Air Monitor	1–10
*Renteria, Jess T., T/Sgt AF	Air Monitor	1–11
*Sass, Charles W., T/Sgt AF	Air Monitor	1–10
*Cormier, Johnnie E., S/Sgt AF	Air Monitor	1–9
*Danenberg, Paul S., Sgt	Air Monitor	1–11
*Gilman, Alden R., A/1C AF	Air Monitor	1–10
*King, Raymond R., A/1C AF	Air Monitor	1–11
*Patterson, Ralph C., A/1C AF	Air Monitor	1–11

Name	Assignment	Shot period
	On-Site Decontamination Section	
Boyle, Kenneth E., Lt	Chief, Decon. Section	1–11
Hall, Richard M., Lt	Asst. Chief, Decon. Section	1–5
Young, H. L., Lt	Asst. Chief, Decon. Section	6–11
*Stevens, Robert A., EMC (USN)	Asst. Chief, Decon. Section	1–5
	Off-Site Monitor	6–11
Fisher, Gerald D., Sgt	NCOIC	1–6
Johnston, Robert D., Cpl	Asst. NCOIC	1–9
Johnson, Samuel G., Pfc	Spray Man	1–11
Walsh, John A., Pfc	Spray Man	1–11
Andrade, Antonia R., Pfc	Spray Man	1–11
Angell, Billy E., Pfc	Spray Man	1–11
Kiekover, Jerald A., Pvt	Spray Man	1–11
Amoroso, Joseph A., Pvt	Spray Man	1–11
Kilgore, William D., Pvt	Spray Man	1–11
Kiser, Clifford L., Pvt	Spray Man	1–11
	Off-Site Operations	
Los Alamos Group:		
Johnson, William S.	Operations Officer	1–11
Skillern, C. P.	Asst. Operations Officer	1–11
Smith, Margaret J.	Stenographer	2–7
		9–11
Edwards, Vrina M.	Stenographer	8–9
Jordan, Harry S.	Monitor	8–11
McClelland, Jean	Chemist	10–11
Mitchell, Robert N.	Monitor	1–3
Military personnel:		
Clausen, Vincent P., Lt	Monitor (Military Deputy)	1–11
*Claborn, Eldred S., ADC (USN)	Monitor	1–11
*Rowe, John C., AMC (USN)	Monitor	1–11
*Melton, John R., RMC (USN)	Monitor	1–11
*Shipman, Harold D., T/Sgt	Monitor	1–4
		6–9 & 11
*Harrison, Alfred S., A/1C	Monitor	1–11
Williams, David E., Pfc	Monitor	1–11
Williams, George, Pvt	Monitor	1–11
Wothington, Thomas, Cpl	Radio Operator	1–11
Forsythe, George F., Pfc	Monitor	1–11
Forsythe, Charles F., Pfc	Monitor	1–11
Albertson, James H., Pfc	Monitor	1–5
U.S.P.H.S. (Group No. 1):		
Ayer, H. E. (Capt)	Monitor	1–5
Christman, R. P. (1st Lt)	Chief, Counting Lab (Mercury)	1–5
Fooks, J. H. (Maj)	Monitor	1–5
Henderson, P. C. (Maj)	Monitor	1–5
Holaday, D. A. (Lt Col)	Asst. Operations Officer	1–5
Holy, W. E. (Lt Col)	Monitor	1–5

Name	Assignment	Shot period
Jaworski, C. A. (1st Lt)	Monitor	1–5
Johnson, C. C. (Capt)	Monitor	1–5
Payne, W. W. (Lt Col)	Chief, Counting Lab (CP)	1–5
Rechen, H. J. L. (Maj)	Monitor	1–5
Spangler, C. E. (Lt Col)	Monitor	1–5
Stafford, R. E. (1st Lt)	Monitor	1–7
Wheeler, G. B. (M.D.)(Maj)	Monitor	1–5
Wolff, A. H. (Maj)	Monitor	1–5
Myer, O. S. (Capt)	Monitor	1–5
U.S.P.H.S. (Group No. 2):		
Barry, D. E. (1st Lt)	Monitor	5–8
Butrico, F. A. (Maj)	Monitor	5–11
Carter, M. A. (Capt)	Chief, Counting Lab (Mercury)	5–11
Fetz, Richard, (Capt)	Monitor	5–11
Frazier, Russell, (Capt)	Monitor	8–11
Graber, R. C. (Lt Col)	Monitor	5–10
Ingraham, S. C. (M.D.)(Lt Col)	Chief, Counting Lab (CP)	5–11
Jensen, C. R. (Maj)	Monitor	5–11
Larsen, R. I. (1st Lt)	Monitor	5–11
Lawrence, P. A. (Lt Col)	Asst. Operations Officer	5–11
MacMurray, L. C. (Capt)	Monitor	8–11
Paganini, Otto, (Capt)	Monitor	5–11
Platz, A. L. (Capt)	Monitor	5–11
Rossane, A. T. (Lt Col)	Monitor	6–11
Smithson, H. K. (Capt)	Monitor	6–11
Weathersbee, E. J. (Capt)	Monitor	5–11
Dahl, Arve	Special Consultant	9

Inclosure 3

RAD-SAFE INSTRUCTIONS TO PROGRAM PERSONNEL

OFFICE OF THE TEST DIRECTOR
Nevada Proving Grounds
Post Office Box L
Mercury, Nevada

9 March 1953

TO: See Distribution

FROM: Test Director

SUBJECT: RAD-SAFE INSTRUCTIONS TO PROGRAM PERSONNEL

1. Purpose: The purpose of this document is to acquaint all interested parties with the functioning of the Rad-Safe Unit so that On-Site operations may proceed with a minimum of interference and delay and yet be consistent with Rad-Safe requirements of the Test Director.

2. Coordination of Rad-Safe Requirements and Program Monitors: A member of the On-Site Operations Office will contact program leaders and heads of other interested agencies to explain in detail the operation of the On-Site Rad-Safe program, to ascertain the Rad-Safe requirements of all agencies, and in the case of programs, to introduce the program monitor. The program monitor will generally coordinate the program's need for Rad-Safe facilities and additional monitor requirements. The program monitor will leave his phone number, and may generally be reached through the On-Site Operations Office, or the R.S.S.U. Administrative Office.

3. Control in Contaminated Areas:

a. The On-Site Rad-Safe Section will determine the extent of contamination in the target area by daily surveys. All areas of radiation greater than 10 mr/hr will be controlled. Fixed and mobile check points will be established. Access to the area will require a clearance from the On-Site Operations Officer. For this clearance, contact your program monitor or the On-Site Operations Office. It is desired that arrangements for entry or clearance to the area be made 24 hours in advance. For shot days, a schedule for entry will be published by the Test Director.

b. In making arrangements for entry, either through the program monitor or through the On-Site Operations Office, party leaders should submit the following information:

(1) Program, project, or other agency

(2) Full name of all personnel in party

(3) Party leader

(4) Desired entry time and expected time of stay

(5) Locations to be visited

Receipt of such advance notice will materially assist the Rad-Safe Unit in reducing party processing time at the Rad-Safe building.

c. A map of the target area, showing radiation intensities, will be posted daily by the On-Site Operations Officer outside building 200 in the Mercury area for the convenience of project personnel.

d. Protective clothing, to be utilized only for wear in contaminated areas, may be obtained at the Rad-Safe building on a five day issue basis. Individuals scheduled for entry to controlled areas should draw their protective clothing in advance and dress in Mercury. When the protective clothing is contaminated, it will be exchanged for fresh clothing at the Rad-Safe building.

4. Party Control and Briefing: Parties reporting to the Rad-Safe building for processing into controlled areas will normally remain with their transportation. For large parties, the party leader only will enter the Rad-Safe building by the Clean Entrance on the east side balcony. He will pick up his monitor and contact the representative of the Plotting and Briefing Section located just inside the door, who will advise him as to further processing required. If the work load permits, all members of small parties may enter the Rad-Safe building for their briefing. Schedules of entry will be followed explicitly and parties will not congregate in or near the Rad-Safe building.

5. Return from Contaminated Areas: Personnel returning from contaminated areas must process through the Personnel Decontamination Station located in the Rad-Safe building. Enter via the Contaminated Entrance at the Southeast corner of the building.

6. Relation of Monitor to Party: Rad-Safe monitors assigned to individuals or groups working in contaminated areas, or with contaminated equipment during recovery operations, will act in an advisory capacity to keep the recovery party leader informed of radiation intensities at all times. The recovery party leader is expected to accept this advice and act accordingly. It is the responsibility of both the party leader and members of the recovery party to adhere to the limits established in the Rad-Safe Annex.

7. Vehicle Control: All vehicles used in contaminated areas will be checked through the Vehicle Decontamination Section before return to Camp Mercury or reentry into contaminated areas. A check point has been established south of the C.P. to assist in this process. Vehicles which exceed prescribed radiation tolerance levels will be decontaminated or otherwise disposed of, as determined by the Officer-in-Charge of the Vehicle Decon Station, in conjunction with the party leader concerned. In general, operational vehicles will not be decontaminated merely to serve as personnel transportation to Mercury, as a contaminated vehicle park has been established.

8. Telephone Numbers:

On-Site Operations Office -- 8263, 8264

R.S.S.U. Administrative Office -- 9288

TOM D. COLLISON
Lt. Col., Cml C (Arty)
Rad-Safe Officer, NPG

DISTRIBUTION:
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S. R. Woodruff (50 cys) ATTN: All Contractors
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Chapter 2

SHOT ANNIE*

2.1 INTRODUCTION

2.1.1 At 0520 PST, 17 March 1953, the first shot of the Upshot-Knothole series, Annie, was detonated from a 300-ft tower in Area 3 of Yucca Flat, NPG. The decision to fire was made at 0830, 16 March 1953, after the 48-hr forecast indicated favorable weather for the shot.

2.1.2 The Rad-Safe Unit performed its mission without undue difficulties. The On-Site Initial Survey was completed and plotted for general use by 0650. Recovery parties were released to the 100 mr/hr line at 0640. General recovery, "R" hour, was announced at 0715. Contamination of the target area was generally to the east of ground zero. The eastern sector of the pattern was not delineated by the initial survey team as it was above 10 r/hr and did not interfere with recovery operations. The fall-out in the peripheral areas of NPG was to the east in a relatively narrow band (10 miles or less in width), extending from Alamo to Carp to immediately north of St. George, Utah. The maximum integrated infinity dose in the fall-out path was from 4 to 6 roentgens. St. George received approximately 0.5 roentgen dose. The aircraft assisting in the delineation of the fall-out pattern were generally satisfactory with the exception of a general lack of air to ground communications. This delayed receipt of the aerial data and hampered optimum utilization. Completion of the actual fall-out pattern (Incl. 1) verified the fall-out forecast made at 0400 PST, 17 March 1953. The forecast fall-out pattern made by this section is shown in Incl. 2.

2.2 ON-SITE OPERATIONS

2.2.1 A dry run was made at 0600 D−1 day. Considerable difficulty was encountered with communications, although all radios had recently been in the communications shop for service. Additional 6-volt batteries were placed in all operational radio vehicles to support the radios on D day. After D day 6-volt generators were added.

2.2.2 The initial survey party, consisting of four teams, started at H+30 min, and the survey was completed by H+1½ hr. Communication with three of these four initial survey teams was satisfactory. Subsequent surveys were made daily through 21 March 1953. Additional surveys were made as required. Survey plots for all surveys are attached as Incl. 3.

2.2.3 One hundred thirteen (113) parties were briefed and cleared for entry into controlled areas during the period of this report. On shot day, area access clearance forms were submitted to parties prior to their call for briefing. This practice led to some loss of control. One party entered the contaminated area prior to R hour without being briefed or cleared. For future operations, clearance forms will be issued to party leaders only as they are briefed.

* Period covered, 16 to 22 March 1953.

2.2.4 During the period, nine monitors received more than one (1) roentgen cumulative exposure. Of these, the highest was 1.906 roentgens. Some monitor personnel were found to need more orientation on the shot area and the processing procedure in the Rad-Safe Building. In general, all monitoring requirements were satisfactorily met.

2.2.5 Approximately fifteen hundred film badges were processed during the period. Eleven personnel received more than 2 roentgens cumulative exposure. Of these, ten were project personnel and one was the Rad-Safe Control Officer, who took a ground zero reading on D + 3 days. Highest exposure reported for the period was 3.385 roentgens.

2.2.6 Fifty (50) vehicles were found to be contaminated above tolerance levels and were decontaminated during the period. Two (2) vehicles were temporarily placed in the Hot Park for aging and subsequently decontaminated and released.

2.2.7 A vehicle check point was maintained on Mercury Highway just south of the CP entrance to check vehicle decontamination.

2.2.8 Experience from this period shows that

(a) Some monitors had not received sufficient orientation in the test area.

(b) Standby monitors were not prepared to assume missions without delay. For future shots the standby monitors will be fully dressed in protective clothing and will have film badges and dosimeters on their persons.

(c) Area access forms were given to parties prior to their scheduled briefing. In the future, the access form will be issued after all other processing is completed.

2.3 OFF-SITE OPERATIONS

2.3.1 Fixed and mobile monitors were distributed on D−1 day as shown in Incl. 4.

2.3.2 The wind pattern at H hour resulted in an abnormally narrow distribution of the fall-out of radioactive material (see Sec. 2, WT-705). In general, the predicted path of fall-out from the 0400 wind was almost due east of ground zero with the bulk of the activity concentrated in a narrow path only a few miles wide.

2.3.3 Measurable activity was detected on the ground on Highway 93 from 25 to 65 miles south of Alamo. Activity was also detected on Nevada Highway 55 in the interval from 10 to 30 miles north of Highway 91. On Highway 91 activity was detected from 46 miles west of St. George to St. George. Fall-out also occurred from 3 miles south of St. George to 15 miles north of St. George. On Highway 91 from St. George to Cedar City, activity was measured as far as 26 miles northeast of St. George. Highway Utah 15 was surveyed as far east as Zion National Park, and activity was detected all along this route. The towns of Virgin, Hurricane, Springdale, and Rockville were generally in the fall-out path. The data from the monitors' reports on inhabited localities and at the centers of activity on highways is shown in Incl. 5. Air samples taken at St. George, Mesquite, and Glendale Junction showed airborne activity. Late fall-out, undetectable by field survey instruments, was measured at Mesquite and Glendale Junction. This data is presented in Incl. 6.

2.3.4 Some information on the difference between exposure inside and outside of buildings was obtained at St. George. A background recorder with a film badge attached was located in the shop building of Dixie College. The background recorder showed a maximum reading of 0.4 mr/hr. The film badge on the recorder showed no reading. The film badge of the monitor working in this area showed an exposure of 140 mr, and the outside radiation intensity reading was 26 mr/hr.

2.3.5 Inclosure 7 shows the highest rates at inhabited localities and on highways, with the time of reading, and the calculated infinite dose based on the $t^{-1.2}$ decay law. Inclosure 8 shows the fall-out pattern as determined by analysis of the ground monitors' reports.

2.3.6 Radio reception and transmission were generally good from about 0600 to 0845 on D day. After this time, the AEC Communications men reported that climatic interference was proving generally troublesome on all HF networks. From 0845 to 1445 a total of nine radio messages were received at the CP. Three of these were from Groom Mine, three from the Ely-Tonopah-Beatty region, and the other three from what might be considered the region of immediate interest at that time, the area to the east. Radio reception was considerably improved from 1445 until 1813 except in the town of St. George. From this time until sign-off at 2200, radio communication was unsatisfactory.

2.4 AIRCRAFT PARTICIPATION

2.4.1 The aircraft participation consisted of a close-in terrain survey (performed by an L-20 aircraft), an extended terrain survey (performed by L-20 and C-47 aircraft), and a cloud tracking operation (performed by two B-29's and one B-25 aircraft).

2.4.1.1 The close-in terrain survey was scheduled to be performed by a helicopter. However, since the helicopter did not arrive in time to participate in the D−1 day dry run, it was considered unwise to commit the helicopter on D-day to the initial aerial on-site survey of the target area. Because of this, an L-20, the crew of which had been rehearsed, was used for the initial survey. The L-20 left Indian Springs AFB at H+2 min (entering the prohibited area by way of Mercury and Gate 2), made a survey of the Mercury Highway up to a point adjacent to ground zero, and proceeded in a square pattern around ground zero at a distance of approximately 2 miles, in order to verify the fall-out in the immediate vicinity of ground zero. The L-20 then executed a similar pattern around Tower No. 4 to give immediate results as to the contamination in that area. The survey was continued to the north end of Yucca Flat, down the east side of the flat to Frenchman Flat, and back to Indian Springs on a route east of the test site. Difficulties were encountered in relaying accurate data to the Control Point as the minimum speed of the aircraft was too great for this type survey. By the time the monitor had taken down a reading, given the pilot directions, and performed the radio call, he had already passed his next planned point of reading. Consequently, only limited data were received at the Control Point from this aircraft.

2.4.1.2 The extended terrain survey consisted of two parts. The portion radially within 20 miles of ground zero was performed by a second mission of the L-20 aircraft used on the initial survey. The extended portion was performed by a C-47 aircraft. Both aircraft flew at 500 ft above the terrain commensurate with safety.

The L-20 flew a prescribed pattern based on the grid system shown in Incl. 9 and reported the radiological data shown in Incl. 10. The aircraft left Indian Springs AFB at H+2 hr 25 min with a Rad-Safe monitor and performed the mission as planned. Communications were unsatisfactory throughout the flight. The plane was equipped only with VHF which was ineffective in the mountainous terrain. Consequently, data from this flight were not obtained until the end of the flight.

The extended portion performed by the C-47 aircraft was planned in a similar manner. The plane left Indian Springs AFB at H+2 hr but did not complete its prescribed pattern, since, in order to establish communications, the aircraft frequently had to fly out of the pattern and was forced to return to base because of a shortage of gas. Reference is made to the predicted fall-out plots (Incl. 2) prepared by the Weather Section (Sec. II, WT-705) and the Rad-Safe Control Officer. In preparing the terrain survey pattern, it was realized that the C-47 would receive some contamination from the 3 to 6 hr fall-out. However, as it was considered important to clearly delineate the maximum fall-out area early, the plane was put in the air at H+2 hr on the pattern indicated. The contamination received by the aircraft was low and did not interfere with the mission. The pattern flown and data for the C-47 are shown in Incl. 11. The grid system is that shown in Incl. 9.

As the survey pattern for the C-47 was not completed because of time lost trying to establish communications and also because of the narrow fall-out pattern, accurate correlation of the terrain survey information with actual ground readings was not possible for this shot. However, from a qualitative standpoint, the fall-out pattern as shown in Incl. 12 for each instrument is considered accurate. The monitoring instruments used in the aircraft were two MX-5's, two T1B's, one Scintelog (from NYOO) and recorder. The C-47 also had a C-1 filter with an MX-5 indicator. Inclosure 12 contains a plot for each instrument and a plot of the ground survey results.

2.4.1.3 The cloud tracking operation was performed to ascertain the actual path of the contaminated air mass to at least the 200-mile limit and as much farther as practical within the limitations of the aircraft. The cloud was tracked at three different levels by aircraft assigned directly to the mission. In addition, location of the mushroom was determined by cloud samplers assigned a separate mission. At the 12,000 ft level, tracking was performed by a B-25 aircraft. It started its mission at H+15 min. At detailed briefing the pilot was told to fly the 5 mr/hr line of the leading edge of the contaminated air mass at the 12,000 ft level; the pilot, however, visually followed the mushroom of the cloud, and no significant readings were taken at the 12,000 ft level. Data collected by this aircraft are listed in Incl. 13.

Two B-29's were committed to track the cloud at 18,000 and 22,000 ft msl. They left Kirtland Air Force Base on schedule and arrived over their orbit point (the Las Vegas Radio Range Station). Through the lack of further direction, they continued to orbit at this location until approximately 0830 hr. Consequently, no data were collected at their respective levels. At approximately 0830 hr, however, they were directed to proceed from the intersection of Amber-2 and Red-6 Airways to Bryce Canyon on Red Airway to determine the contamination along these airways at 18,000 and 22,000 ft. The B-29 at 18,000 ft was directed to descend to 14,000 ft and survey the air mass at that level from Bryce Canyon on Red-6 to the intersection of Red-6 and Amber-2 Airways. It was found at 1123 hr that the airways were clear at this altitude. This B-29 was then released and returned to base. The second B-29, which originally was at 22,000 ft, having found Red-6 clear at 22,000 ft at 1012 hr, was directed to descend to 18,000 ft and survey the airways from Bryce Canyon to intersection of Red-6 and Amber-2. He reported the airway clear at 18,000 ft at 1148 hr. He was then released and returned to base at Kirtland.

Data collected by the two B-29 cloud trackers are shown in Incl. 14. The predicted cloud trajectory as of 0300, 17 March is shown in Incl. 15. The actual trajectory plotted from the data in Incls. 13 and 14 is shown in Incl. 16.

2.4.2 A summary of aircraft participation follows.

2.4.2.1 Generally speaking, the greatest difficulty encountered was that of faulty communications. This was so general in nature that the details of the difficulties could not immediately be determined. However, it appeared that VHF communications could not be depended upon at low altitudes except within 20 miles of ground zero. HF communication was never established due to trouble at the local repeater station. To prevent the recurrence of these difficulties on subsequent shots, a test was made on D+1 day using the C-47 aircraft in an extended 360° pattern to check at low altitudes the HF network out to a range of approximately 150 miles. No difficulty was encountered on this flight, which ranged as far as the east slopes of the Sierra Nevada Mountains. Also, no radioactive contamination was found on this flight.

2.4.2.2 The instruments used in this operation were the MX-5 GM type survey meter, the T1B ion chamber type survey meter, and the Scintelog scintillation type meter from the New York Operations Office. No malfunctions were experienced with any of the type meters used.

2.5 LOGISTICS AND SUPPLY

2.5.1 For the period of 16 to 23 March, the Supply Section issued 1958 shoe covers, 834 protective caps, 951 coveralls, 824 cotton gloves, 1058 high density goggles, 78 protective goggles, and 190 respirators. The laundry serviced 651 shoe covers, 494 protective caps, 579 coveralls, 494 cotton gloves, 109 respirators, 14 pillowcases, 42 sheets, and 65 towels.

2.5.2 Prior to 16 March, 198 AN/PDR T1B's, 64 SU10's, 90 MX-5's, 73 AN/PDR 39's, 85 Victoreen 389A's, 4 AN/PDR-10A's, and 2 Pee Wee No. 211 survey instruments were on hand and calibrated. During the period 16 to 22 March, 93 survey instruments were recalibrated and 50 repaired.

2.5.3 Second echelon maintenance was performed on 21 military vehicles. Four vehicles were deadlined owing to lack of spare parts.

2.5.4 Communication for this shot was not satisfactory. Installation of the 6-volt radios in the military weapons carriers (M-37) was unsatisfactory for this first shot, although different modifications were tried prior to the shot.

2.6 GENERAL

The Rad-Safe Organization as a whole functioned efficiently. Information from the field was presented by the Rad-Safe Control Room in a satisfactory manner. General interest started with the On-Site situation and after R hour shifted to the cloud path and the fall-out area. The Off-Site fall-out pattern was fairly well presented by Off-Site ground monitors and the Aerial Terrain Survey. The lack of radio communications delayed presentation of all phases of data. Off-Site Operations had to resort to telephone to obtain data from Off-Site ground monitors. The aerial monitors telephoned their information into the control room after they landed at Indian Springs.

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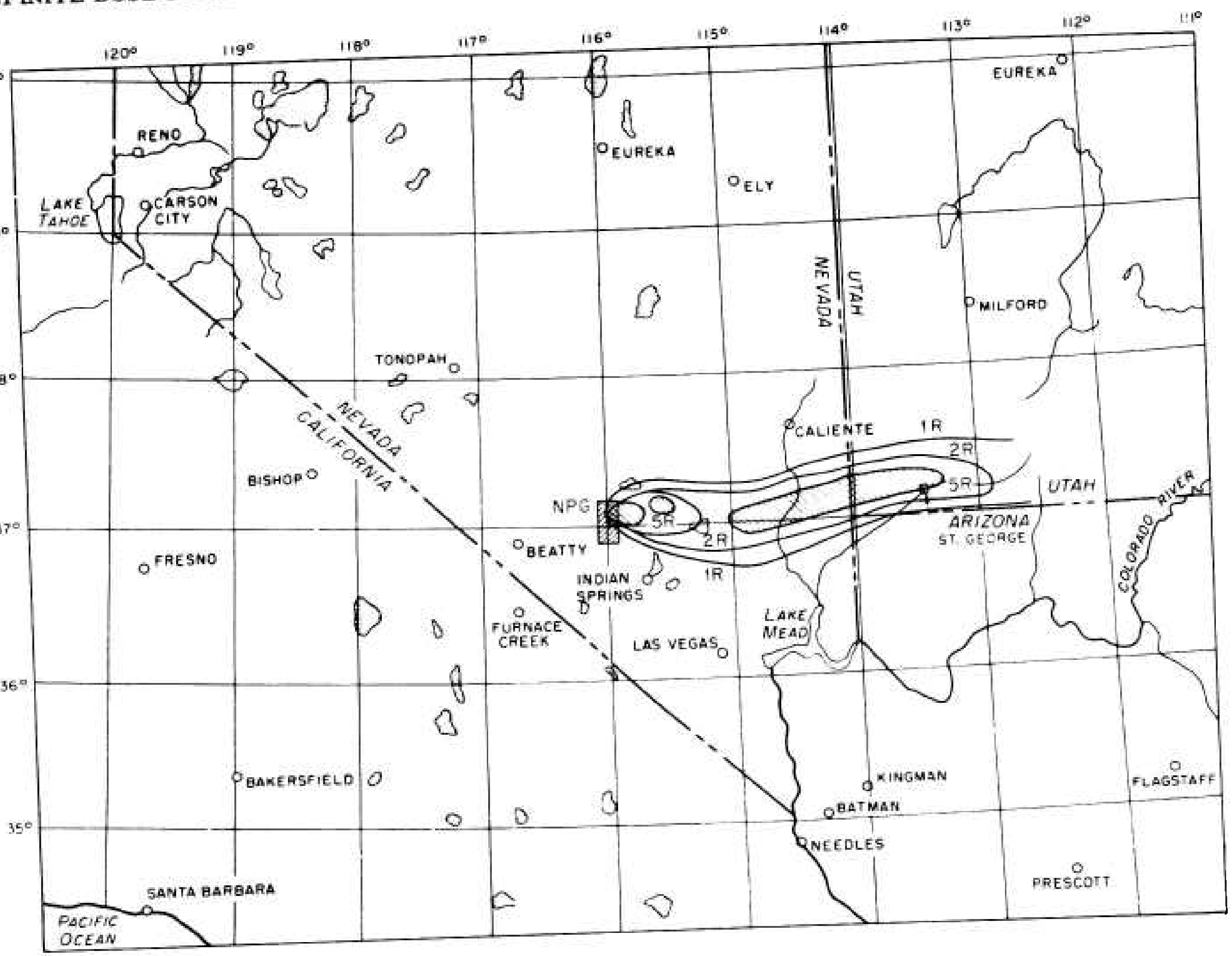
Inclosure 1

INFINITE DOSE FALL-OUT PATTERN



Data based on combined air and ground survey. Shot Annie, 17 March 1953.

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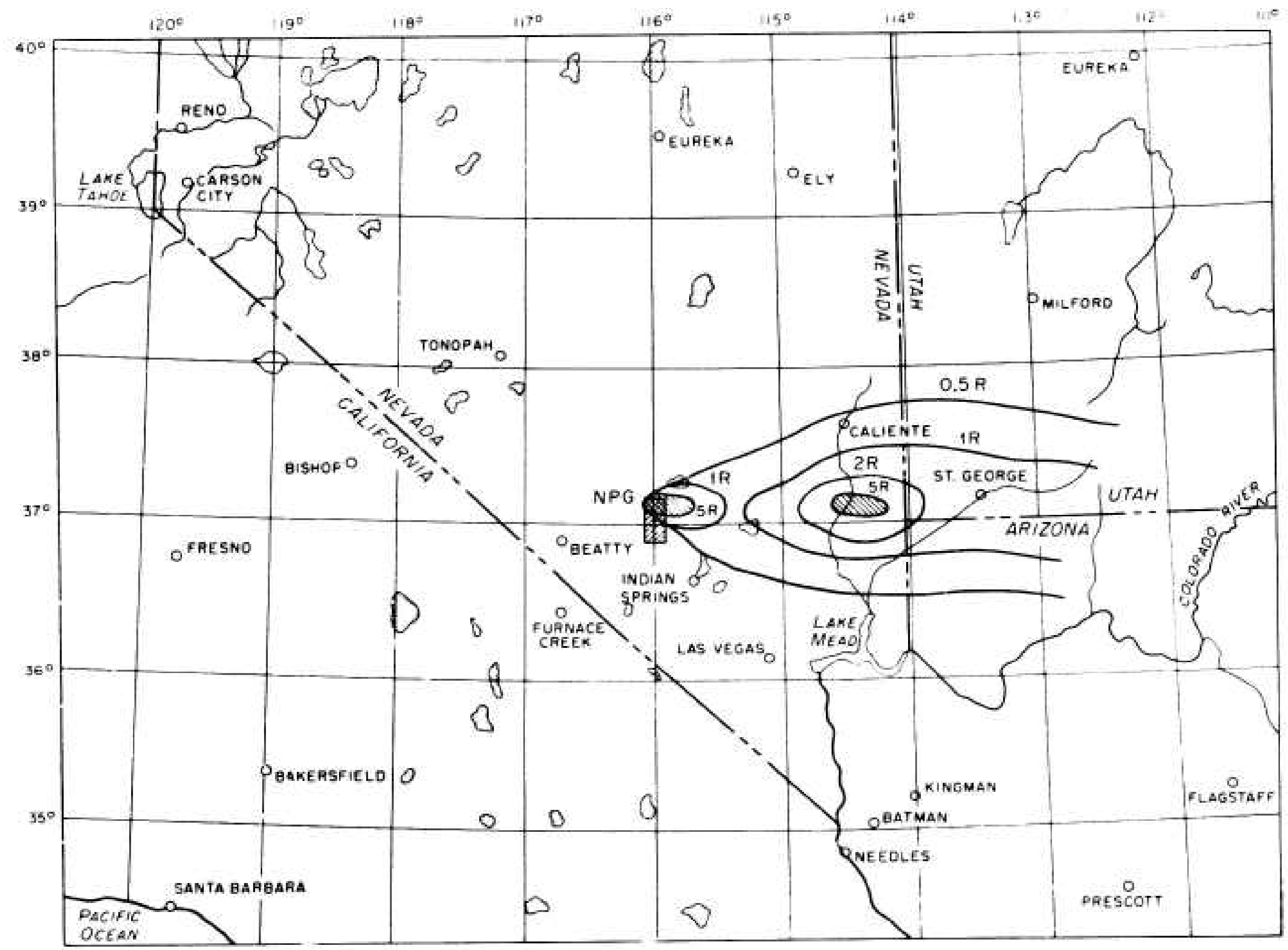
Inclosure 2

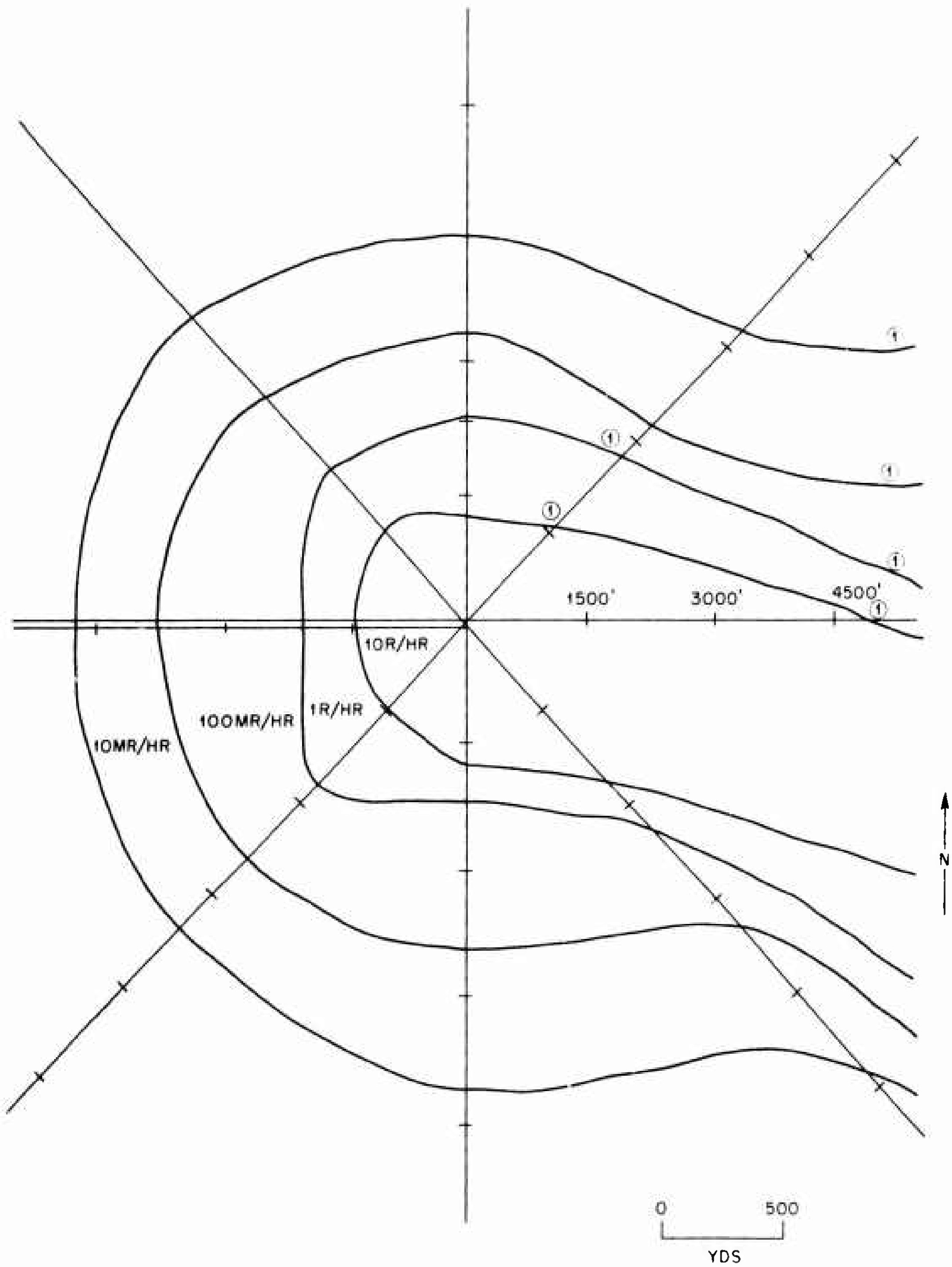
FORECAST FALL-OUT PLOT



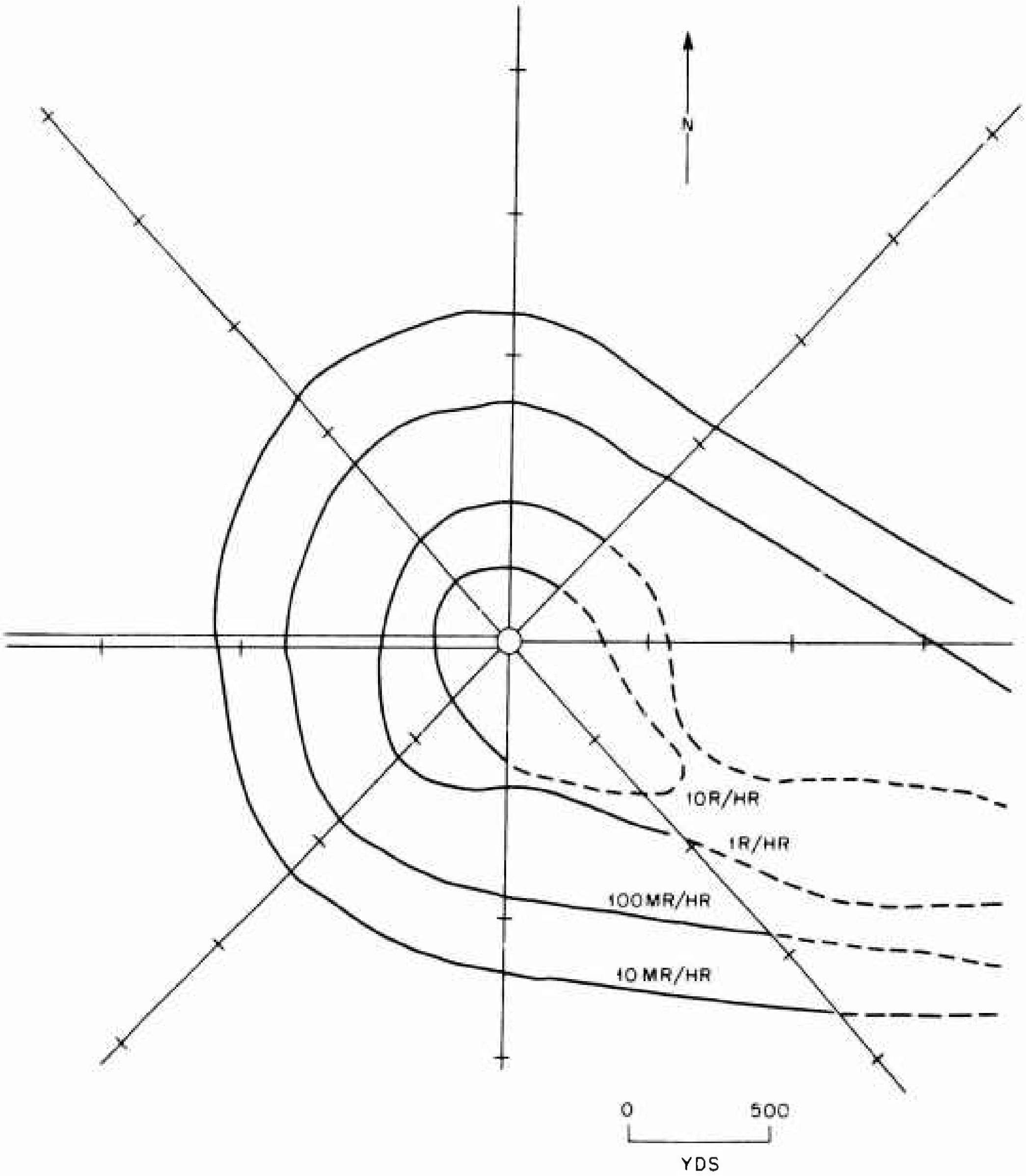
Data based on 0400 winds. Infinite dose lines are given in roentgens. Shot Annie, 0500, 17 March 1953 H-hr, 0520.

Inclosure 3

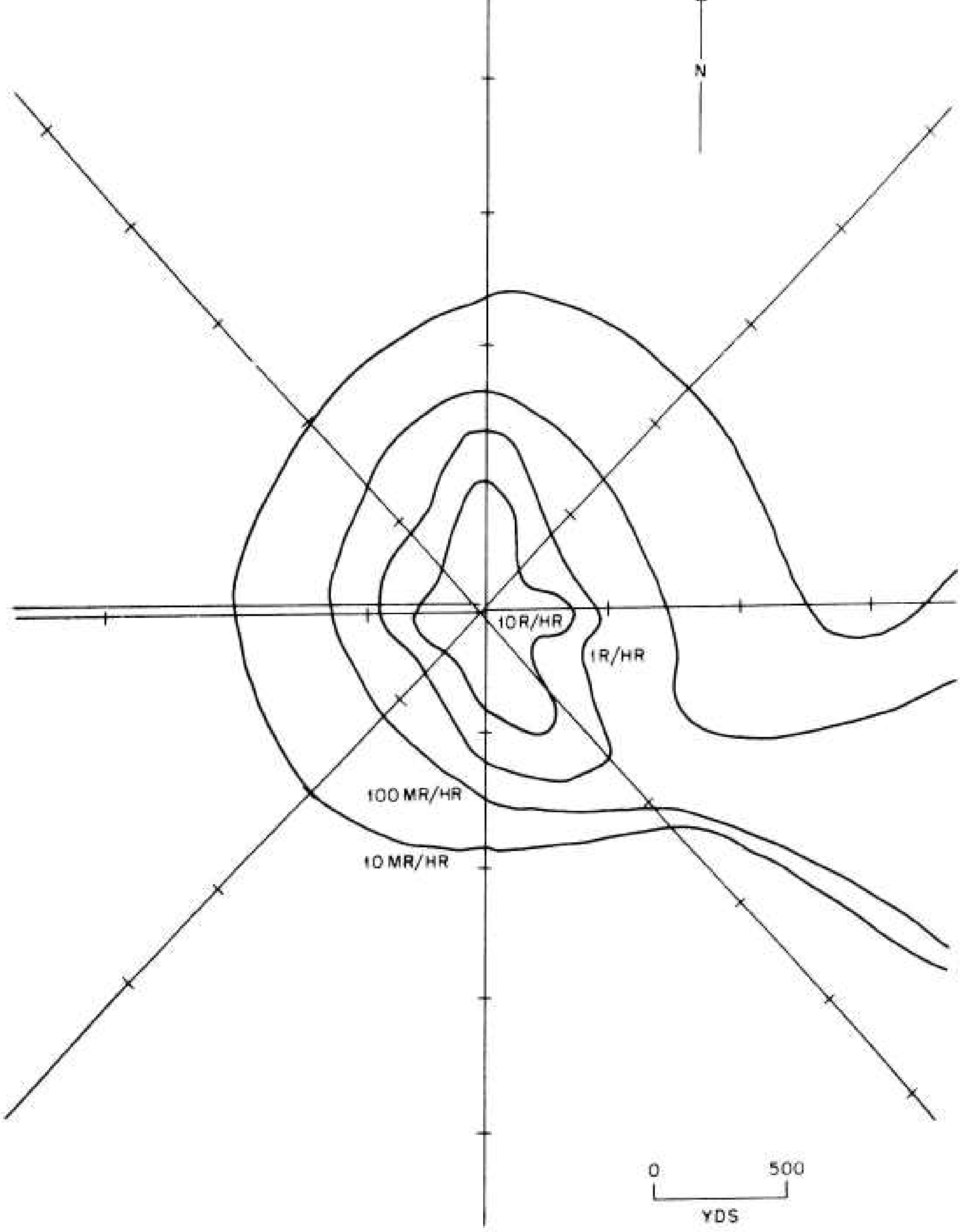
SURVEYS OF TEST AREA 3



Initial Shot Annie survey, 0630, 17 March 1953. Points marked (1) were extrapolated from data taken between 0830 and 0915.



Resurvey, 0600 to 1100, 18 March 1953. Dotted lines are from a 1100 survey. All other lines from 0600 survey. At 0600 the road proceeding ESE from GZ had intensities along it above 10 r/hr. This contamination shifted rapidly for several hours and by 1100 had been dissipated by the winds.



Resurvey, 0630, 19 March 1953.

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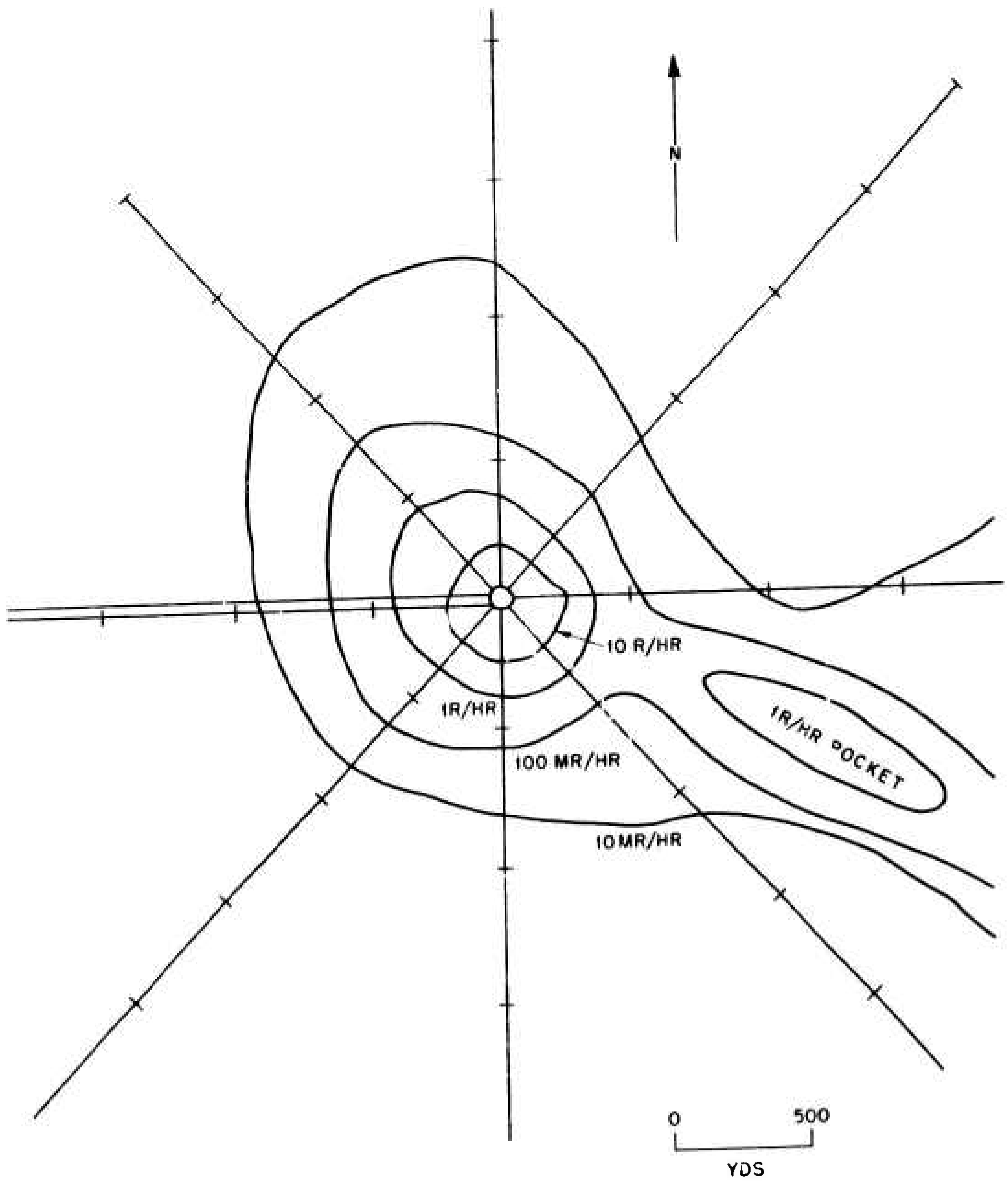
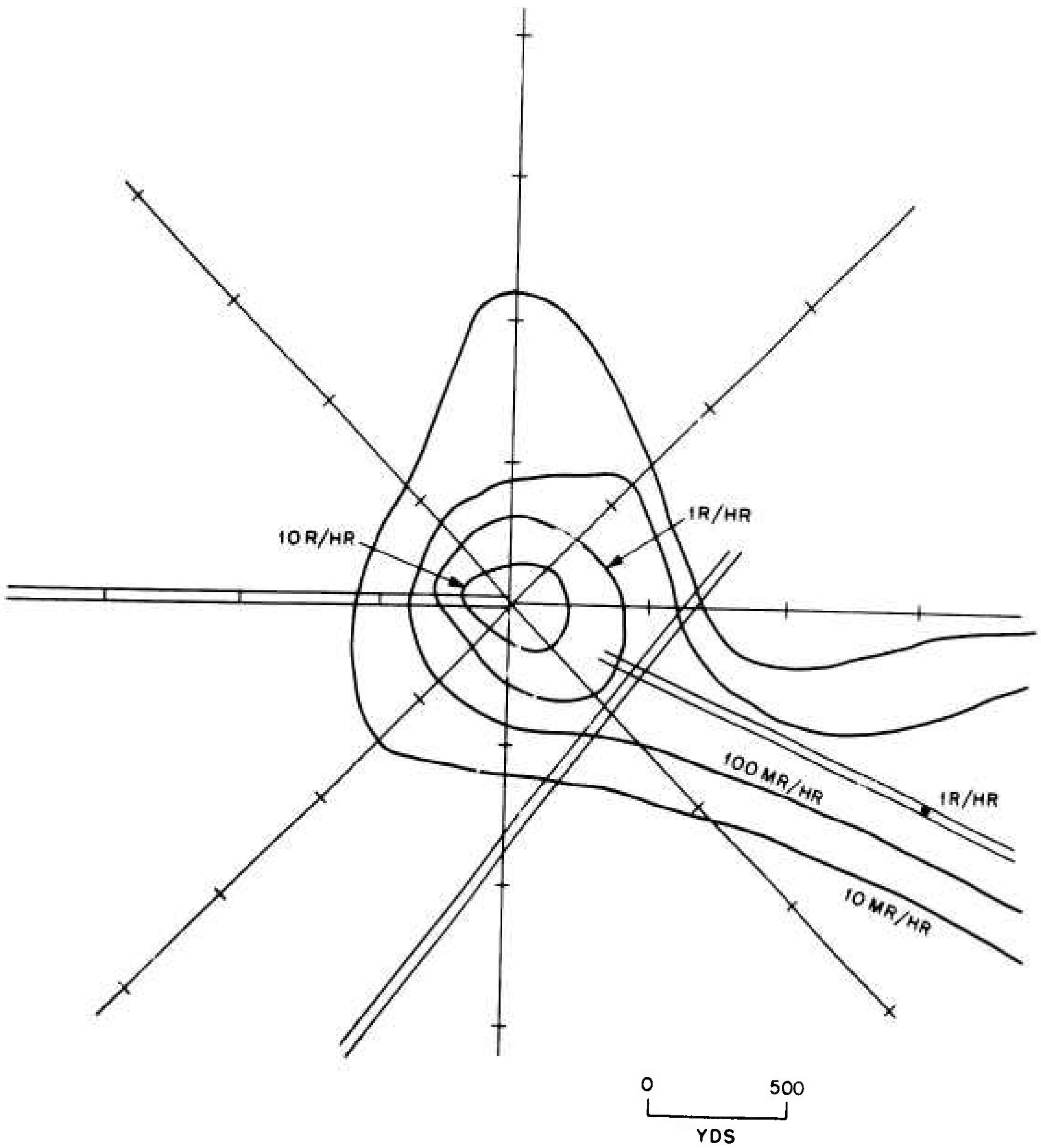


Resurvey, 0630, 20 March 1953.



Resurvey, 0630, 21 March 1953.

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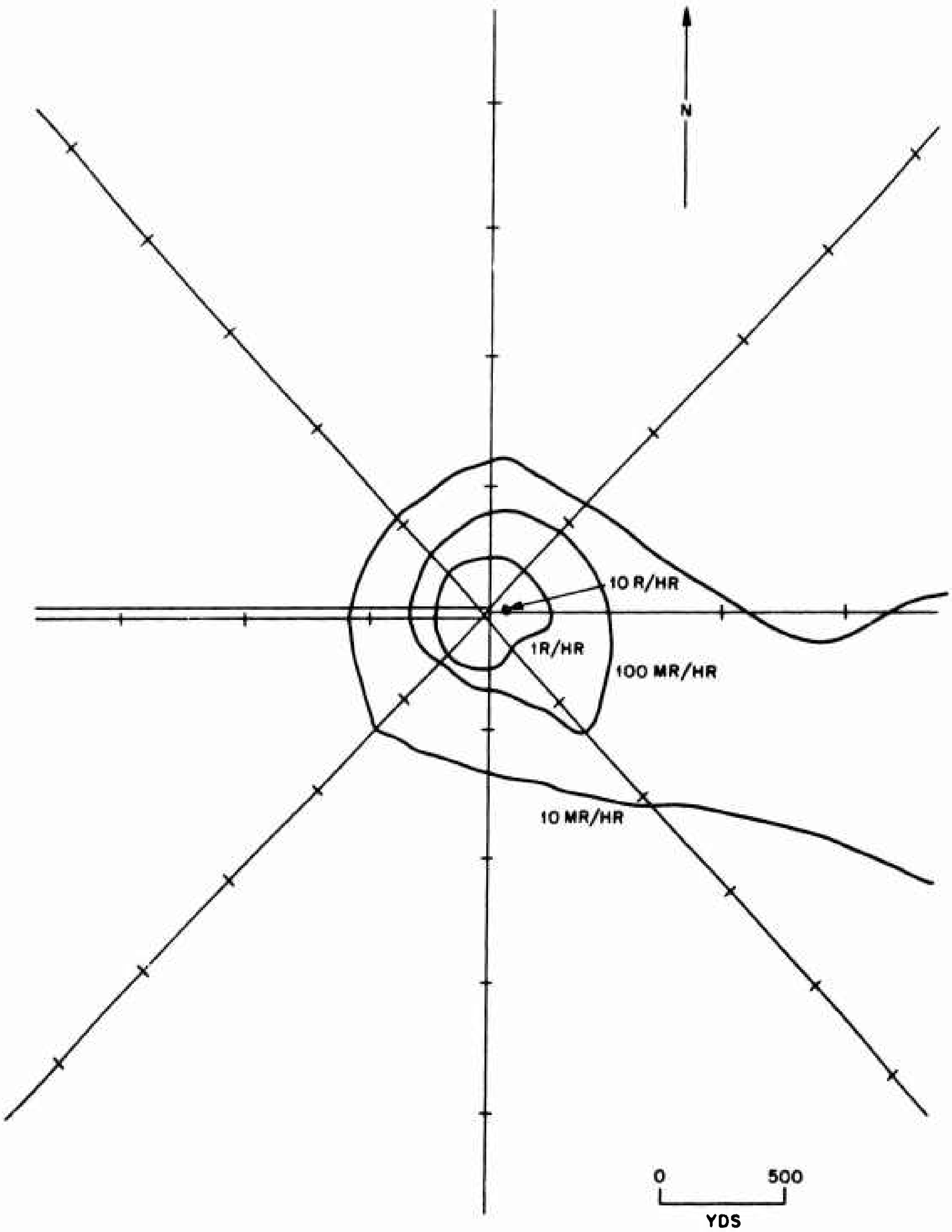
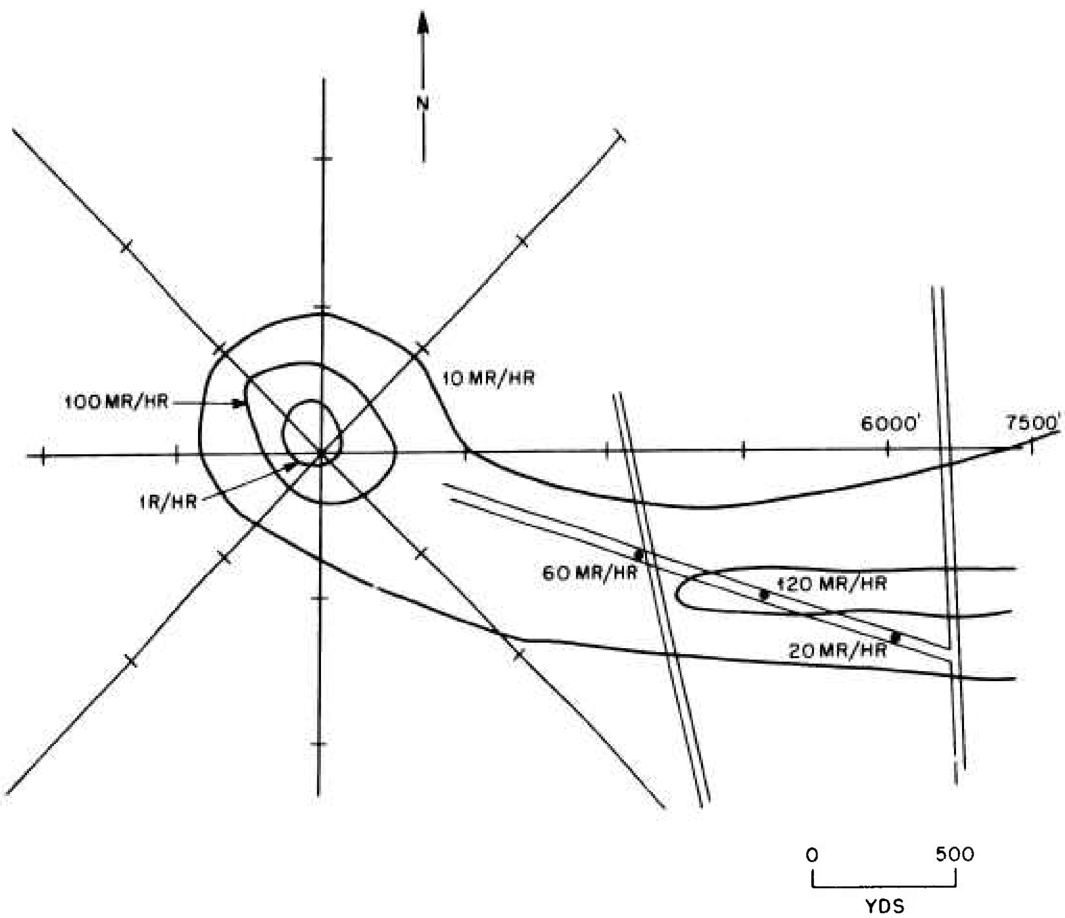


Resurvey, 1100 23 March 1953.



Resurvey, 0700, 2 April 1953.

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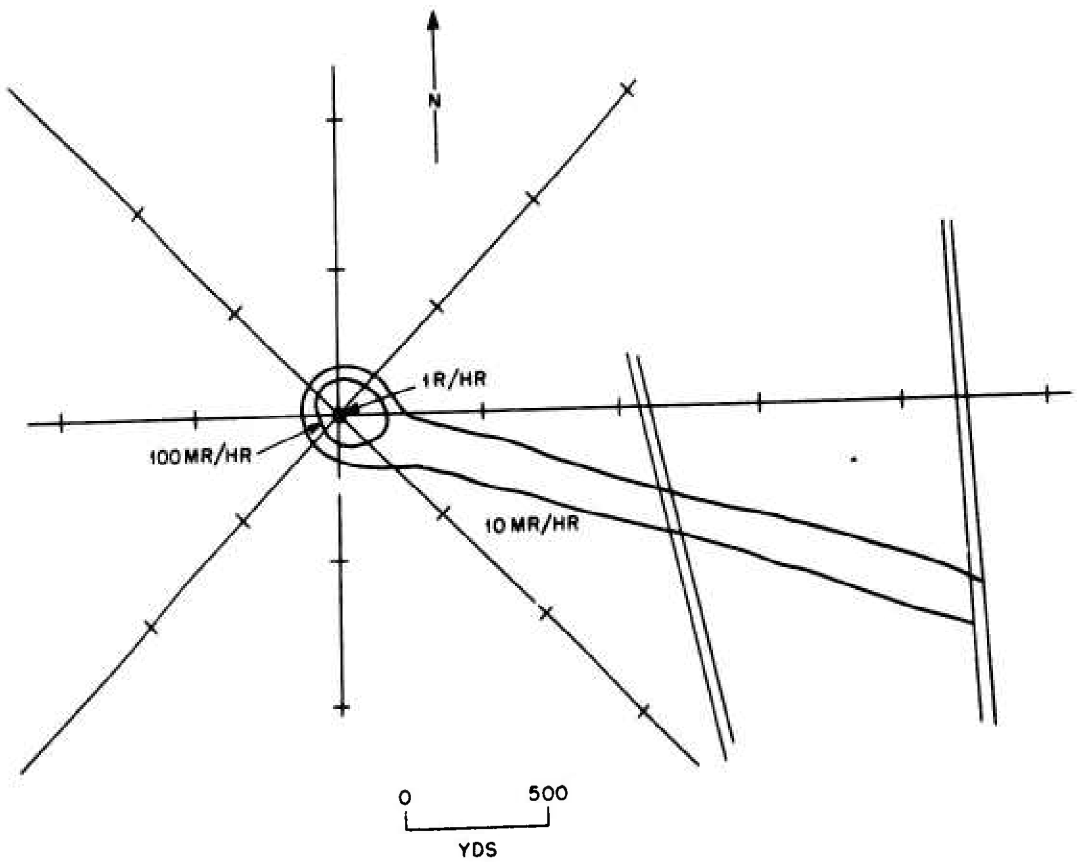

Resurvey, 7 April 1953.

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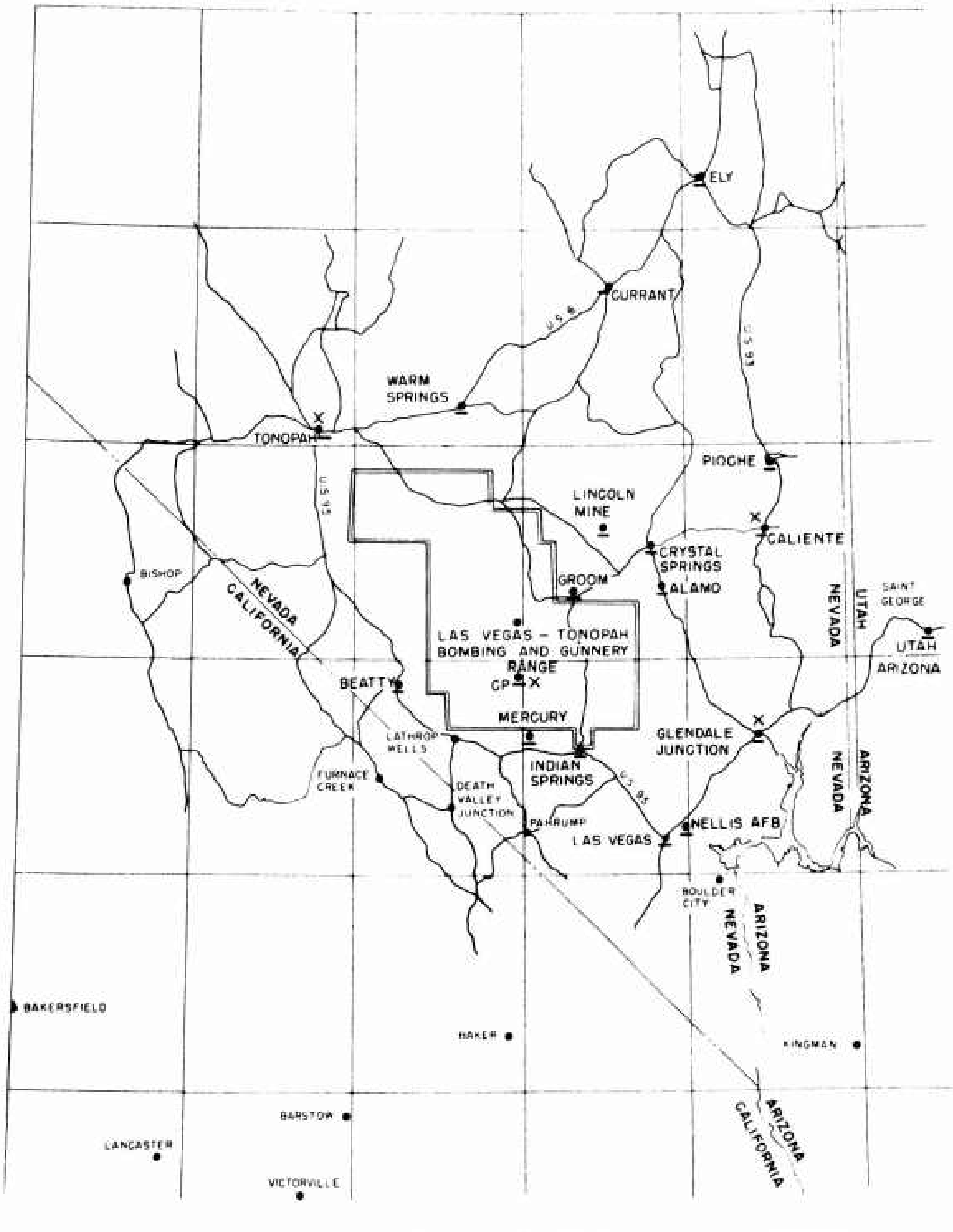
Inclosure 4

DISTRIBUTION OF FIXED AND MOBILE OFF-SITE MONITORS, D-1, SHOT ANNIE



Distribution of monitors on D-1, Shot Annie. ●, fixed stations. ×, mobile monitors.

Inclosure 5

GROUND MONITORS' DATA, SHOT ANNIE

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Claborn	H+2:50	St. George	4	2.75	4
Claborn	H+3:00	St. George	6	2.75	7
Claborn	H+3:05	St. George	10	2.75	12
Claborn	H+3:20	St. George	26	2.75	32
Claborn	H+3:25	St. George	24	2.75	33
Claborn	H+3:30	St. George	23	2.75	31
Claborn	H+3:33	St. George	24	2.75	32
Claborn	H+3:40	St. George	22	2.75	31
Claborn	H+3:45	St. George	20	2.75	30
Claborn	H+3:50	St. George	22	2.75	33
Claborn	H+3:55	St. George	22	2.75	34
Claborn	H+4:05	St. George	22	2.75	35
Claborn	H+4:10	St. George	23	2.75	39
Claborn	H+4:15	St. George	24	2.75	41
Claborn	H+4:20	St. George	22	2.75	38
Claborn	H+4:40	St. George	20	2.75	38
Claborn	H+5:00	St. George	22	2.75	47
Claborn	H+5:10	St. George	20	2.75	45
Claborn	H+5:20	St. George	19	2.75	43
Claborn	H+6:10	St. George	18	2.75	49
Claborn	H+6:25	St. George	17	2.75	48
Claborn	H+7:25	St. George	14	2.75	47
Claborn	H+8:05	St. George	20	2.75	75
Claborn	H+8:50	St. George	12	2.75	50
Claborn	H+9:15	St. George	12	2.75	53
Claborn	H+9:55	St. George	12	2.75	57
Claborn	H+10:30	St. George	9	2.75	46
Claborn	H+11:40	St. George	10	2.75	56
Claborn	H+25:30	St. George	4	2.75	58
Claborn and Forsyth	H+7:25	15 miles N of St. George, Utah Hwy 18	1	2.75	3
Claborn and Forsyth	H+7:35	10 miles N of St. George, Utah Hwy 18	4	2.75	14

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Claborn and Forsyth	H + 7:40	8 miles N of St. George, Utah Hwy 18	20	2.75	70
Claborn and Forsyth	H + 7:50	6 miles N of St. George, Utah Hwy 18	46	2.75	170
Claborn and Forsyth	H + 7:55	4 miles N of St. George, Utah Hwy 18	60	2.75	220
Claborn and Forsyth	H + 8:05	1 mile N of St. George, Utah Hwy 18	70	2.75	260
Claborn and Forsyth	H + 8:10	North city limits of St. George	25	2.75	93
Claborn and Forsyth	H + 6:40	1 mile S of Dixie College	20	2.75	58
Claborn and Forsyth	H + 6:45	3 miles S of Dixie College	5	2.75	14
Henderson and Rowe	H + 10:17	24 miles NE on Hwy 91	1	2.75	5
Henderson and Rowe	H + 10:30	21 miles NE on Hwy 91	0.3	2.75	1.5
Henderson and Rowe	H + 10:40	Toquerville	0.3	2.75	1.6
Henderson and Rowe	H + 32:00	10 miles N of U. S. Hwy 91 on Nevada Hwy 55	1.1	1.67	38
Henderson and Rowe	H + 32:15	15 miles N of U. S. Hwy 91 on Nevada Hwy 55	1.0	1.67	35
Henderson and Rowe	H + 32:31	20 miles N of U. S. Hwy 91 on Nevada Hwy 55	2.2	1.67	80
Henderson and Rowe	H + 2:27	20 miles N of U. S. Hwy 91 on Nevada Hwy 55	22	1.67	34
Henderson and Rowe	H + 32:38	21 miles N of U. S. Hwy 91 on Nevada Hwy 55	8	1.67	280
Henderson and Rowe	H + 32:48	22 miles N of U. S. Hwy 91 on Nevada Hwy 55	12	1.67	400
Henderson and Rowe	H + 2:38	22 miles N of U. S. Hwy 91 on Nevada Hwy 55	260	1.67	450
Henderson and Rowe	H + 32:52	23 miles N of U. S. Hwy 91 on Nevada Hwy 55	11	1.67	390
Henderson and Rowe	H + 32:57	24 miles N of U. S. Hwy 91 on Nevada Hwy 55	6.0	1.67	220
Henderson and Rowe	H + 2:48	25 miles N of U. S. Hwy 91 on Nevada Hwy 55	20	1.67	36.4
Henderson and Rowe	H + 33:03	26 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.2	1.67	7
Henderson and Rowe	H + 3:05	20 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.2	1.67	0.4
Henderson and Rowe	H + 3:20	35 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.2	1.67	0.46
Henderson and Rowe	H + 3:36	40 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.5	1.67	1.25

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Clausen	H + 9:32	0 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.15	1.67	1.2
Clausen	H + 9:47	5 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.4	1.67	5
Henderson	H + 31:49	5 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.1	1.67	3.3
Clausen	H + 10:09	10 miles N of U. S. Hwy 91 on Nevada Hwy 55	7	1.67	60
Henderson	H + 32:02	10 miles N of U. S. Hwy 91 on Nevada Hwy 55	1.5	1.67	55
Clausen	H + 10:17	15 miles N of U. S. Hwy 91 on Nevada Hwy 55	3.0	1.67	27
Clausen	H + 10:32	20 miles N of U. S. Hwy 91 on Nevada Hwy 55	6.2	1.67	58
Clausen	H + 10:47	22 miles N of U. S. Hwy 91 on Nevada Hwy 55	41	1.67	390
Clausen	H + 10:50	25 miles N of U. S. Hwy 91 on Nevada Hwy 55	32	1.67	310
Henderson	H + 33:08	28 miles N of U. S. Hwy 91 on Nevada Hwy 55	0.04	1.67	
Mitchell	H + 3:20	23 miles S of Alamo, Hwy 93	0.4	1.25	2
Fooks	H + 5:14	23.5 miles S of Alamo, Hwy 93	0.2	1.25	1
Fooks	H + 5:11	24 miles S of Alamo, Hwy 93	0.5	1.25	3
Clausen	H + 27:45	24 miles S of Alamo, Hwy 93	0.2	1.25	8
Fooks	H + 5:08	24.5 miles S of Alamo, Hwy 93	0.9	1.25	5
Fooks	H + 5:05	25 miles S of Alamo, Hwy 93	2	1.25	12
Mitchell	H + 3:12	25 miles S of Alamo, Hwy 93	30	1.25	95
Clausen	H + 6:55	25 miles S of Alamo, Hwy 93	0.2	1.25	2
Fooks	H + 5:03	25.5 miles S of Alamo, Hwy 93	8	1.25	23
Clausen	H + 27:40	26 miles S of Alamo, Hwy 93	12	1.25	460
Fooks	H + 7:10	27 miles S of Alamo, Hwy 93	16	1.25	130
Fooks	H + 7:10	27 miles S of Alamo, Hwy 93	7	1.25	57
Fooks	H + 12:25	27 miles S of Alamo, Hwy 93	18	1.25	300
Mitchell	H + 3:35	27 miles S of Alamo, Hwy 93	180	1.25	650

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Fooks	H+12:30	28 miles S of Alamo, Hwy 93	20	1.25	320
Clausen	H+27:35	28 miles S of Alamo, Hwy 93	24	1.25	890
Clausen	H+27:30	29 miles S of Alamo, Hwy 93	22	1.25	800
Fooks	H+12:34	29 miles S of Alamo, Hwy 93	26	1.25	420
Fooks	H+12:37	30 miles S of Alamo, Hwy 93	18	1.25	280
Clausen	H+7:20	30 miles S of Alamo, Hwy 93	110	1.25	920
Mitchell	H+3:05	30 miles S of Alamo, Hwy 93	150	1.25	290
Mitchell	H+3:40	30 miles S of Alamo, Hwy 93	180	1.25	670
Fooks	H+12:39	31 miles S of Alamo, Hwy 93	12	1.25	190
Fooks	H+12:39	31 miles S of Alamo, Hwy 93	18	1.25	290
Clausen	H+27:26	31 miles S of Alamo, Hwy 93	14	1.25	510
Clausen	H+27:26	31 miles S of Alamo, Hwy 93	15	1.25	560
Fooks	H+12:45	32 miles S of Alamo, Hwy 93	8	1.25	130
Clausen	H+7:25	32 miles S of Alamo, Hwy 93	82	1.25	720
Mitchell	H+3:45	32 miles S of Alamo, Hwy 93	60	1.25	230
Fooks	H+12:45	33 miles S of Alamo, Hwy 93	6	1.25	97
Clausen	H+7:28	33 miles S of Alamo, Hwy 93	14	1.25	380
Clausen	H+27:20	33 miles S of Alamo, Hwy 93	9.5	1.25	360
Fooks	H+12:47	34 miles S of Alamo, Hwy 93	6	1.25	97
Clausen	H+7:30	34 miles S of Alamo, Hwy 93	44	1.25	290
Mitchell	H+2:57	34 miles S of Alamo, Hwy 93	50	1.25	140
Mitchell	H+3:50	35 miles S of Alamo, Hwy 93	35	1.25	140
Mitchell	H+2:55	36 miles S of Alamo, Hwy 93	40	1.25	115
Clausen	H+7:35	37 miles S of Alamo, Hwy 93	20	1.25	175

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Mitchell	H+3:53	38 miles S of Alamo, Hwy 93	26	1.25	100
Clausen	H+27:10	39 miles S of Alamo, Hwy 93	8	1.25	290
Clausen	H+7:40	40 miles S of Alamo, Hwy 93	22	1.25	190
Mitchell	H+2:50	40 miles S of Alamo, Hwy 93	60	1.25	160
Mitchell	H+3:56	40 miles S of Alamo, Hwy 93	50	1.25	190
Mitchell	H+2:40	41 miles S of Alamo, Hwy 93	20	1.25	50
Mitchell	H+2:35	42 miles S of Alamo, Hwy 93	0.4	1.25	0.9
Clausen	H+27:02	44 miles S of Alamo, Hwy 93	1.5	1.25	55
Clausen	H+7:50	45 miles S of Alamo, Hwy 93	8	1.25	72
Mitchell	H+4:03	45 miles S of Alamo, Hwy 93	16	1.25	65
Clausen	H+26:54	49 miles S of Alamo, Hwy 93	1.6	1.25	58
Clausen	H+7:57	50 miles S of Alamo, Hwy 93	6	1.25	56
Mitchell	H+4:10	50 miles S of Alamo, Hwy 93	10	1.25	41
Clausen	H+26:45	54 miles S of Alamo, Hwy 93	1.3	1.25	49
Clausen	H+8:05	55 miles S of Alamo, Hwy 93	6	1.25	58
Mitchell	H+4:17	55 miles S of Alamo, Hwy 93	5	1.25	22
Mitchell	H+4:25	60 miles S of Alamo, Hwy 93	0.5	1.25	2
Mitchell	H+4:40	Glendale Junction	0.15	1.25	0.7
Mitchell	H+4:55	Glendale Junction	0.15	1.25	0.8
Mitchell	H+5:10	Glendale Junction	0.15	1.25	0.8
Mitchell	H+5:40	Glendale Junction	0.15	1.25	1.0
Mitchell	H+6:00	Glendale Junction	0.15	1.25	1.0
Mitchell	H+6:25	Glendale Junction	0.15	1.25	1.2
Mitchell	H+6:40	Glendale Junction	0.15	1.25	1.2
Mitchell	H+7:10	Glendale Junction	0.15	1.25	1.3
Mitchell	H+8:00	Glendale Junction	0.15	1.25	1.4
Mitchell	H+27:00	Glendale Junction	0.05	1.25	2
Wheeler and Williams	H+102:25	Veyo	0.02		
Wheeler and Williams	H+102:32	5 miles SW of Veyo, Hwy Utah 18	0.02		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Wheeler and Williams	H+102:38	10 miles SW of Veyo, Hwy Utah 18	0.04		
Wheeler and Williams	H+102:42	11 miles SW of Veyo, Hwy Utah 18	0.05		
Wheeler and Williams	H+102:44	11.5 miles S of Veyo, Hwy Utah 18	0.2		
Wheeler and Williams	H+102:46	12 miles S of Veyo, Hwy Utah 18	0.4		
Wheeler and Williams	H+102:48	12.5 miles S of Veyo, Hwy Utah 18	0.4		
Wheeler and Williams	H+102:49	13.0 miles S of Veyo, Hwy Utah 18	0.4		
Wheeler and Williams	H+102:51	14 miles S of Veyo, Hwy Utah 18	0.6		
Wheeler and Williams	H+102:53	15 miles S of Veyo, Hwy Utah 18	0.8		
Wheeler and Williams	H+102:54	15.5 miles S of Veyo, Hwy Utah 18	1.0		
Wheeler and Williams	H+102:56	16 miles S of Veyo, Hwy Utah 18	1.2		
Wheeler and Williams	H+102:57	16.5 miles S of Veyo, Hwy Utah 18	0.9		
Wheeler and Williams	H+102:58	17 miles S of Veyo, Hwy Utah 18	1.0		
Wheeler and Williams	H+103:00	Intersection of Hwys 18 and 91	1.1		
Wheeler and Williams	H+103:02	1 mile E of intersection	0.4		
Wheeler and Williams	H+103:05	Main Street, St. George	0.2		
Wheeler and Williams	H+103:07	1 mile E of St. George, Hwy U. S. 91	0.6		
Wheeler and Williams	H+103:10	2 miles E of St. George, Hwy U. S. 91	0.9		
Wheeler and Williams	H+103:17	7 miles E of St. George, Hwy U. S. 91	0.9		
Wheeler and Williams	H+103:20	8.4 miles E of St. George, Hwy U. S. 91	1.2		
Wheeler and Williams	H+103:25	Junction of Hwys Nevada 17 and U. S. 91	0.5		
Wheeler and Williams	H+103:31	4 miles E of Junction of Hwys Nevada 17 and U. S. 91 on Hwy Nevada 17	0.5		
Wheeler and Williams	H+103:40	Hurricane	0.8		
Wheeler and Williams	H+103:47	1 mile S of Hurricane	1.1		
Wheeler and Williams	H+103:48	2 miles S of Hurricane	1.1		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Wheeler and Williams	H+103:50	3 miles S of Hurricane	1.0		
Wheeler and Williams	H+103:51	4 miles S of Hurricane	0.4		
Wheeler and Williams	H+103:55	5 miles S of Hurricane	0.1		
Wheeler and Williams	H+104:16	1 mile N of Hurricane	0.4		
Wheeler and Williams	H+104:24	1 mile E of Hurricane	0.3		
Wheeler and Williams	H+104:26	2 miles E of Hurricane	0.2		
Wheeler and Williams	H+104:29	2 miles NE of Hurricane, Hwy 15	0.03		
Wheeler and Williams	H+104:32	5 miles NE of Hurricane, Hwy 15	0.015		
Wheeler and Williams	H+104:45	15 miles E of Hurricane, Hwy 15	0.5		
Wheeler and Williams	H+104:50	Rockville	0.5		
Wheeler and Williams	H+104:57	Springdale	0.06		
Wheeler and Williams	H+105:25	E of Entrance Zion N. P.	0.01		
Wheeler and Williams	H+105:40	5 miles W of Mt. Carmel Junction	0.01		
Wheeler and Williams	H+105:50	Mt. Carmel Junction	0.05		
Wheeler and Williams	H+105:51	1 mile S of Mt. Carmel Junction	0.2		
Wheeler and Williams	H+105:52	1.5 miles S of Mt. Carmel Junction	0.4		
Wheeler and Williams	H+105:53	2.0 miles S of Mt. Carmel Junction	0.5		
Wheeler and Williams	H+105:54	2.5 miles S of Mt. Carmel Junction	0.6		
Wheeler and Williams	H+105:55	3 miles S of Mt. Carmel Junction	0.6		
Wheeler and Williams	H+105:56	3.5 miles S of Mt. Carmel Junction	0.4		
Wheeler and Williams	H+105:57	4 miles S of Mt. Carmel Junction	0.3		
Wheeler and Williams	H+105:58	4.5 miles S of Mt. Carmel Junction	0.3		
Wheeler and Williams	H+106:00	5 miles S of Mt. Carmel Junction	0.4		
Wheeler and Williams	H+106:03	5.5 miles S of Mt. Carmel Junction	0.3		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Wheeler and Williams	H+106:04	6 miles S of Mt. Carmel Junction	0.2		
Wheeler and Williams	H+106:06	7 miles S of Mt. Carmel Junction	0.2		
Wheeler and Williams	H+106:08	8 miles S of Mt. Carmel Junction	0.2		
Wheeler and Williams	H+106:10	9 miles S of Mt. Carmel Junction	0.2		
Wheeler and Williams	H+106:13	11 miles S of Mt. Carmel Junction	0.05		
Wheeler and Williams	H+106:14	11.2 miles S of Mt. Carmel Junction	0.03		
Wheeler and Williams	H+106:15	12 miles S of Mt. Carmel Junction	0.03		
Wheeler and Williams	H+106:16	12.5 miles S of Mt. Carmel Junction	0.02		
Wheeler and Williams	H+106:18	13 miles S of Mt. Carmel Junction	0.02		
Wheeler and Williams	H+106:19	13.5 miles S of Mt. Carmel Junction	0.02		
Wheeler and Williams	H+106:20	14 miles S of Mt. Carmel Junction	0.02		
Wheeler and Williams	H+106:22	15 miles S of Mt. Carmel Junction	0.015		
Wheeler and Williams	H+106:23	16 miles S of Mt. Carmel Junction	0.01		
Wheeler and Williams	H+106:25	17 miles S of Mt. Carmel Junction	0.01		
Wheeler and Williams	H+106:27	Kanab	0.01		
Wheeler and Williams	H+106:50	0.5 mile N of Mt. Carmel Junction	0.03		
Wheeler and Williams	H+106:51	1.0 mile N of Mt. Carmel Junction	0.02		
Wheeler and Williams	H+106:52	1.5 miles N of Mt. Carmel Junction	0.01		
Wheeler and Williams	H+106:53	2 miles N of Mt. Carmel Junction	0.01		
Wheeler and Williams	H+127:57	17.5 miles N of Glendale Junction	0.06		
Wheeler and Williams	H+127:58	18 miles N of Glendale Junction	0.06		
Wheeler and Williams	H+127:59	18.5 miles N of Glendale Junction	0.06		
Wheeler and Williams	H+128:00	19 miles N of Glendale Junction	0.06		
Wheeler and Williams	H+128:01	19.5 miles N of Glendale Junction	0.1		

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Wheeler and Williams	H+128:03	20 miles N of Glendale Junction	0.15		
Wheeler and Williams	H+128:04	20.5 miles N of Glendale Junction	0.15		
Wheeler and Williams	H+128:05	21 miles N of Glendale Junction	0.14		
Wheeler and Williams	H+128:07	21.5 miles N of Glendale Junction	0.12		
Wheeler and Williams	H+128:08	22 miles N of Glendale Junction	0.15		
Wheeler and Williams	H+128:10	22.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:12	23 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:13	23.5 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:14	24 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:15	24.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:16	25 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:17	25.5 miles N of Glendale Junction	0.4		
Wheeler and Williams	H+128:18	26 miles N of Glendale Junction	0.4		
Wheeler and Williams	H+128:19	26.5 miles N of Glendale Junction	0.5		
Wheeler and Williams	H+128:20	27 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:22	27.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:23	28 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:24	28.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:25	29 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:26	29.5 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:28	30.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:30	31.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+128:32	32.5 miles N of Glendale Junction	0.6		
Wheeler and Williams	H+128:34	33.5 miles N of Glendale Junction	0.5		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Wheeler and Williams	H+128:36	34.5 miles N of Glendale Junction	0.6		
Wheeler and Williams	H+128:39	35.5 miles N of Glendale Junction	1.2		
Wheeler and Williams	H+128:40	36 miles N of Glendale Junction	1.2		
Wheeler and Williams	H+128:41	36.5 miles N of Glendale Junction	1.2		
Wheeler and Williams	H+128:43	37 miles N of Glendale Junction	1.1		
Wheeler and Williams	H+128:44	37.5 miles N of Glendale Junction	0.9		
Wheeler and Williams	H+128:45	38 miles N of Glendale Junction	0.9		
Wheeler and Williams	H+128:46	38.5 miles N of Glendale Junction	0.8		
Wheeler and Williams	H+128:47	39 miles N of Glendale Junction	0.6		
Wheeler and Williams	H+128:49	39.5 miles N of Glendale Junction	0.3		
Wheeler and Williams	H+128:50	40 miles N of Glendale Junction	0.07		
Wheeler and Williams	H+128:51	40.5 miles N of Glendale Junction	0.03		
Wheeler and Williams	H+128:52	41 miles N of Glendale Junction	0.01		
Wheeler and Williams	H+128:53	41.5 miles N of Glendale Junction	0.01		
Wheeler and Williams	H+123:50	0.5 mile S of St. George	0.3		
Wheeler and Williams	H+123:51	1.0 mile S of St. George	0.1		
Wheeler and Williams	H+123:53	1.5 miles S of St. George	0.09		
Wheeler and Williams	H+123:54	2 miles S of St. George	0.07		
Wheeler and Williams	H+123:55	2.5 miles S of St. George	0.05		
Wheeler and Williams	H+123:56	3 miles S of St. George	0.03		
Wheeler and Williams	H+123:57	3.5 miles S of St. George	0.02		
Wheeler and Williams	H+123:58	4 miles S of St. George	0.02		
Wheeler and Williams	H+124:00	4.5 miles S of St. George	0.02		
Wheeler and Williams	H+124:01	5 miles S of St. George	0.02		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Wheeler and Williams	H+126:25	Glendale Junction	0.01		
Wheeler and Williams	H+126:37	10 miles N of Glendale Junction	0.03		
Wheeler and Williams	H+126:38	10.5 miles N of Glendale Junction	0.05		
Wheeler and Williams	H+126:39	11 miles N of Glendale Junction	0.1		
Wheeler and Williams	H+126:41	11.5 miles N of Glendale Junction	0.1		
Wheeler and Williams	H+126:42	12 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+126:43	12.5 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+126:44	13 miles N of Glendale Junction	0.2		
Wheeler and Williams	H+126:46	13.5 miles N of Glendale Junction	0.1		
Wheeler and Williams	H+126:47	14 miles N of Glendale Junction	0.11		
Wheeler and Williams	H+126:49	14.5 miles N of Glendale Junction	0.12		
Wheeler and Williams	H+126:51	15 miles N of Glendale Junction	0.09		
Wheeler and Williams	H+126:52	15.5 miles N of Glendale Junction	0.08		
Wheeler and Williams	H+126:53	16 miles N of Glendale Junction	0.08		
Wheeler and Williams	H+126:54	16.5 miles N of Glendale Junction	0.06		
Wheeler and Williams	H+126:55	17 miles N of Glendale Junction	0.07		

Inclosure 6

LATE FALL-OUT DATA, SHOT ANNIE

Station	Date	Time	MMD,* μ	SD†	Activity, μc/M³
St. George	3/17	0820–0855	5.3	2.52	1.47×10^{-1}
	3/17	0855–1400	3.2	2.78	4.9×10^{-2}
	3/17	1410–1800	2.1	4.2	5×10^{-3}
	3/17	1800–2210			4×10^{-3}
	3/17-18	2210–0625			1×10^{-3}
			Average activity for 24 hr		1.8×10^{-2}
Mesquite	3/17	0830–1030			1.07×10^{-6}
	3/17	1030–1230			2.22×10^{-3}
	3/17	1240–1440			2.01×10^{-3}
	3/17	1440–1640			2.44×10^{-3}
	3/17	1640–2000	0.9		3.98×10^{-3}
	3/17	2000–2320	0.94		1.7×10^{-3}
			Average activity for 24 hr		2.2×10^{-3}
Glendale	3/17	0420–0620			6.95×10^{-7}
	3/17	0620–1040			7.9×10^{-5}
	3/17	1040–1300			1.19×10^{-2}
	3/17	1300–1420			3.19×10^{-2}
	3/17	1420–1820	0.74	1.2	1.8×10^{-3}
	3/17	1820–2245			1.47×10^{-3}
	3/17-18	2245–0545	1.3	3.1	6.8×10^{-4}
			Average activity for 24 hr		3.7×10^{-3}

*MMD is mass medium diameter based on an assumed density of 2.5 g/cc.
†Standard deviation.

Inclosure 7

CALCULATED INFINITE DOSE, SHOT ANNIE

Location	Time of reading	Maximum ground level, mr/hr	Fall-out time	Infinite dose, r
U. S. 93, 30 miles S of Alamo	1240 March 17	110	H + 1.25	5.5
Nevada 55, 22 miles N of U. S. 91	0800 March 17	260	H + 1.67	3.5
U. S. 91, 10 miles N of St. George	1025 March 17	110	H + 2.75	3.0
St. George	0845 March 17	26	H + 2.75	0.55
1 mile N of St. George	1325 March 17	70	H + 2.75	3.5
Virgin	1635 March 17	1.6	H + 2.75	0.1
Rockville	1715 March 17	24	H + 2.75	3.0
Springdale	1730 March 17	8	H + 2.75	1.25
Hurricane	1016 March 18	10	H + 2.75	2.5

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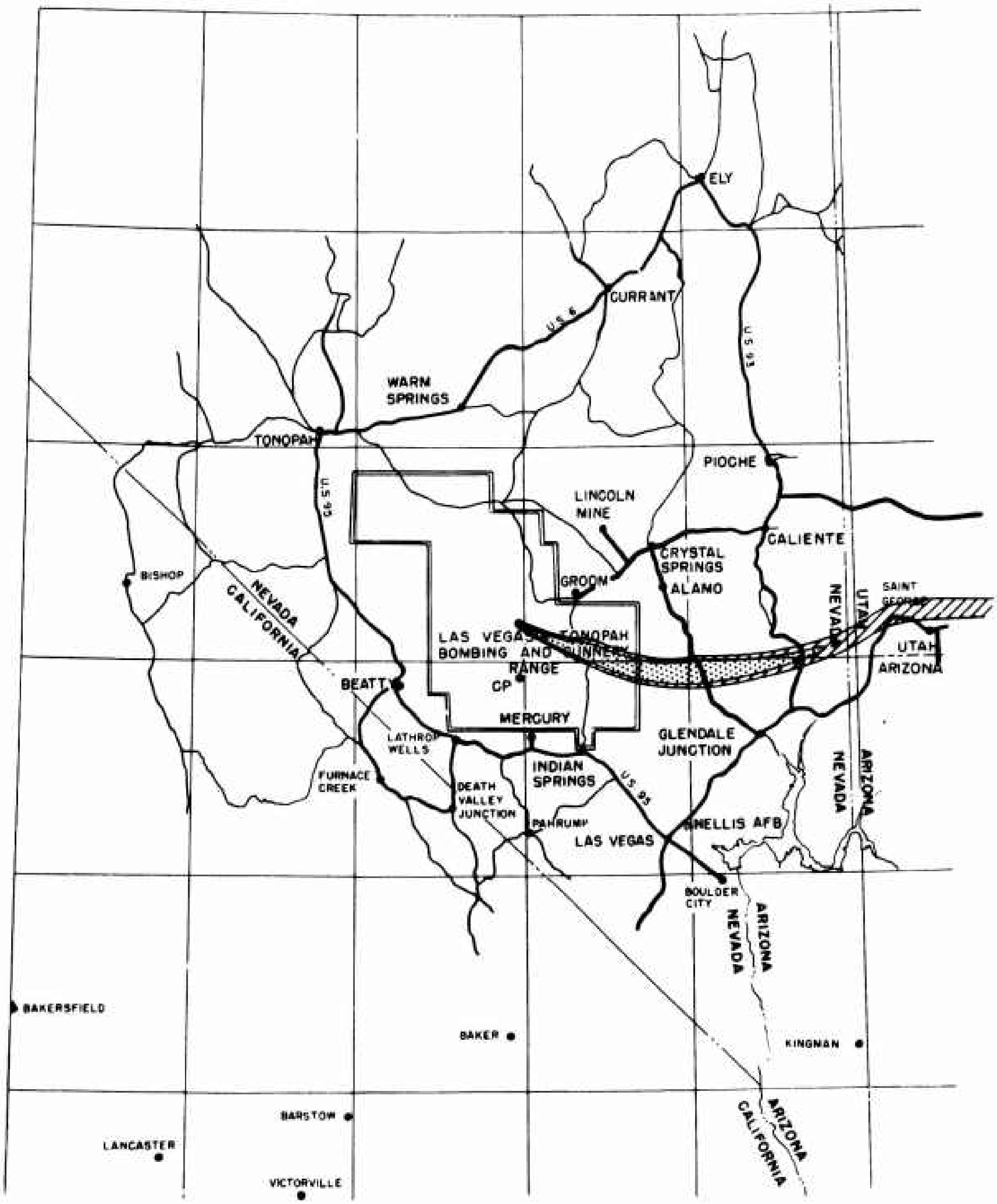
Inclosure 8

GROUND MONITORING RESULTS, SHOT ANNIE



Shot Annie, spring 1953. [dotted pattern], 400 mr/hr or above at time of fall-out. [hatched pattern], 200 to 400 mr/hr at time of fall-out. Heavy lines show the monitoring runs.

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Inclosure 9

COORDINATE SYSTEM USED IN RAD-SAFE OPERATIONS

Grid	Longitude	Grid	Longitude	Grid	Latitude	Grid	Latitude
A	116° 00′ W	ZA	116° 10′ W	25	40° 00′ N	41	37° 20′ N
B	115° 50′ W	ZB	116° 20′ W	26	39° 50′ N	42	37° 10′ N
C	115° 40′ W	ZC	116° 30′ W	27	39° 40′ N	43	37° 00′ N
D	115° 30′ W	ZD	116° 40′ W	28	39° 30′ N	44	36° 50′ N
E	115° 20′ W	ZE	116° 50′ W	29	39° 20′ N	45	36° 40′ N
F	115° 10′ W	ZF	117° 00′ W	30	39° 10′ N	46	36° 30′ N
G	115° 00′ W	ZG	117° 10′ W	31	39° 00′ N	47	36° 20′ N
H	114° 50′ W	ZH	117° 20′ W	32	38° 50′ N	48	36° 10′ N
I	114° 40′ W	ZI	117° 30′ W	33	38° 40′ N	49	36° 00′ N
J	114° 30′ W	ZJ	117° 40′ W	34	38° 30′ N	50	35° 50′ N
K	114° 20′ W	ZK	117° 50′ W	35	38° 20′ N	51	35° 40′ N
L	114° 10′ W	ZL	118° 00′ W	36	38° 10′ N	52	35° 30′ N
M	114° 00′ W	ZM	118° 10′ W	37	38° 00′ N	53	35° 20′ N
N	113° 50′ W	ZN	118° 20′ W	38	37° 50′ N	54	35° 10′ N
O	113° 40′ W	ZO	118° 30′ W	39	37° 40′ N	55	35° 00′ N
P	113° 30′ W	ZP	118° 40′ W	40	37° 30′ N	56	34° 50′ N
Q	113° 20′ W	ZQ	118° 50′ W				
R	113° 10′ W	ZR	119° 00′ W				
S	113° 00′ W	ZS	119° 10′ W				
T	112° 50′ W	ZT	119° 20′ W				
U	112° 40′ W	ZU	119° 30′ W				
V	112° 30′ W	ZV	119° 40′ W				
W	112° 20′ W	ZW	119° 50′ W				
X	112° 10′ W	ZX	120° 00′ W				
Y	112° 00′ W	ZY	120° 10′ W				
Z	111° 50′ W	ZZ	120° 20′ W				

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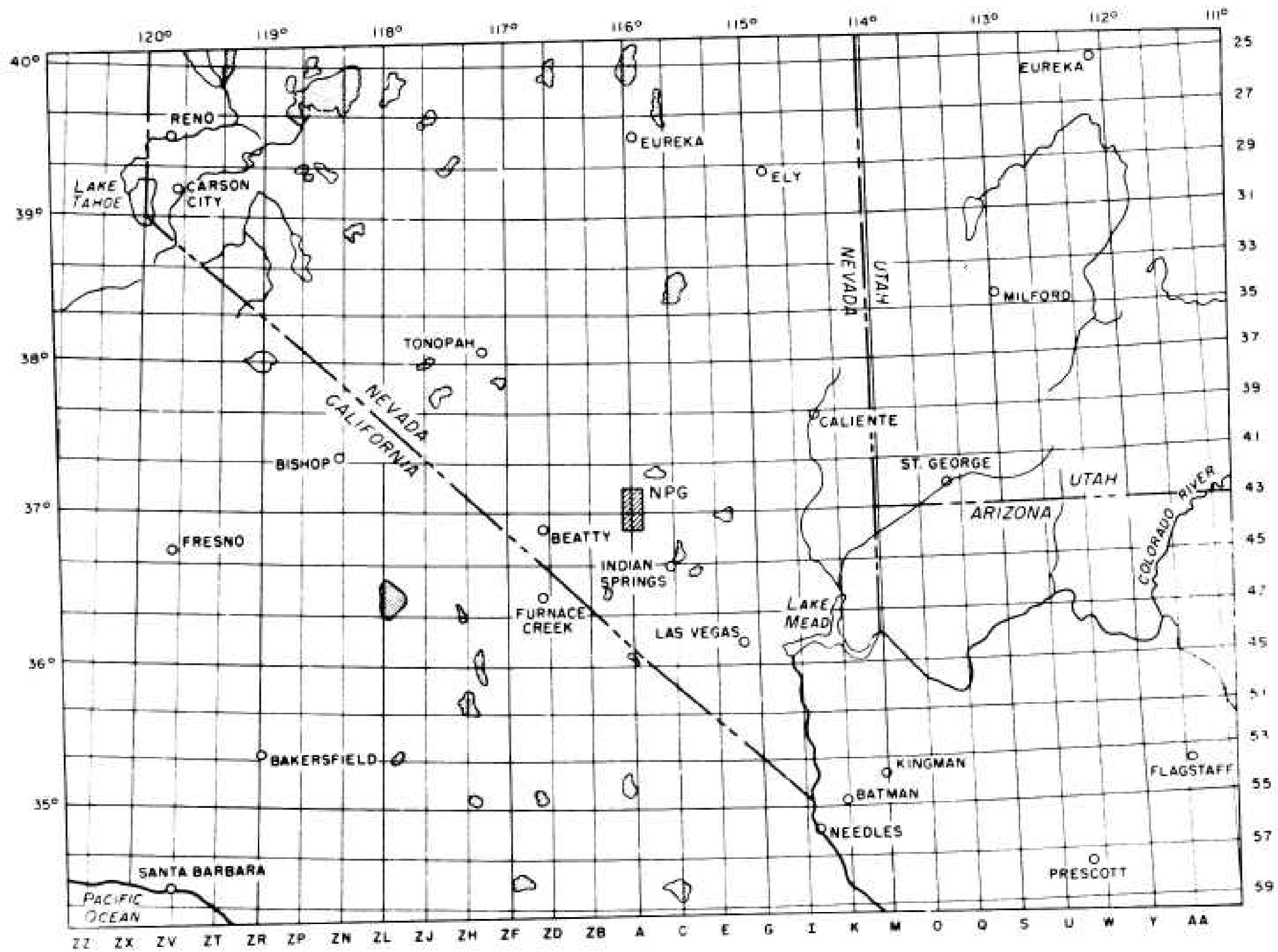

Grid system for Rad-Safe operations.

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Inclosure 10

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	Calculated intensity at H+1 hr MX-5	T1B	"Scint"
ZA 44	0820	500	0	0.2	0.019	0	0	0
ZA 41	0840	500	0.1	0.1	0.016	0	0	0
B 41	0845	500	0	0	0.016	0	0	0
B 43	0905	500	20	100	48	>20/100	425	200
B 44	0906	500	0.1	0.2	0.035	0	0	0
B-C 44	0907	700	0.0	0.1	0.035	0	0	0
B-C 42.5	0913	500	20	180	150	>20/100	900	750
B-C 41	0924	500	0.0	0.1	0.016	0	0	0
C 41	0928	500	0.3	0.2	0.013	0	0	0
C 43	0940	500	20	80	36	>20/1107	475	200
C 44	0945	500	0.0	0.2	0.035	0	0	0
C-D 44	0950	500	0.0	0.2	0.028	0	0	0
C-D 42.3	0950	500	20	22	17	>20/130	140	100
C-D 41	1000	500	0	0.2	0	0	0	0
D 41	1004	500	0	0.2	0	0	0	0
D 42.5	1014	500	20	24	9	>20/100	170	62
E-G 43	1016	500	10	12	3.3	70	90	22
D 44	1028	500	0	0.1	0.022	0	0	0

Inclosure 11

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

			Meter readings, mr/hr			Calculated intensity at H+1 hr		
Position	Time	Altitude above ground, ft	MX-5	T1B	"Scint"	MX-5	T1B	"Scint"
D 44	0735	500	0.4	0.6	0.47	1	1.5	1
D 43	0738	1000	0.2	0.2	0.13	0.5	0.5	0.3
D 43	0745	600	15	28	25	40	80	70
D 42	0751	600	0.05	0.2	0.01	0	0	0
D 41	0754	500	0.04	0	0	0	0	0
E 41	0756	500	0.02	0	0.013	0	0	0
E 42	0758	500	0.07	0	0	0	0	0
E 43	0804	500	15	26	20	50	80	70
E 44	0808	500	20	80	36	70	260	140
E 44	0810	500	0.4	0.4	0.47	1.4	1.4	1.5
E 43.5	0814	50	3	4.8	3.3	11	17	12
F 43	0815	100	20	80	36	75	300	140
F 43	0817	500	13	22	20	50	85	75
F 44	0819	500	0.5	1	0.44	1.7	3.5	2.5
F 43	0822	500	18	34	22	70	140	85
F 42	0826	500	0.4	1.2	0.23	0	0	0
F 41	0831	300	0.3	1.2	0.32	0	0	0
F 41	0904	6000	0.2	1.2	0.23	0	0	0
G 41	0912	1000	0.3	0.6	0.23	0	0	0
G 42	0916	500	0.2	0.4	0.23	0	0	0
G 43	0920	500	1.4	2.8	2.3	6	12	11
G 44	0924	500	2	4	1.5	10	20	7
H 44	0926	500	1.1	2.6	1.5	5	12	8
H 43	0929	500	4	10	4.6	20	55	25
H 42	0934	500	0.2	0.8	0.23	0	0	0
H 41	0936	700	0.3	0.8	0.22	0	0	0
I 41	0939	600	0.2	0.6	0.22	0	0	0
I 42	0944	600	1.3	2.8	1.9	6	11	10
I 43	0950	500	1.1	2.4	0.96	5	9	4
I 44	0950	500	1.2	2.2	0.88	5	9	3

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Position	Time	Altitude above ground, ft	Meter readings, mr/hr			Calculated intensity at H+1 hr		
			MX-5	T1B	"Scint"	MX-5	T1B	"Scint"
J 44	0952	500	0.8	2	0.7	3	8	2.5
J 43	0956	500	1.4	3	1.25	7	15	6
J 42	1000	600	0.3	1	0.32	6	2	1
J 41	1004	500	0.3	1.2	0.3	0	0	0
K 41	1027	1000	0.3	0.8	0.25	0	0	0
K 42	1030	700	0.4	0.8	0.17	0	0	0
K 43	1033	500	0.7	1.6	0.7	3	6	4
K 44	1036	500	0.4	1.2	0.4	7	3	2
L 44	1039	500	0.3	0.8	0.28	0	0	0
L 43	1042	500	0.4	0.8	0.32	0	0	0
L 42.5	1045	500	0.5	1.4	0.54	1.5	5	2
L 42	1045	500	1	2.6	1.07	5	15	6
L 41.5	1047	500	4	6	2.6	25	35	20
L 41	1048	500	0.3	0.6	0.28	0	0	0
M 41	1054	500	0.7	1.4	0.8	3	5	4
M 42	1052	600	0.4	1.2	0.4	0.7	3	2
M 43	1059	500	0.4	1.2	0.38	0.7	3	2
M 44	1102	500	0.4	1.2	0.38	0.7	3	2
N 44	1104		0.5	1.4	0.4	0.8	4	2
N 42.5	1107	500	0.4	1.4	0.38	0.7	4	2
N 42	1112	500	0.5	1.4	0.36	0.7	4	2
N 41	1114	500	0.4	1.0	0.28	0.7	4	2
O 41	1119	500	0.3	1.0	0.23	0.7	4	2
St. George	1125	600	1.6	4	1.25	9	25	8
Q 42	1126	600	1.7	4.4	1.5	10	30	10

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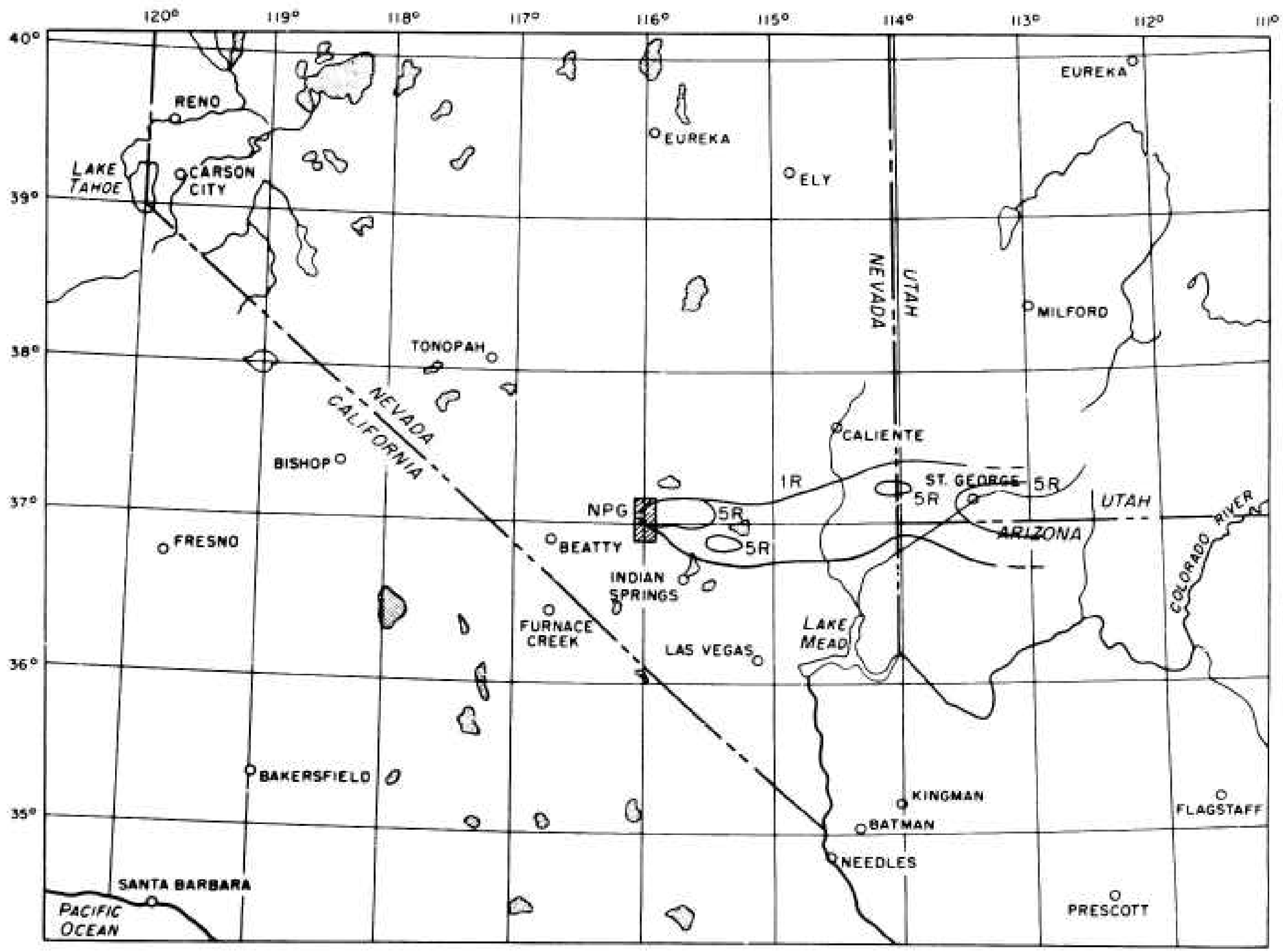
Inclosure 12

INFINITE DOSE FALL-OUT DATA PLOTS



Aerial terrain survey, T1B survey instrument, 17 March 1953.

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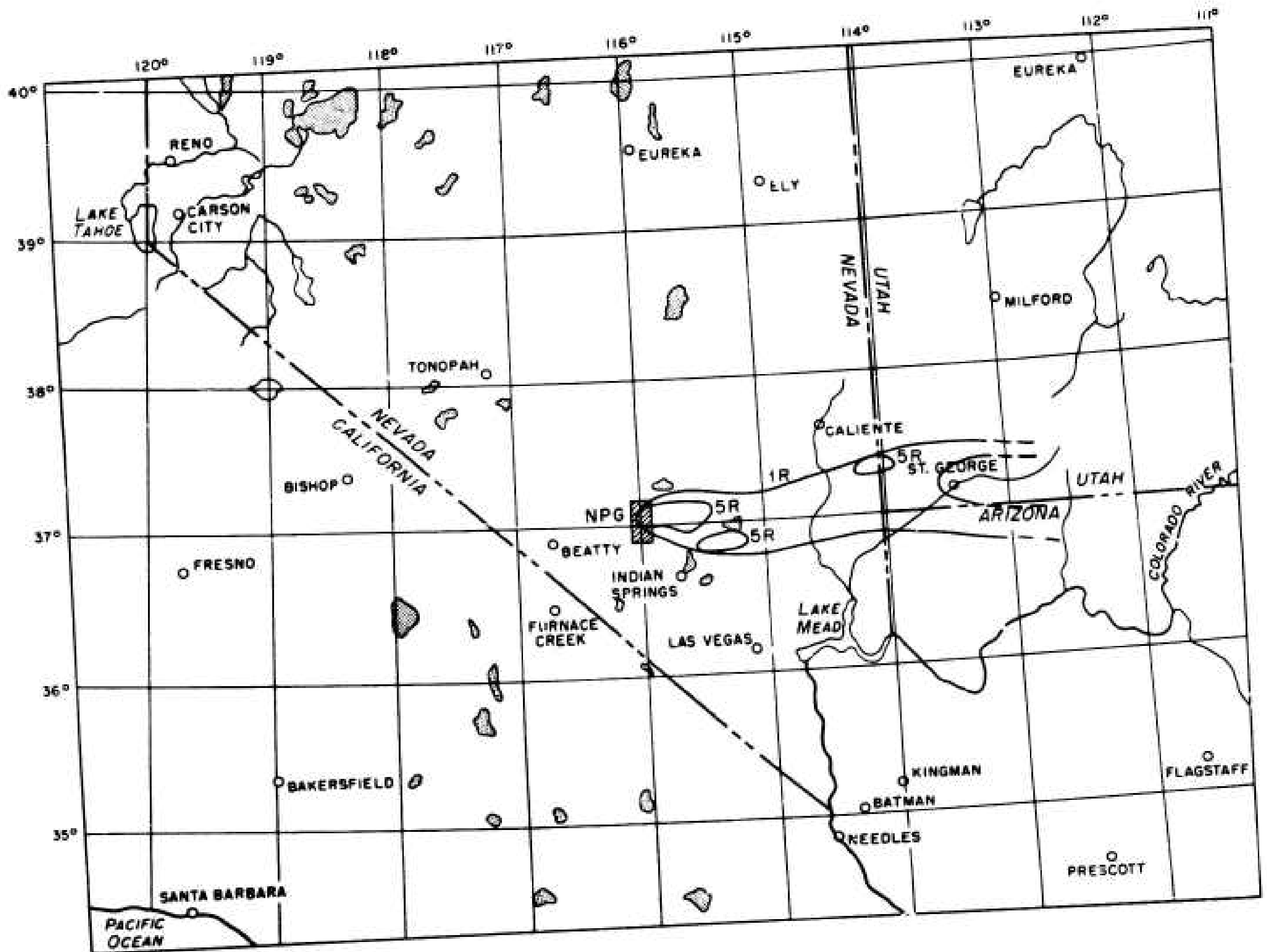

Aerial terrain survey, MX-5 survey instrument, 17 March 1953.

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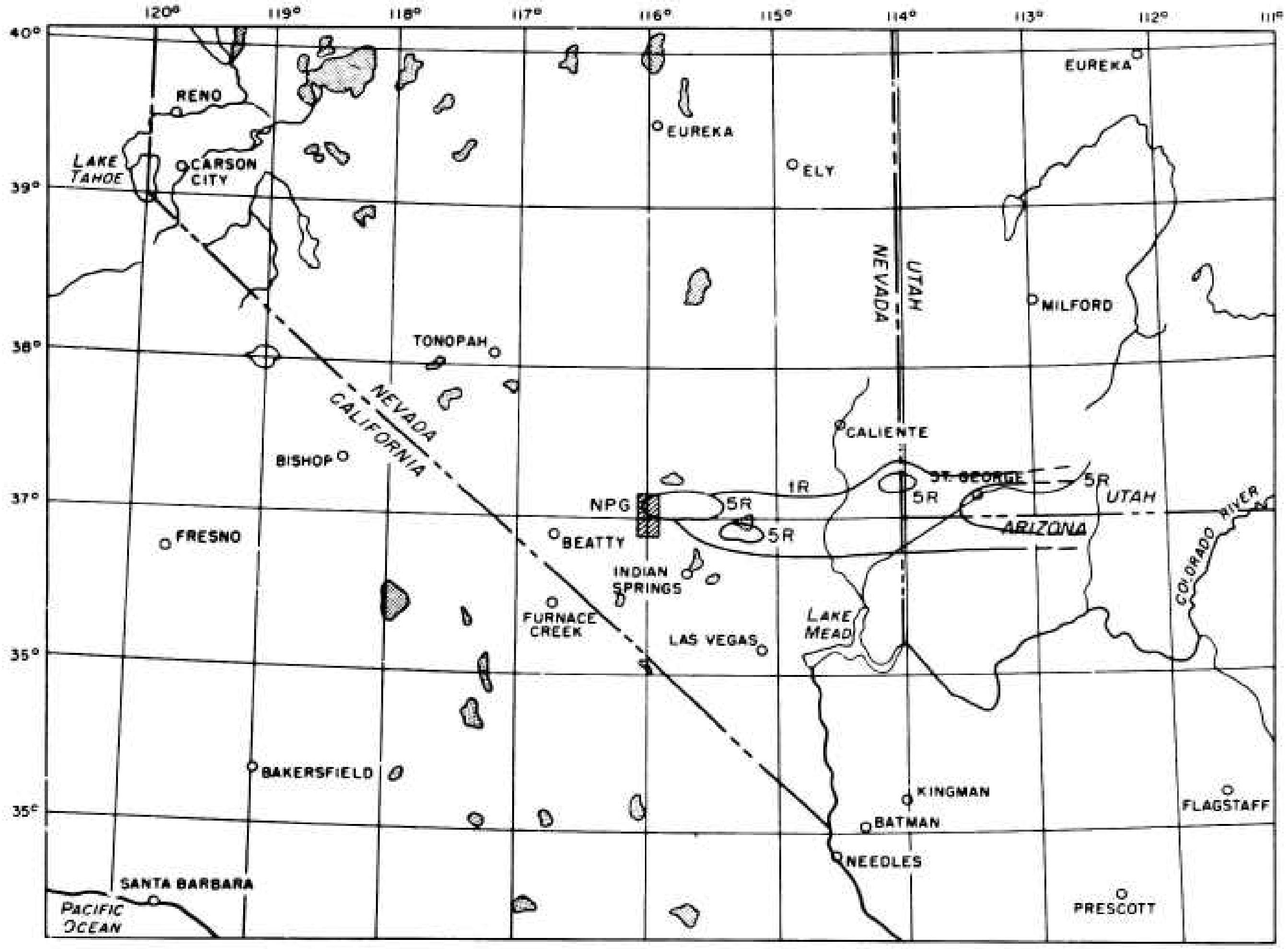

Aerial terrain survey, Scinteiog survey instrument, 17 March 1953.

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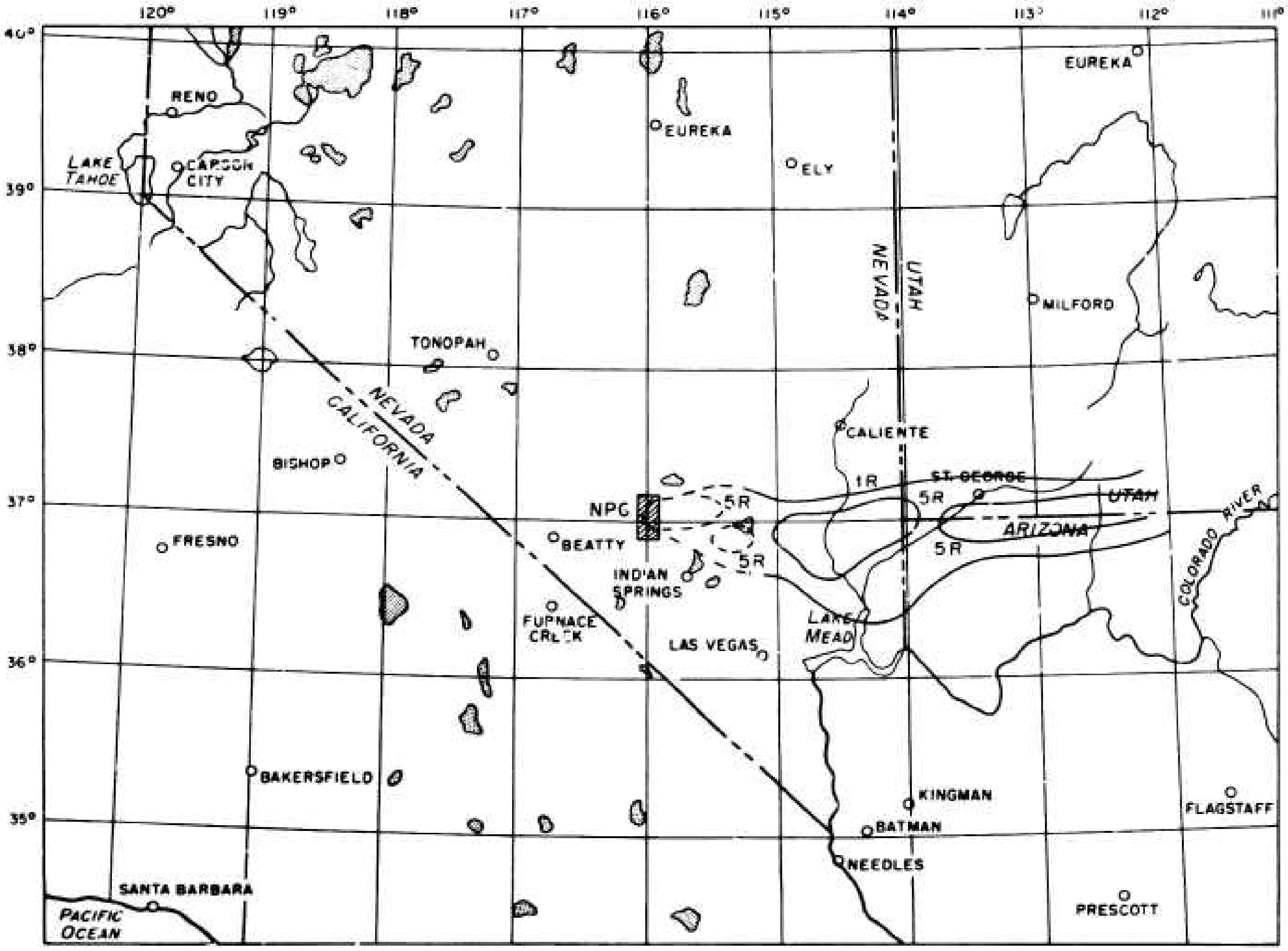


Ground survey, 17 March 1953.

Inclosure 13

DATA FOR CLOUD TRACKING AIRCRAFT B-25 (COOK BOOK 3)

				Meter readings, mr/hr		
Position	Time	Altitude	Direction of cloud	MX-5	T1B	Remarks
E 42	0558	12000	Under	0.05	0.03	
F 43	0608	12000	Under	0.1	0.1	
I 42	0623	12000		0.05	0.04	
K 43	0639	12000	Under	0.05	0.03	
M 43	0656	12000	Under	0.04	0.03	
R 41	0725	12000		0.04	0.03	
T 41	0750	12000	Under	0.1	0.2	
W 42	0819	12000	Under	0.06	0.05	
A 42	0847	12000	Under	0.05	0.05	Went home

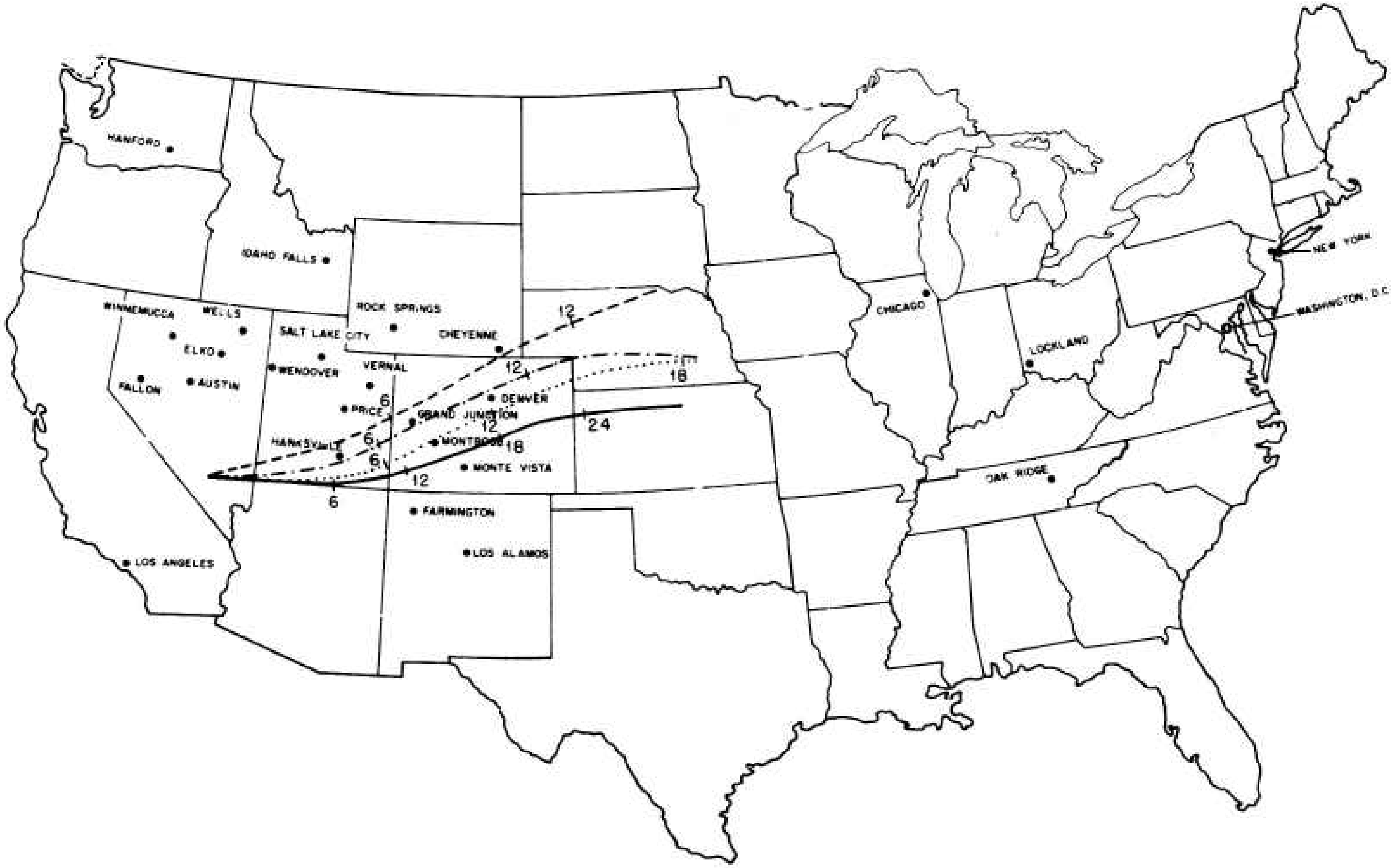
Inclosure 14

DATA FOR CLOUD TRACKING AIRCRAFT B-29

Position	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
			Cook Book 1			
Q 42	0845	22000	Left	8	6	
Q 42	0858	22000	Left	0	0	
Z 39	1012	22000		0	0	Red 6 clear at 22000
AC 43	1037	22000		20	40	
AE 42	1050	20000		8	10	Directed to descend to 18000
AB 41	1058	19500		5	5	In patches
V 40	1120	18000		0	0	
K 43	1148	18000		0	0	Red 6 clear at 18000; sent home
			Cook Book 2			
Q 24	0834	18000		20	95	
N 43	0845	18000		20	70	
K 42	0902	18000		11	12	Directed to Bryce Canyon on R-6
S 42	0912	18000		20	300	
V 42	0920	18000		20	4	
V 42	0922	18000		20	100	
T 41	0927	18000		8	3	Bg
P 42	1013	14000		20	80	Directed to R-6 at 14000
K 44	1035	14000		0	0	Bg
T 41	1112	14000		9	12	
X 39	1123	14000		0	0	R-6 clear at 14000; sent home

Inclosure 15

PREDICTED CLOUD TRAJECTORY, 0300, 17 MARCH 1953



________, 10,000 ft msl. ...., 20,000 ft msl. -.-.-.-.-, 30,000 ft msl. - - - - - - -, 40,000 ft msl.
Rain predicted in Oklahoma.

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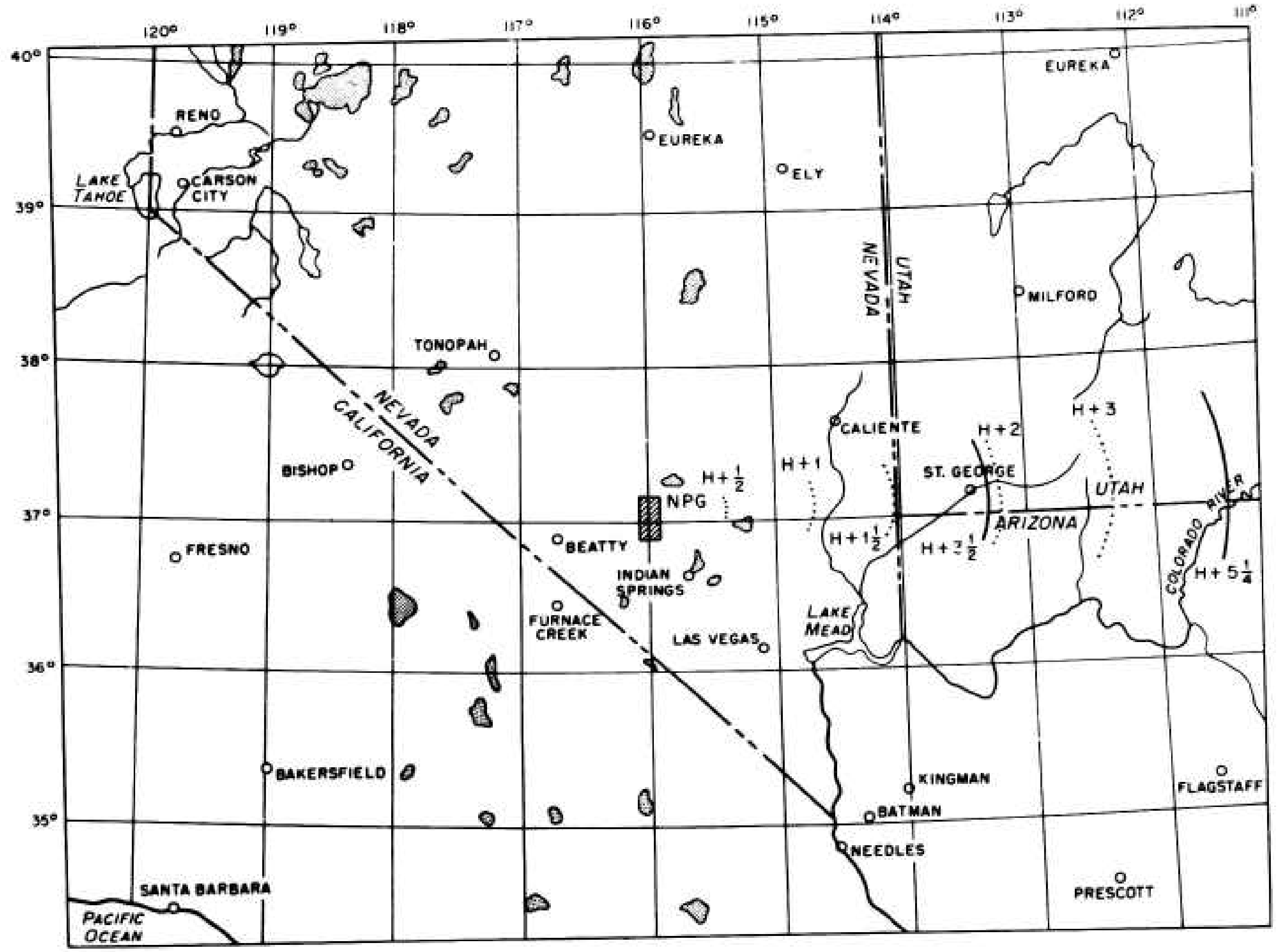
Inclosure 16

ACTUAL CLOUD TRACK, 17 MARCH 1953



......., cloud top. ———, 18,000 to 22,000 ft altitude.

Chapter 3

SHOT NANCY*

3.1 INTRODUCTION

3.1.1 The second shot of the Upshot/Knothole series, Nancy, was detonated on a 300 ft tower in Area 4 of Yucca Flat, NPG, at 0510 PST, 24 March 1953. The decision to fire was made by the Test Director at the 2100 weather briefing on 23 March 1953.

3.1.2 The final forecast of contamination fall-out was made at 0400 PST, 24 March 1953 (Incl. 1). The actual fall-out (Incl. 2) was somewhat to the west of the predicted position. The fall-out in the immediate vicinity (within 20 miles) of ground zero was somewhat greater than expected. It is assumed that this was due to the fact that the winds aloft were weaker than forecast.

3.1.3 The On-Site ground survey started at 0545 and ended at 0830. This long period of time was due to poor communications. Radio reception in the area was generally poor. One ground monitor team was unable to make any report by radio. The south and east portions of the target area were readily accessible, and the data were plotted early; whereas the northwest and north portions could not be delineated since most of this area was contaminated to an extent greater than 10 r/hr. Area 2 in Yucca Flat was heavily contaminated.

3.1.4 General recovery, "R" hour, was announced at H+2 hr. With the Test Director's concurrence, however, four projects were released prior to this time. In addition to the above, the Test Director released Project 15.4 at R hour to proceed past the 10 r/hr intensity line.

3.1.5 The point of maximum fall-out was in the immediate vicinity of Lincoln Mine. The Test Director made the decision to have the people remain inside their homes as soon as it was determined that the community was being contaminated. The maximum integrated dose of gamma radiation did not exceed 3.4 roentgens. With the personnel indoors this value was reduced by about one-half. Details on Lincoln Mine appear in the Off-Site section of this chapter.

3.2 ON-SITE OPERATIONS

3.2.1 Two dry runs were held on D−3, and one was held on D−1 at 0510 hr. Communications were good. In the evening of D−1, Reynolds Electric and Engineering Company technicians checked the ignition systems, batteries, and radio hookups on all vehicles; however, communications were not entirely satisfactory on the initial survey on D-day and caused some delay.

3.2.2 The initial survey party was dispatched from the Rad-Safe Building at 0520 hr and completed the survey at 0711 hr. Two stake lines could not be reached as they lay entirely

*Period covered, 23 to 29 March 1953.

within the 10 r/hr iso-intensity line. One party of two monitors in the initial survey team received a cumulative exposure greater than the maximum permissible exposure. It was determined that this overexposure was a result of carelessness, since the men did not turn on their survey meter until they had reached their initial stake line, where they found they were being exposed to an intensity greater than 50 r/hr. Subsequent surveys were made daily through 28 March 1953, with additional surveys made as required. The survey plots for all surveys of this area are attached as Incl. 3. A ground zero reading of 240 r/hr was made at 1000 on D + 1 day.

3.2.3 Three hundred fifty-three (353) persons in ninety-three (93) parties were briefed and cleared for entry to controlled areas during the period of this report. Processing procedures for parties clearing the Rad-Safe Building were streamlined during this period by requiring personnel to go directly to the plotting and briefing room and then through the operations office for a final clearance. This reduced the over-all time required to process a party through the building. To accomplish this, an additional clerk was assigned to the plotting and briefing section.

3.2.4 The cumulative exposures for Rad-Safe monitors at the end of this reporting period show that 3 monitors have received more than 3 r and that 18 have received more than 1 r. The average cumulative exposure for the monitoring section was six hundred fifty (650) milliroentgens.

3.2.5 (a) Approximately eighteen hundred eighty (1880) film badges were processed during this period; of these, some nine hundred were badges issued to the FCDA-Joint Information Office observers for Shot Annie.

(b) Calibration curves were run on the modified 502-606 film-badge packets which had been previously returned to DuPont for modification of the lead shield. These badges were found to be entirely satisfactory, and plans were made to shift to the modified badges for the next shot.

(c) Two persons from Project 6.8 were reported to the Rad-Safe Officer as having exceeded the maximum permissible exposure of 3.9 roentgens.

3.2.6 Fifty-two (52) vehicles were decontaminated during this reporting period. One (1) vehicle was temporarily placed in the Hot Park and later released. Surveys were made of all motor pools in Mercury on the nights of 25 and 26 March 1953. Three contaminated vehicles were discovered in the AEC Motor Pool. These vehicles were decontaminated on 26 March 1953. The vehicle check point located on Mercury Highway was moved north of the access road to CP Building No. 1. All vehicles out of the area north of the CP are checked at this point. It was felt this would prevent recurrence of such incidents.

3.2.7 Warning signs to designate contaminated areas were posted on all access roads leading to Areas T-2, T-3, and T-4. An officer of the Monitoring Section was assigned the duty of checking all access roads leading to contaminated areas and posting signs on contaminated areas. This reduced the requirement for many of the check points.

3.3 OFF-SITE OPERATIONS

3.3.1 Fixed and mobile monitors were distributed on D−1 day as shown in Incl. 4.

3.3.2 The changes in the anticipated fall-out pattern, as delineated in the maps provided by the Air Weather Service Unit (Sec. II, WT-705), show that the area of primary interest would be in the vicinity of Lincoln Mine and north. The movement of personnel and equipment to provide maximum coverage for the communities in this sector is described in Incl. 5, the Off-Site Activities Journal for the period.

3.3.3 Measurable activity was detected at points along U. S. Highway 6 between Ely and Tonopah, U. S. Highway 93 between Ely and Pioche, Nevada Highway 38 between Hiko and U. S. Highway 6, Nevada Highway 25 in the vicinity of Lincoln Mine, and on the desert road northwest of Groom Lake. Communities receiving fall-out were Lincoln Mine, Adaven, Sunnyside, Lund, Preston, Ely, Currant, Duckwater, and Warm Springs. A documentation of the actual levels encountered in most of these areas is given in Incls. 6 and 7. Details of the report on Lincoln Mine are covered in Sec. 3.3.6.

Confirmatory air sampling results at several of the locations given in Sec. 3.3.3 were obtained and are shown in Incl. 8.

Water samples of interest collected by Off-Site personnel are listed in Incl. 9.

3.3.4 The final fall-out pattern as determined from all the ground survey information collected is illustrated in Incl. 10.

3.3.5 Radio reception was generally poor. This was expected, however; and by prior planning, good use was made of the available telephone lines. Data from Lincoln Mine were telephoned to Groom Mine on a field line, and then radioed to the CP by the VHF on-site net.

3.3.6 Fall-out at Lincoln Mine.

3.3.6.1 For easy reference the data for Lincoln Mine have been separated from the rest of this report and appear in Incls. 11, 12, 13, and 14.

3.3.6.2 The Lincoln Mine monitoring station was established at 1600, 23 March 1953. Equipment used consisted of a Hi-volume sampler, a background recorder, fall-out trays, cascade impactor, and survey instruments consisting of a T1B, an AN/PDR 34, an MX-5, and a Victoreen 389. Two monitors, H. J. L. Rechen, Sanitary Engineer, PHS, and E. S. Claborn, ACD, USN, were assigned.

3.3.6.3 Atomic cloud debris became visible to Lincoln Mine at 0550 PST. The cloud passed directly overhead at 0615. Three separate clouds were apparent, all moving in a NNE direction. A low level cloud passed the station at 0625.

Fall-out was first noticed at 0650 with a reading of 3 mr/hr. By 0709 a peak reading of 580 mr/hr was noted. At 0720 the fall-out appeared complete. Incl. 12 is a record of these readings.

At 0650 PST, the monitor in charge of the station informed Mr. Perkins, the Mine Superintendent, of the situation and asked if the personnel at Lincoln Mine could not take cover. The suggestion was accepted and acted upon immediately. Formal instructions from the CP confirming the above action were received at 0704. At 0900 instructions were that normal activities could be resumed. This was passed to the Superintendent.

At 0740 PST, a low level cloud was observed 5 miles west of Lincoln Mine. The cloud appeared to be traveling at the rate of approximately 10 to 15 mph, and appeared to fill the width of Penoyer Valley. Its maximum altitude was about 2000 ft above ground. A reading was made at Shadow Ranch (about six people live here) 4.5 miles NW of Lincoln at 1210. This reading was 120 mr/hr. At this same time the reading at Lincoln Mine was 90 mr/hr.

Joseph B. Sanders, AEC-LVFO, arrived at Lincoln Mine at 0920. Maj J. Servis, Cml C, and Duncan Holaday, PHS, members of the Off-Site Section, visited the mine at 1300.

3.3.6.4 It is believed that the personnel at Lincoln Mine did not receive a dosage greater than 3.4 r. In Incl. 12 the readings taken for the first 12 hr are plotted. A maximum lifetime dosage of 3.4 r was computed by measuring the first 12-hr dose from the curve, and computing the rest using the $t^{-1.2}$ law. As the workers and inhabitants of Lincoln Mine were inside for the greater part of the period of high intensity readings, and as at 0730 the reading outdoors was 350 mr/hr and the reading at this same time in a typical one-room frame house was 200 mr/hr, it is felt that most of the inhabitants received less than 2 r total dosage.

3.3.6.5 Inclosure 13 shows the film-badge record of the monitors, a telephone lineman, and a Lincoln Mine resident. The results of a water analysis of two samples taken at Lincoln Mine are shown in Incl. 9. Airborne concentrations are shown in Incl. 14. The increase in particle size following primary fall-out is attributed to rising surface winds which necessarily caused surface agitation.

3.4 AIR PARTICIPATION

3.4.1 Weather data indicated that the radioactive air mass would travel in a northeasterly direction. Recommendations were made to close the air space at all altitudes for a radius of 50 miles from ground zero from 0430 to 0600 hr, PST, on D-day. In addition, the air space enclosed by the 330° and 50° vectors from ground zero for a distance of 210 miles at 20,000 ft msl and below was recommended closed to all aircraft except those taking part in the test operation from 0500 to 1100 hr PST on D-day. The air space above 20,000 ft msl enclosed by the vectors 50° and 75° from ground zero (changed at 0945 to 10° and 60°) and a radial distance of 350 miles were also recommended closed. In addition to the above a warning area of a 240 mile radius from Melford Radio at all altitudes was recommended. No changes except the one noted above were required.

3.4.2 The cloud tracking aircraft, two B-29's (Cook Book 1 and 2) and one B-25 (Cook Book 3), were off on schedule. They performed their mission very effectively, considering the fact that the cloud broke up and scattered widely at almost all altitudes. The data are attached as Incl. 15. The cloud track from this data is plotted in Incl. 16. The predicted cloud track is shown in Incl. 17. No change was made in the procedure of tracking. The altitudes were also the same with Cook Book 1 at 22,000 ft msl, Cook Book 2 at 18,000 ft msl, and Cook Book 3 at 12,000 ft msl.

3.4.3 The extended terrain survey was performed by an L-20 and a C-47 aircraft. The data collected were satisfactory. Communication, however, with the L-20 was never established, and consequently data were not delivered until after the mission was completed. The L-20 was off at 0640 and had completed the survey by 0940. The C-47 was off at 0810 and was able to complete the assigned pattern by 1250 hr. Communication was satisfactory with the C-47 on high frequency. The data and pattern from both the C-47 and L-20 are plotted and attached as Incl. 18.

On D+1 day the C-47 performed a 360° aerial survey around the proving grounds as was done for Shot Annie. No readings above background were found.

3.4.4 The close-in aerial survey of the target area was performed by helicopter. Excellent results were obtained. The data are attached as Incl. 19. The grid coordinates on Security Map No. 1, LVFO Security Branch, were used for this data. All other data use coordinates as listed in Incl. 9 of Chap. 2.

3.4.5 Data on the location of cattle in the fall-out area are listed in Incl. 20. These data were obtained from the report of the monitors in the L-20 and C-47.

3.5 LOGISTICS AND SUPPLY

3.5.1 During this period, the Supply Section issued 97 pairs of booties, 118 protective caps, 131 coveralls, 122 pairs of gloves (cotton), 296 protective goggles, and 113 respirators. The laundry serviced 290 pairs of booties, 146 protective caps, 363 coveralls, 1,051 gloves (cotton), 104 respirators, 52 sheets, and 88 towels.

3.5.2 Instruments on hand at the start of this period were 262 T1B's, 90 MX-5's, 85 389A's, 73 PDR39's, 2 Pee Wee No. 211's, 27 chargers (dosimeter), 4 alpha counters No. 95?, and 14 recorders, Esterline-Angus. During the period, 139 instruments were issued, 83 were turned in, and 129 were calibrated.

3.5.3 Three trucks, $\frac{1}{4}$ ton CPW; 7 trucks, $\frac{1}{4}$ ton M38; 6 trucks, $\frac{3}{4}$ ton M37; 5 apparatus decon. M3A2; 1 truck, $2\frac{1}{2}$ ton 6 × 6 (Lab); and 1 trailer, 1 ton, 2 wheel, received general service from the maintenance section. Thirty-four vehicles were lubricated and received weekly maintenance. Six vehicles were deadlined and repaired. Spare parts are still not available for the $\frac{1}{4}$ ton trucks and $\frac{3}{4}$ ton trucks.

3.5.4 All military vehicles were modified by the addition of a 6-volt generator, regulator, ammeter, and a large fan belt. This was done by AEC Communications to improve operation of the radios.

3.6 GENERAL

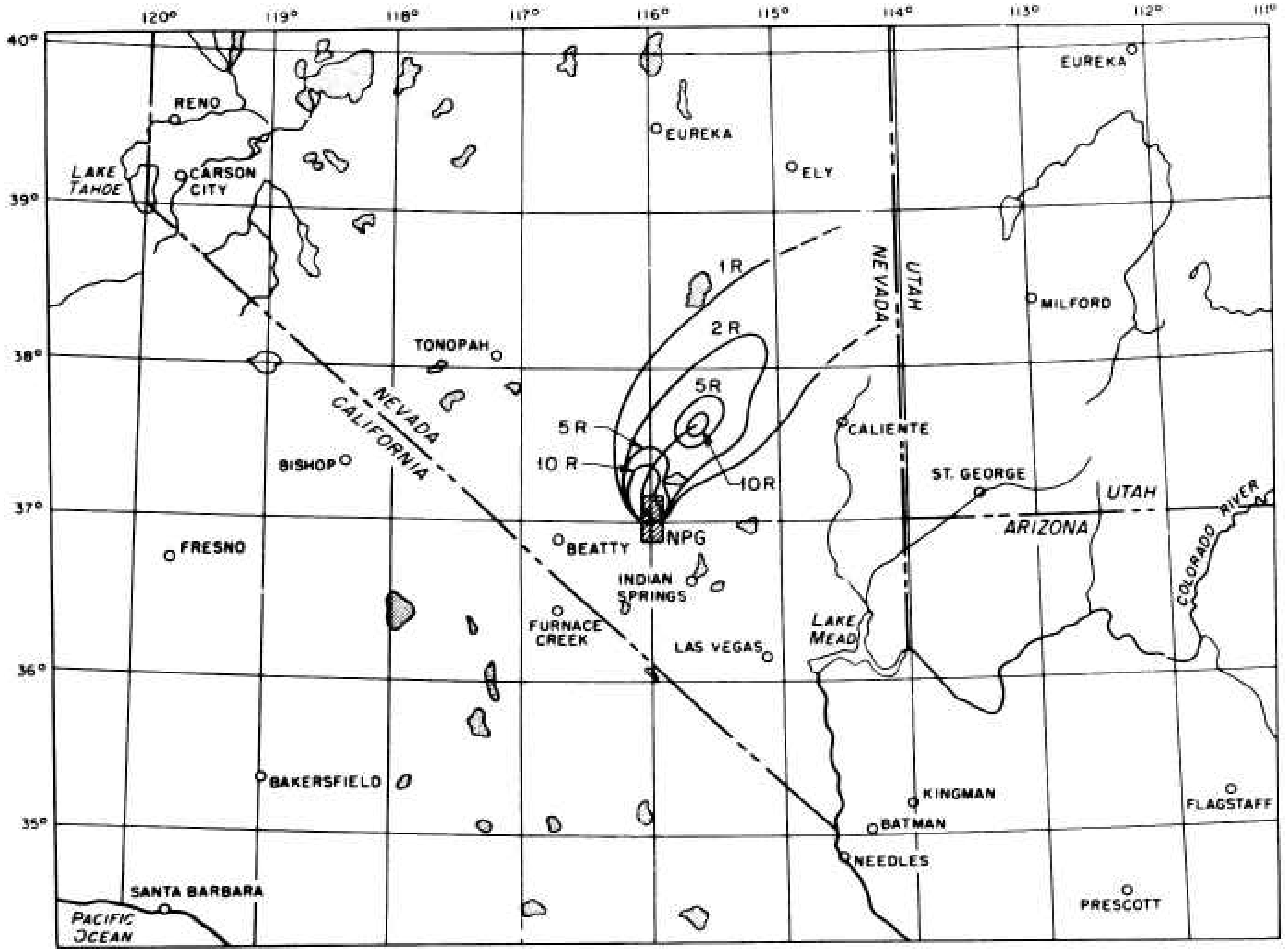
The Rad-Safe data were presented in a satisfactory manner. Communications, although better in general than in the previous shot, did cause some delay.

The Lincoln Mine data caused some anxiety until it was definitely determined that the maximum had been reached. The external gamma lifetime dose did not exceed 3.4 r, and with the population indoors almost immediately after the start of fall-out this value is substantially reduced. The gamma decay after the first day follows very closely to the $t^{-1.2}$ decay law. The possibility does exist that considerable amounts of beta radiation could have been received if some of the people at Lincoln Mine had not taken cover. Fall-out particles clinging to the skin, hair, etc., could have caused local beta burns. However, a lineman, Pfc K. R. Frith, who remained out of doors at Lincoln Mine did not receive beta burns.

A review of dosage records indicates that monitors are not accumulating dosage at an excessive rate, and that there are sufficient personnel with the reserve personnel at the Chemical Corps Training Command to complete the operation.

Inclosure 1

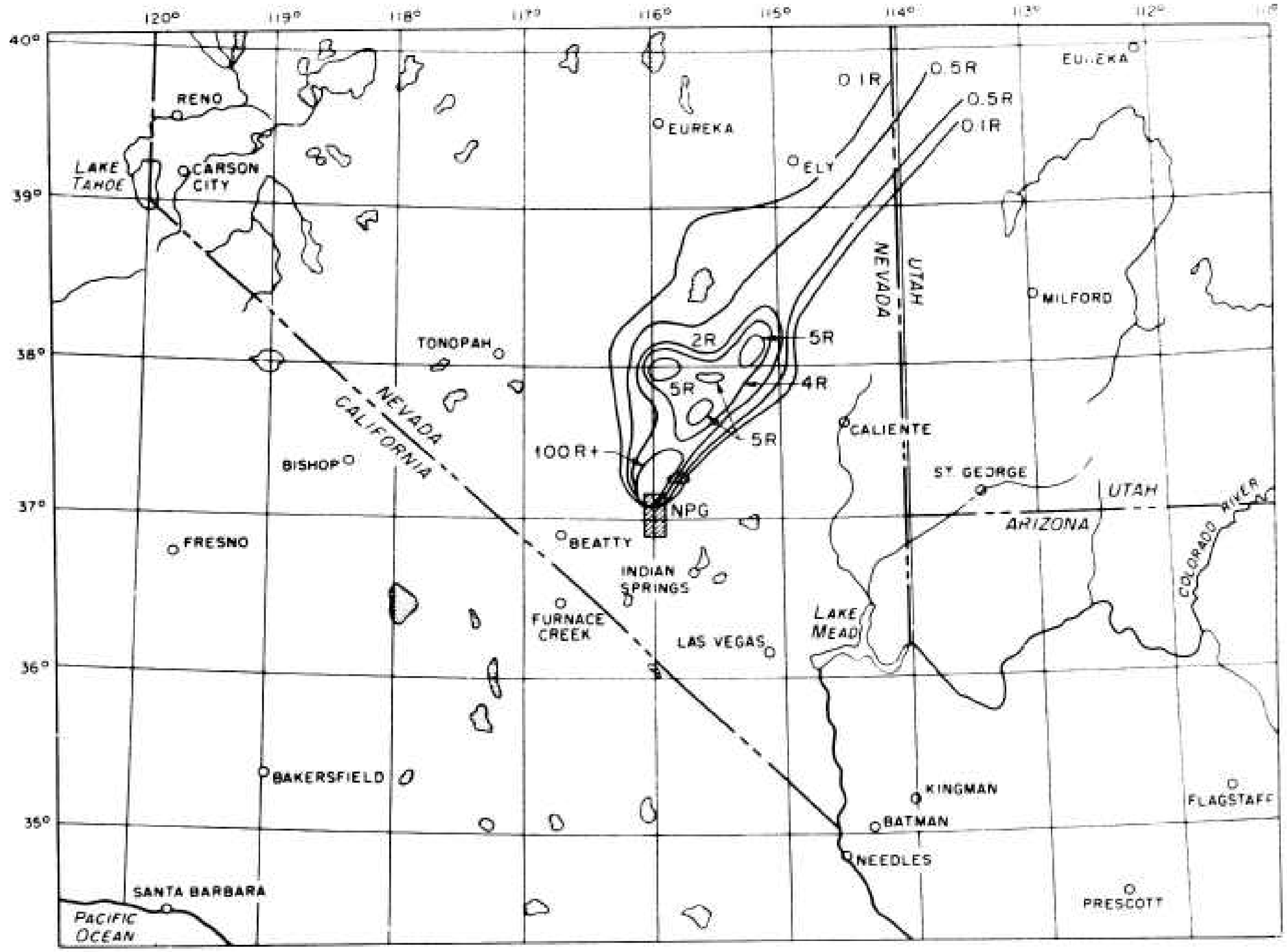
FORECAST FALL-OUT PLOT



Data based on 0330 winds. Shot Nancy, 24 March 1953. Infinite dose lines are given in roentgens.

Inclosure 2

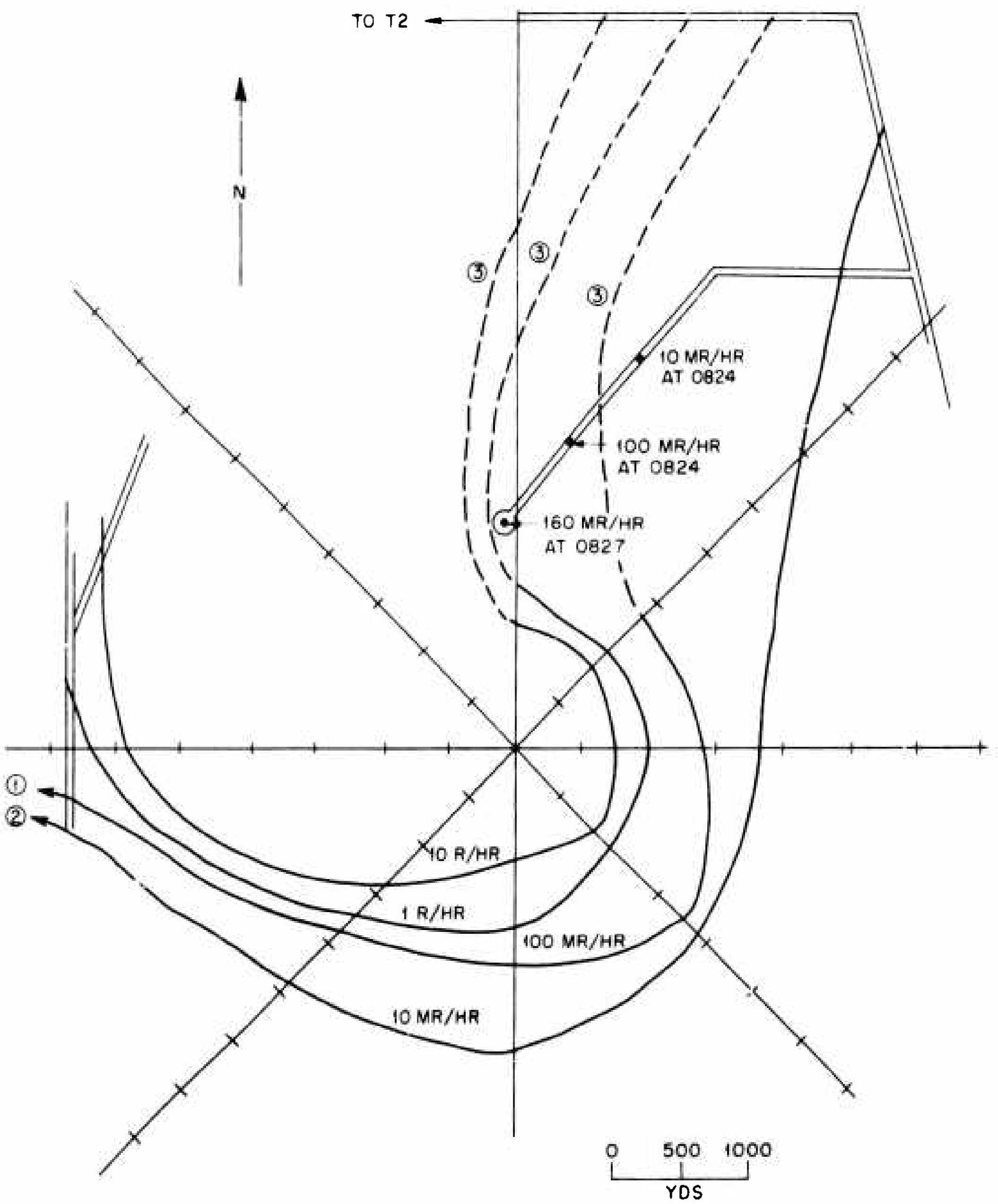
INFINITE DOSE FALL-OUT PATTERN



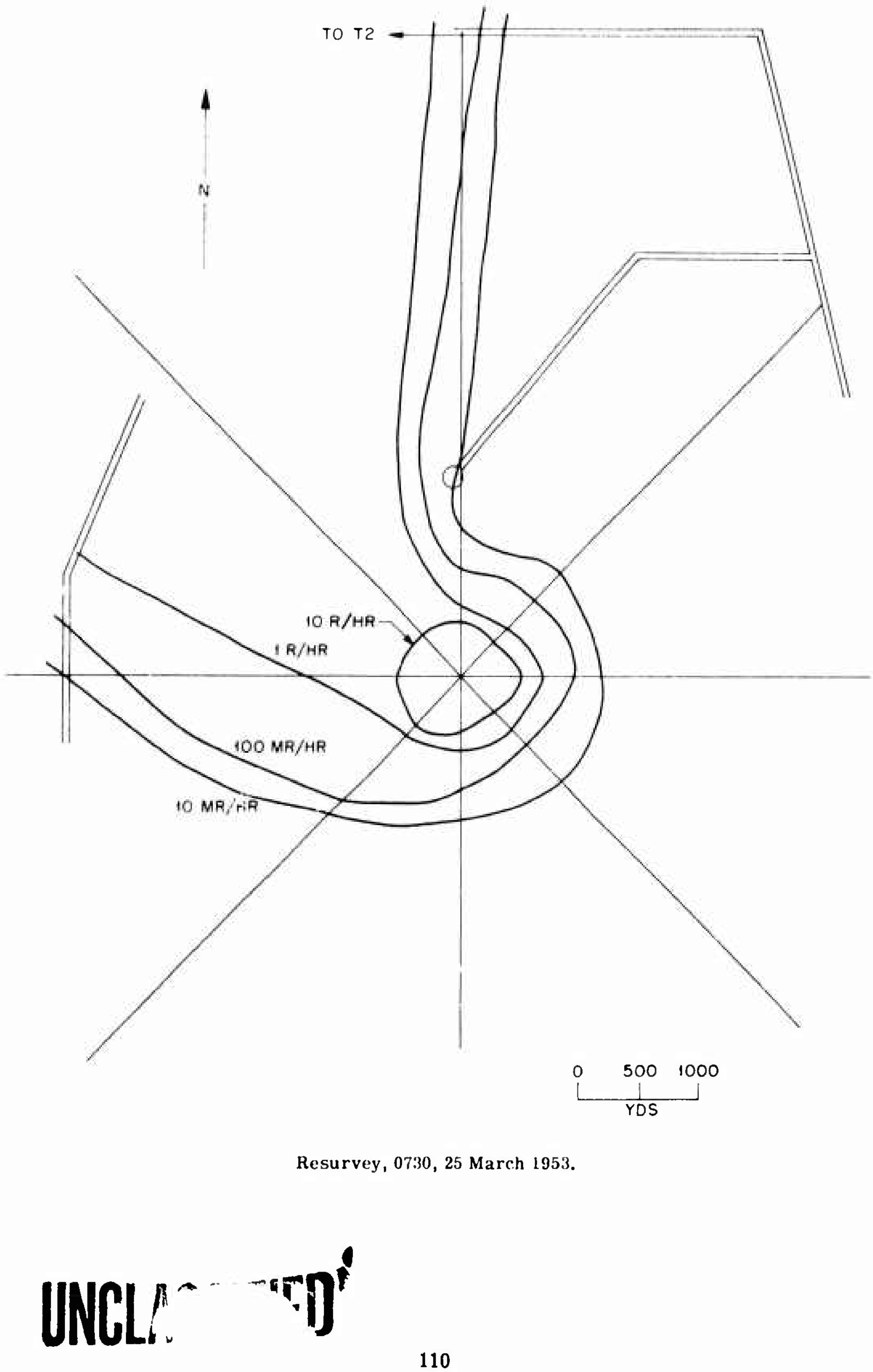
Data based on combined air and ground surveys. Shot Nancy, 24 March 1953.

Inclosure 3

SURVEYS OF TEST AREA 4



Initial surv.y, 0610, 24 March 1953. ①, 10 mr/hr line crosses west stake line 6800 yd from GZ. ②, 100 mr/hr line crosses west stake line 4200 yd from GZ. ③, dotted lines are extrapolated from data taken at 0824 to 0827.



Resurvey, 0730, 25 March 1953.

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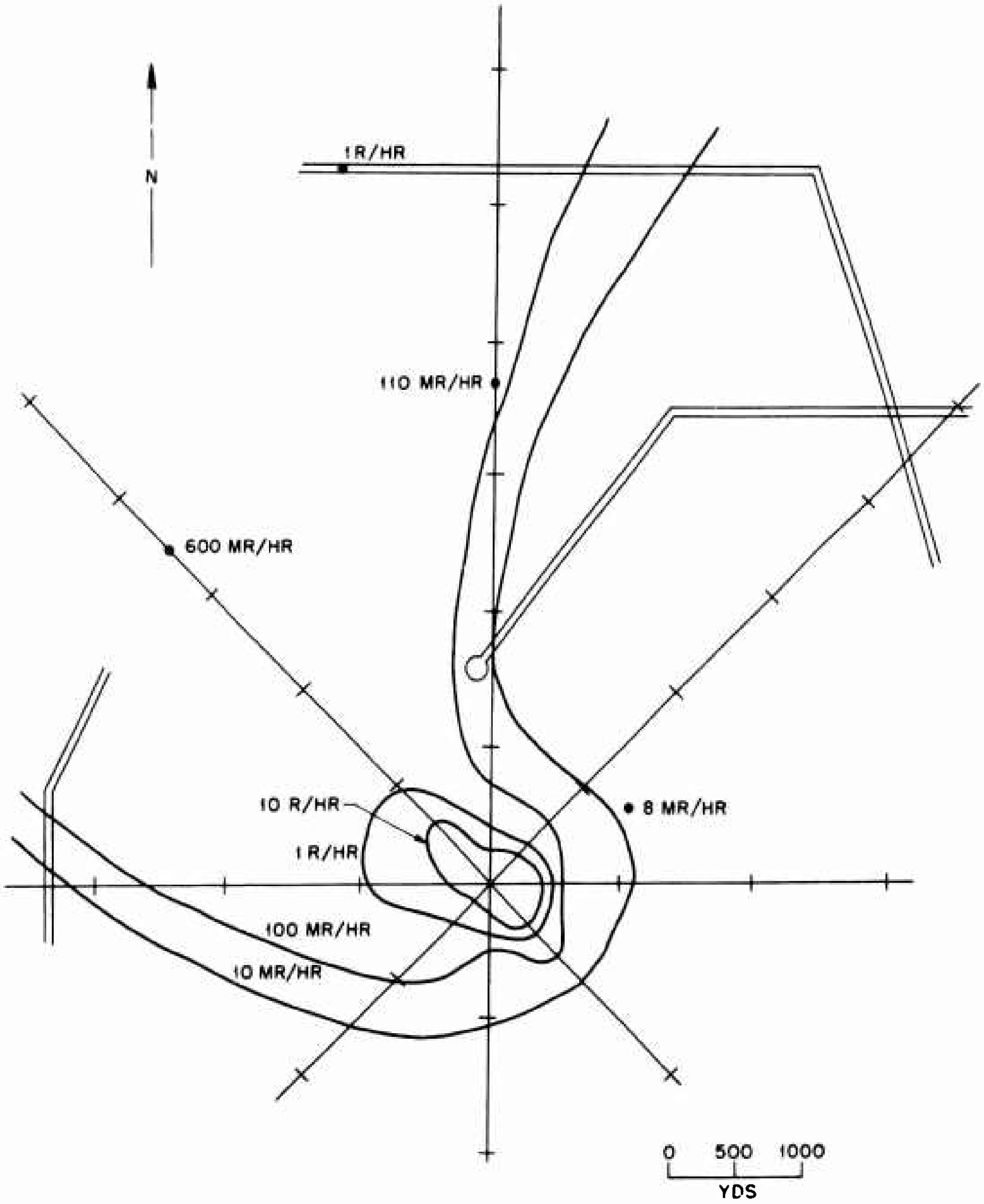
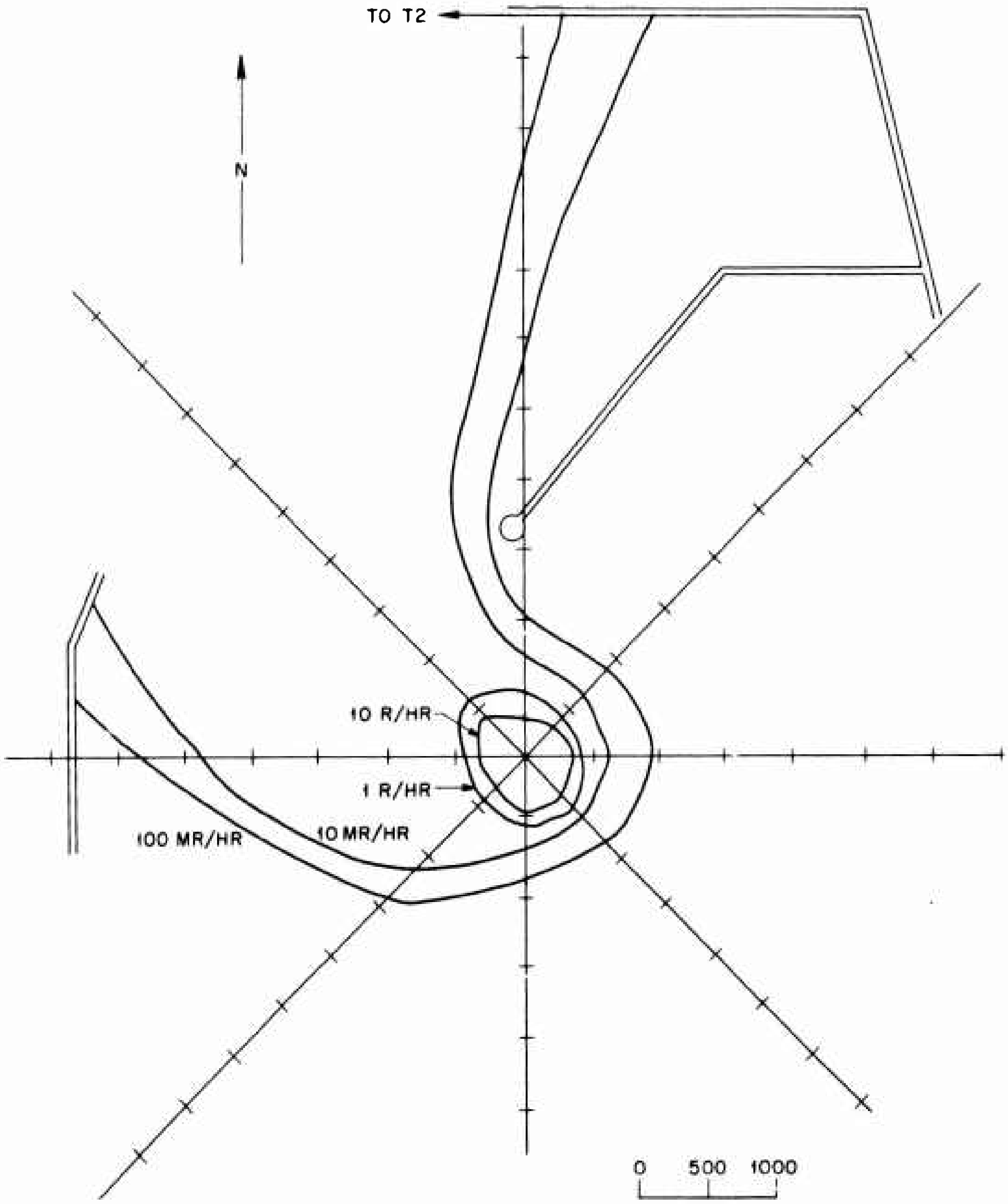
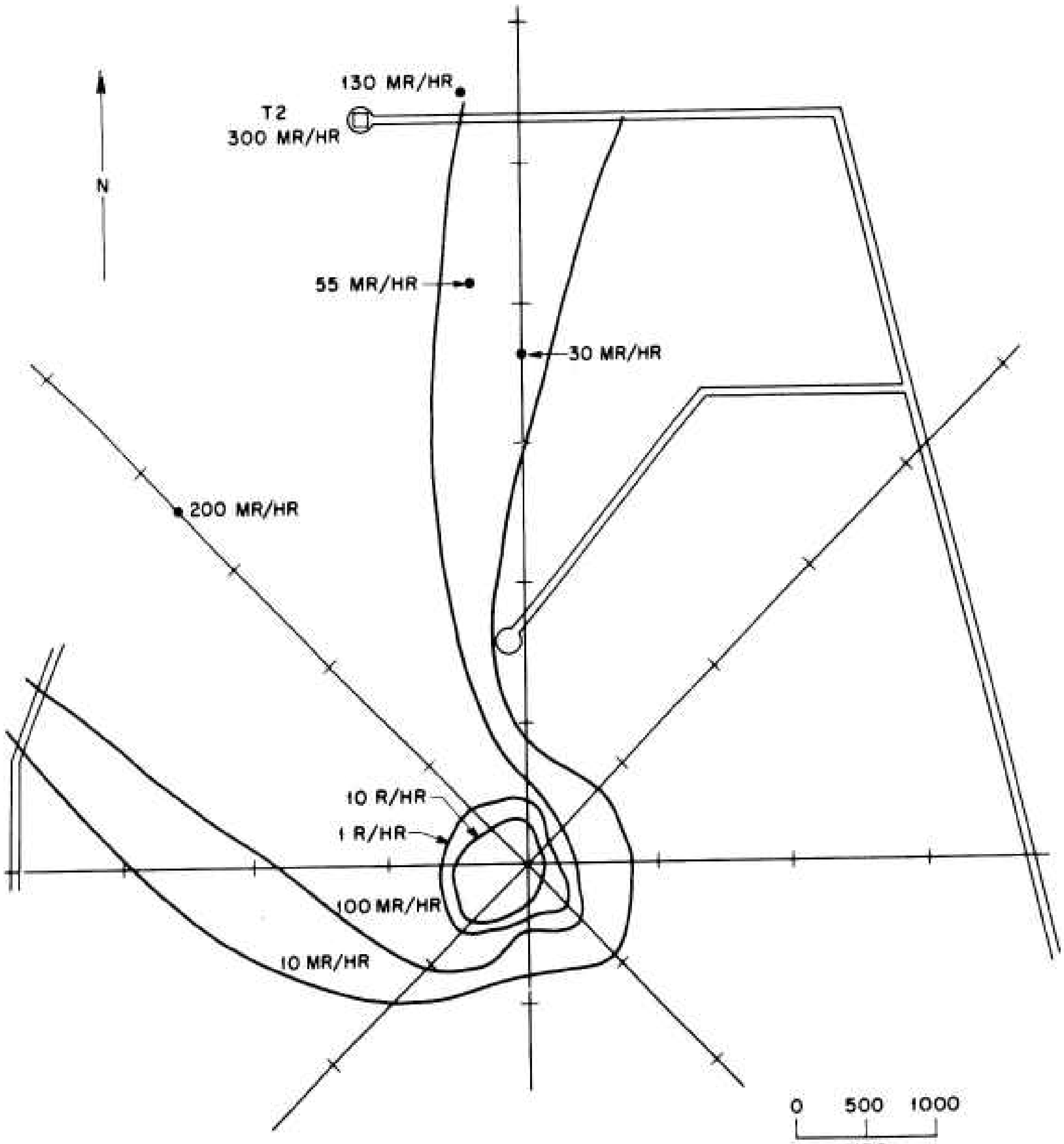


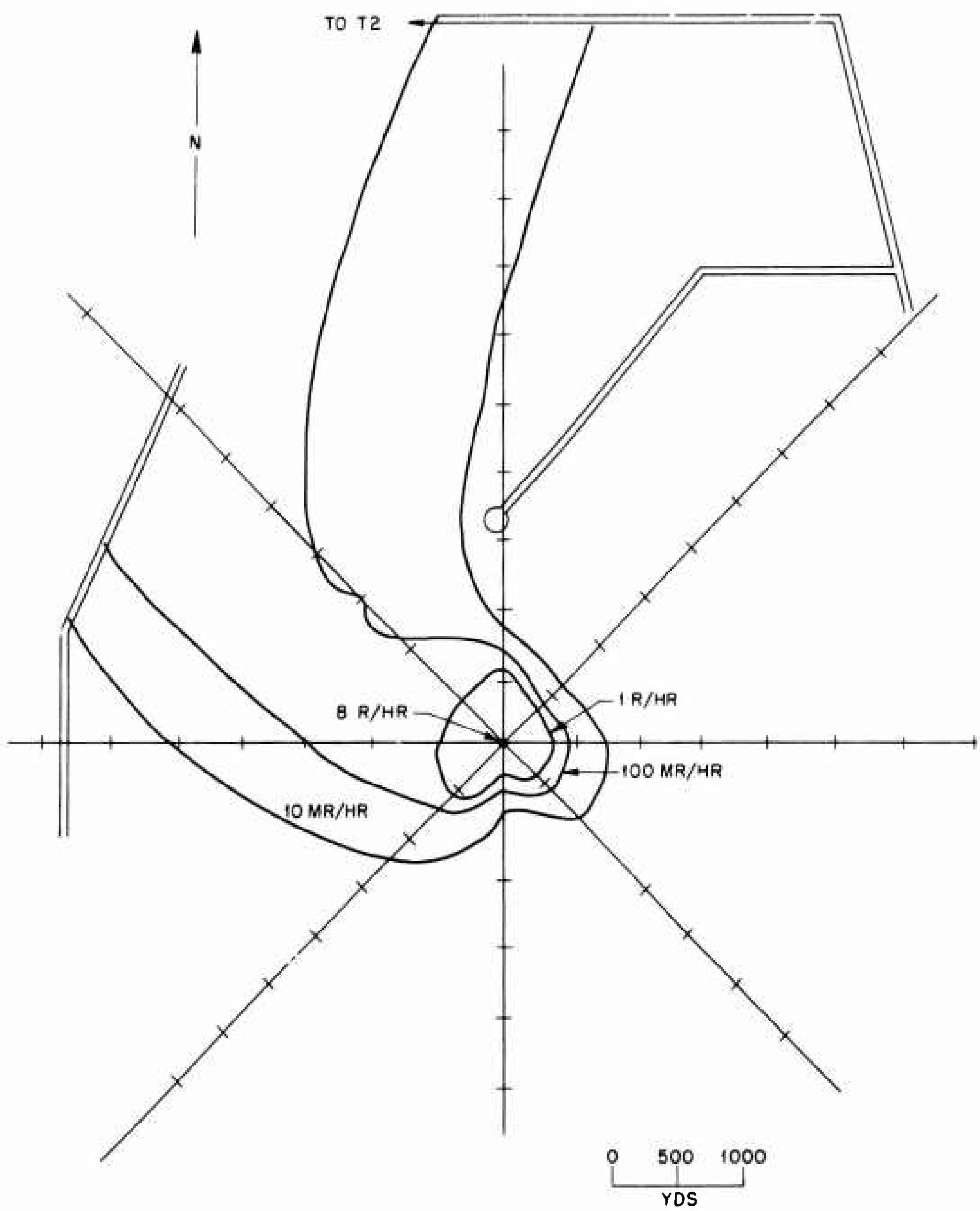
Resurvey, 0630, 26 March 1953.



Resurvey, 0830, 27 March 1953.



Resurvey, 0800, 28 March 1953.



Resurvey, 0930, 30 March 1953.

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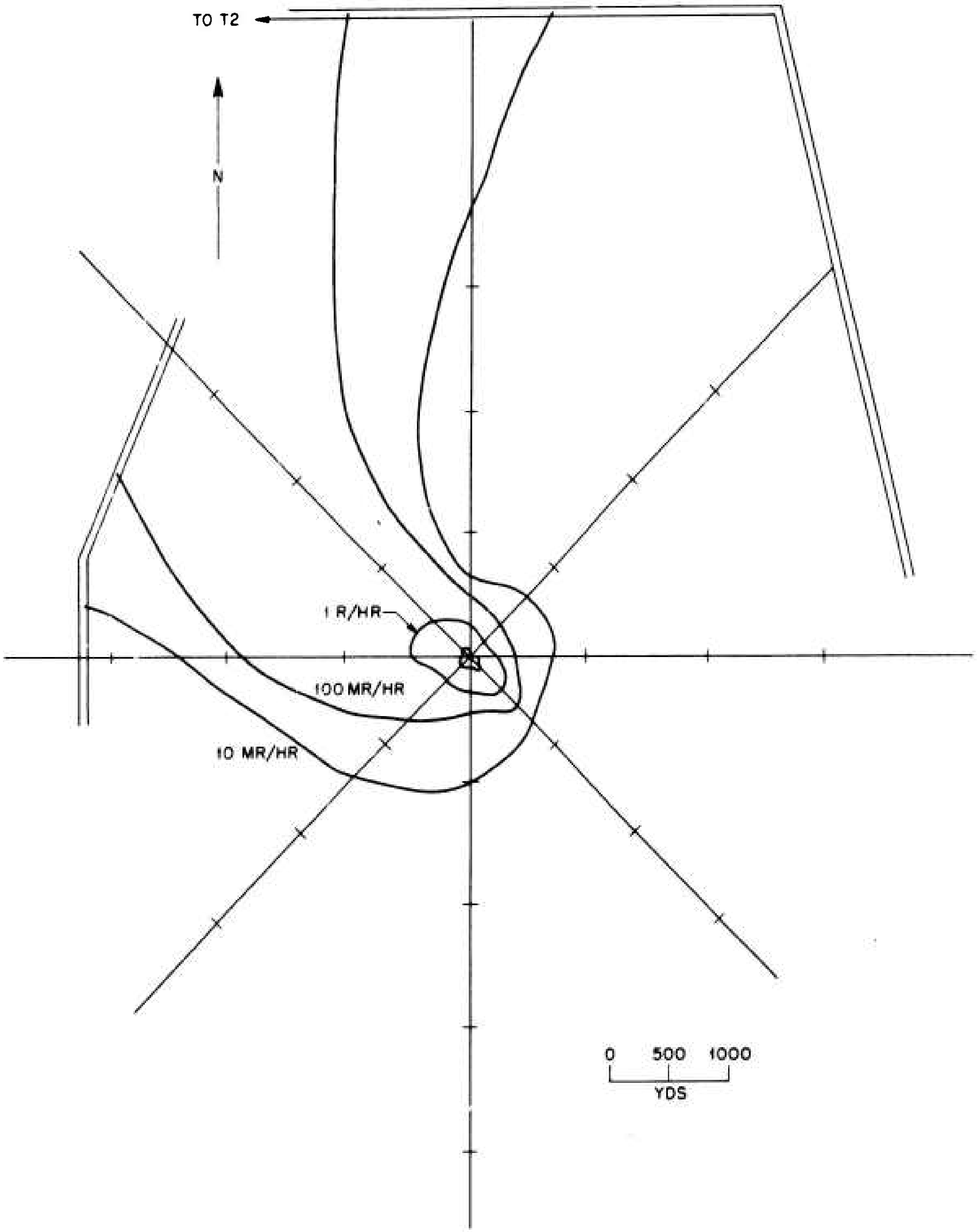
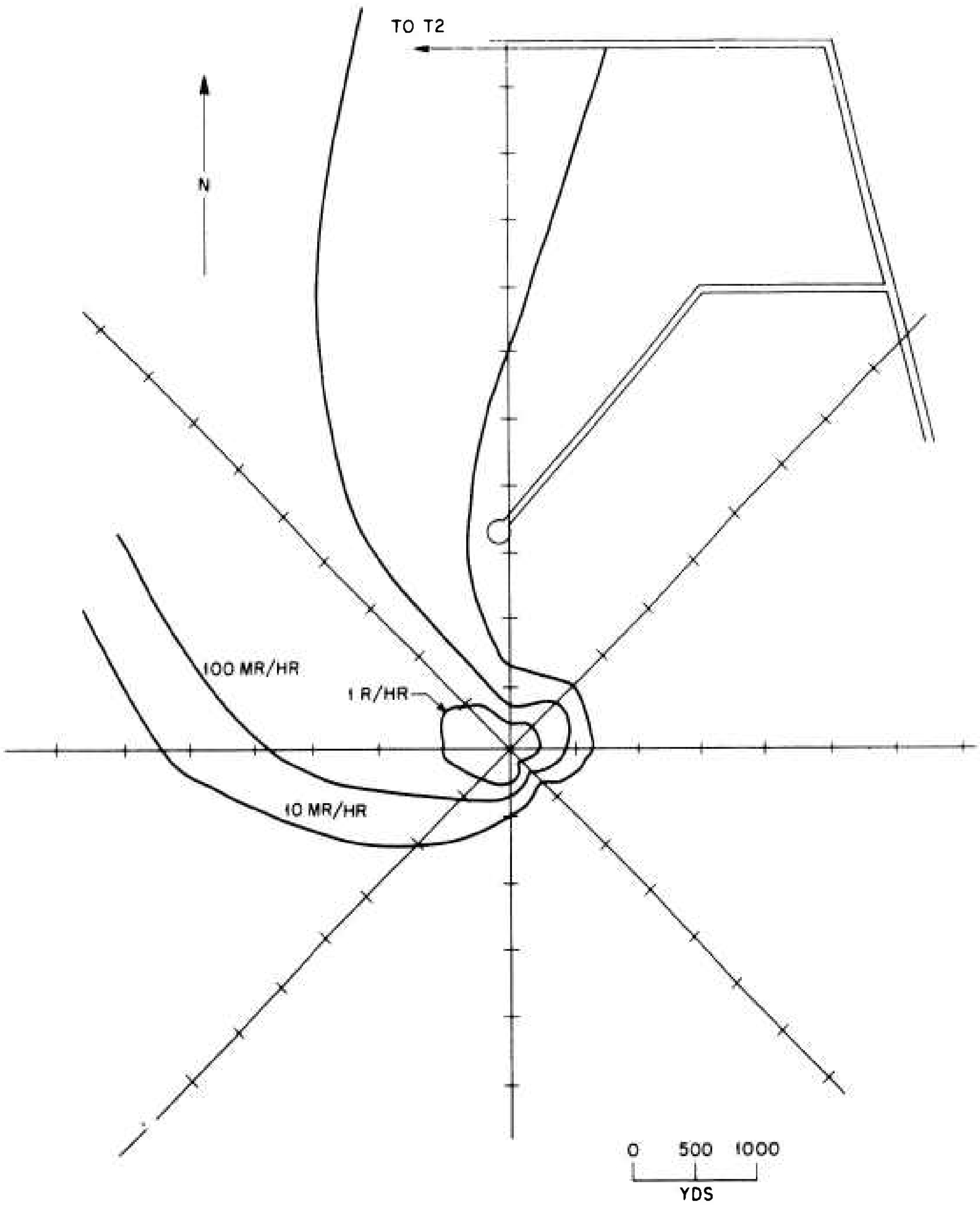
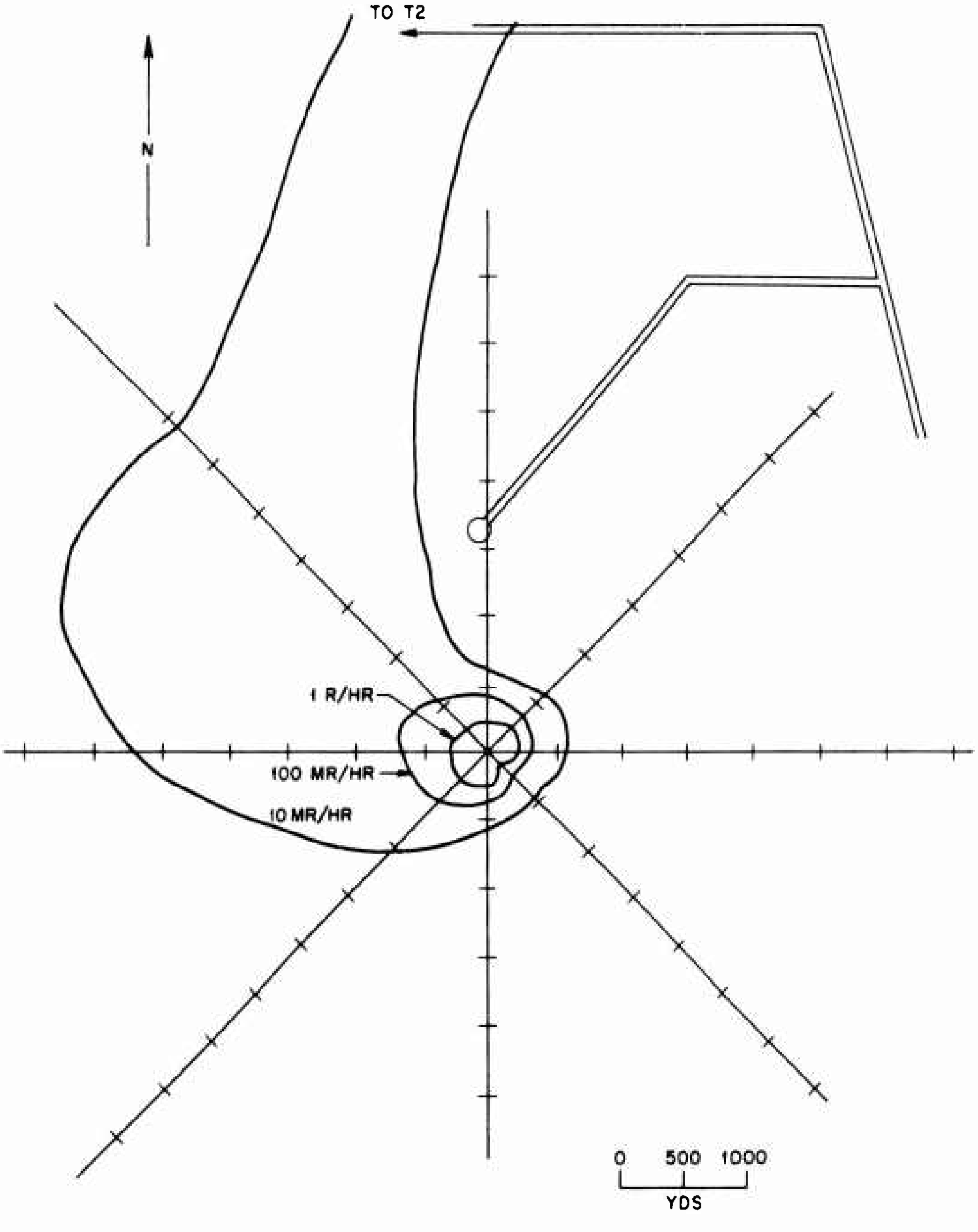


Resurvey, 0630, 1 April 1953.



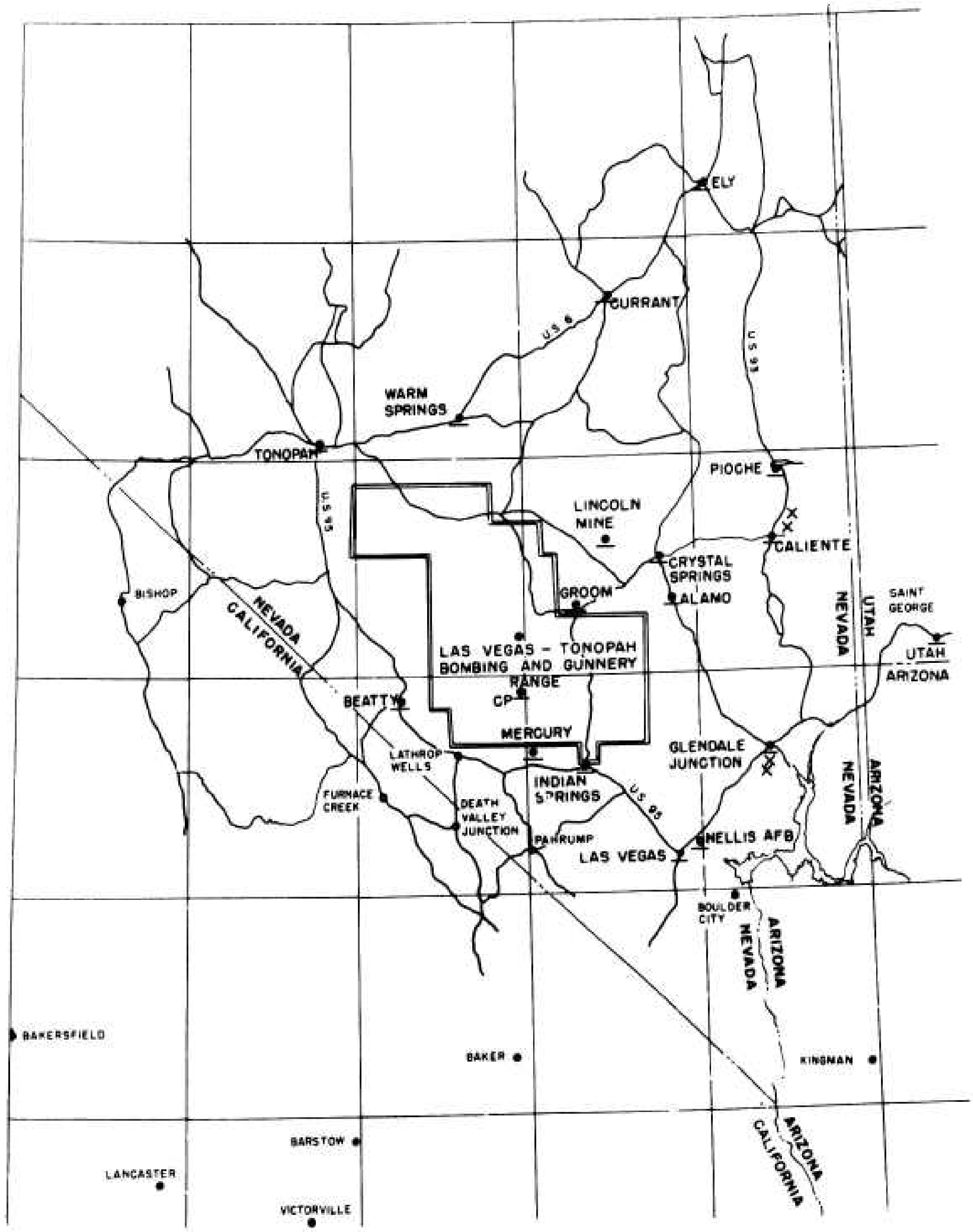
Resurvey, 0730, 4 April 1953.



Resurvey, 1200, 7 April 1953.

Inclosure 4

DISTRIBUTION OF FIXED AND MOBILE OFF-SITE MONITORS, D-1, SHOT NANCY



⚲, fixed stations. ×, mobile monitors.

Inclosure 5

OFF-SITE SHOT ACTIVITIES JOURNAL, SHOT NANCY

Time	Date	Event
1000-1300	3/23/53	All teams departed during this period for their respective stations. One mobile air sampling team and one mobile monitoring team were sent to Caliente, and a similar pair was sent to Glendale Junction because of the anticipated fall-out pattern at this time. Radio contact was initiated upon departure from the Rad-Safe Building and maintained until arrival at Las Vegas, Glendale Junction, Caliente, Ely, Tonopah and Beatty. Alamo and St. George checked in via telephone.
2000	3/23/53	Difficulty was experienced in contacting Groom Mine over HF and VHF. Radio repairmen sent to remedy the trouble, but no report could be received on the radio as to status of Lincoln Mine station.
2315	3/23/53	Contacted Groom Mine via VHF and received report on Lincoln Mine that all was okay there.
2330	3/23/53	Results of 2100 weather briefing indicate no shift in personnel necessary until later forecasts are received.
0430	3/24/53	Mobile units at Glendale dispatched to Caliente for further movement instructions. Mobile units at Caliente dispatched for Ely and Sunnyside.
0435	3/24/53	Groom Mine contacted and instructed to inform Lincoln at next contact to man radio and phone both until told otherwise.
0655	3/24/53	First indication of fall-out received from Lincoln Mine. Dispatched mobile units accordingly to Ely, Ely-Pioche Highway, Duckwater and Sunnyside.
0704	3/24/53	Pursuant to Test Director's request, the monitor was advised to have all residents of Lincoln Mine remain indoors. These instructions were to be implemented through the Mine Superintendent who was standing by as per an earlier message.
0715	3/24/53	Peak level reached at Lincoln Mine.
0900	3/24/53	Pursuant to the Test Director's informal message, residents of Lincoln Mine advised that work in the mine and other usual duties could be resumed as of 0900 PST with the precaution that they remain indoors as much as possible.
0930	3/24/53	Request from the Rad-Safe Officer that special report be prepared for the Test Director on Lincoln Mine.
1000	3/24/53	Duncan Holaday and Maj John D. Servis dispatched to gather data for special report on Lincoln Mine.

Time	Date	Event
1210	3/24/53	Report received by phone that fall-out had started at Ely with background rising slowly and maximum of 1.1 mr/hr obtained.
1250	3/24/53	Report received by radio locating the fall-out on U. S. Highway 6 between Tonopah and Ely.
1355	3/24/53	Report received by radio locating the fall-out on Nevada Highway 38 between Crystal Springs and U. S. Highway 6.
1445	3/24/53	Report received by phone from Ely from monitoring unit between Pioche and Ely permitting the location of fall-out on U. S. Highway 93 between these two points.
1600-1900	3/24/53	All teams reported in for the night. Advised to continue air sampling until H + 24 at all but Duckwater station. One team instructed to re-monitor Highway 93 from Ely to Pioche on the return trip to Mercury. Alamo-Crystal Springs monitor instructed to relieve Lincoln Mine personnel on D + 1 day and remain there until about 1600 D + 1 day.
D+1 day		All teams but Ely and Glendale Junction units returned to Mercury. Ely unit continued working on samples from that area. Glendale Junction unit turned into Nellis AFB dispensary for medical attention.
D+2 days		Monitoring unit dispatched to check Lincoln Mine and road leading up the eastern side of the flat north of Groom Lake. Remainder of personnel worked on compilation of material for the Shot Report. Ely and Glendale Junction units returned to Mercury.

Inclosure 6

GROUND MONITORING DATA, SHOT NANCY

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Spangler	H + 6:50	69 miles S of Ely on Hwy 93	5.0	H+6:00	6.0
Jaworski	H + 29:25	70 miles S of Ely on Hwy 93	0.06	H+6:00	0.3
Spangler	H + 6:15 5:35	79 miles S of Ely to Pioche	*	H+5:30	
Jaworski	H + 29:40 30:15	80 miles S of Ely to Pioche	*	H+5:30	
Servis and Holaday	H + 8:00	Lincoln Mine	60	H+1:40	400
	H + 8:17	2 miles NW of Lincoln Mine	80	H+1:40	530
Claborn	H + 3:35	2 miles NW of Lincoln Mine	200	H+1:40	400
Fooks	H + 34:30	2 miles NW of Lincoln Mine	17	H+1:40	600
Servis and Holaday	H + 9:30	4 miles NW of Lincoln Mine	80		620
Fooks	H + 34:30	4 miles NW of Lincoln Mine	18		660
Servis and Holaday	H + 9:00	8 miles NW of Lincoln Mine	85		620
Fooks	H + 34:35	8 miles NW of Lincoln Mine	20		720
Servis and Holaday	H + 8:37	12 miles NW of Lincoln Mine	80		550
Fooks	H + 35:35	12 miles NW of Lincoln Mine	14		560
Servis and Holaday	H + 8:40	14 miles NW of Lincoln Mine	32		250
Servis and Holaday	H + 8:34	16 miles NW of Lincoln Mine	14		92
Fooks	H + 35:48	16 miles NW of Lincoln Mine	6		250
Servis and Holaday	H + 8:52	18 miles NW of Lincoln Mine	32		250

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Fooks	H + 35:50	18 miles NW of Lincoln Mine	3		140
Servis and Holaday	H + 8:52	20 miles NW of Lincoln Mine	18		310
Fooks	H + 36:00	20 miles NW of Lincoln Mine	4		155
Servis and Holaday	H + 9:00	22 miles NW of Lincoln Mine	8		170
	H to H+24	Beatty	*		
	H to H+24	Nellis	*		
	H to H+24	Las Vegas	*		
	H to H+24	Glendale Junction	*		
Fooks	H + 3:20 3:56	Crystal Springs to Alamo	*		
Fooks	H + 3:56 5:30	Crystal Springs to Groom Lake	*		
Fooks	H + 8:30 9:55	Crystal Springs to Caliente	*		
Fooks	H + 25:40 27:07	Crystal Springs to 34 miles W enroute to Lincoln Mine	*	H+1:40	
Fooks	H + 27:10	34.5 miles W of Crystal Springs enroute to Lincoln Mine	0.25	H+1:40	7
Holaday	H + 7:10	35 miles W of Crystal Springs enroute to Lincoln Mine	1.5	H+1:40	8.5
Fooks	H + 27:18	36 miles W of Crystal Springs enroute to Lincoln Mine	1.65	H+1:40	
Fooks	H + 27:20	36.5 miles W of Crystal Springs enroute to Lincoln Mine	2.60	H+1:40	74
Holaday	H + 7:13	37 miles W of Crystal Springs enroute to Lincoln Mine	10.0	H+1:40	55
Fooks	H + 27:27	38 miles W of Crystal Springs enroute to Lincoln Mine	5.0	H+1:40	170
Holaday	H + 7:15	38 miles W of Crystal Springs enroute to Lincoln Mine	24.0	H+1:40	175
Fooks	H + 27:35	39 miles W of Crystal Springs enroute to Lincoln Mine	13.0	H+1:40	
Mitchell	H + 7:05	St. George	0.1		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Mitchell	H + 7:20	10 miles N of St. George Hwy 18	0.02		
Mitchell	H + 7:40	20 miles N of St. George Hwy 18	0.01		
Mitchell	H + 1:00	Fixed station	0.3		
Mitchell	H + 12:15	At St. George	0.3		
Wheeler	H + 8:35	Pioche North	*		
Wheeler	H + 9:10	On Route 93	*		
Holy	H + 0:00	Groom Mine	*		
Holy	H + 24:12	Groom Mine	*		
Henderson and Rowe	H + 8:10	46.5 SW of Sunnyside	12	H + 5	22
Henderson and Rowe	H + 9:00	36.5 SW of Sunnyside	14		28
Henderson and Rowe	H + 9:20	16.5 SW of Sunnyside	11		18
Henderson and Rowe	H + 10:00	6.5 SW of Sunnyside	4		9
Henderson and Rowe	H + 10:15	Sunnyside	17	H + 5	34
Henderson and Rowe	H + 11:08	5 miles N of Sunny-side	7	H + 5	18
Henderson and Rowe	H + 11:20	15 miles N of Sunny-side	4	H + 5	11
Henderson and Rowe	H + 11:40	25 miles N of Sunny-side	3	H + 5:30	7
Henderson and Rowe	H + 11:55	Lund	3	H + 6	7
Henderson and Rowe	H + 12:20	10 miles N of Lund	7.6	H + 6	35
Meyer	H + 4:27	21 miles E of Warm Springs on Hwy 6	0.07	H + 5:00	
Meyer	H + 4:32	21 miles E of Warm Springs on Hwy 6	0.16		
Meyer	H + 4:35	21 miles E of Warm Springs on Hwy 6	0.3		
Meyer	H + 5:10	32 miles E of Warm Springs on Hwy 6	1.1	H + 5:00	1.1
Meyer	H + 5:25	47 miles E of Warm Springs on Hwy 6	3.0		
Meyer	H + 7:44	Warm Springs	3.0	H + 5:00	5.0
Meyer	H + 12:48	Warm Springs	1.0	H + 5:00	3.0
Meyer	H + 31:30	Warm Springs	0.2	H + 5:00	1.8
Shipman	H + 4:20	Warm Springs	0.8		
Meyer	H + 7:55	8 miles W of Warm Springs on Hwy 6	1.4	H + 5:00	2.0
Shipman	H + 4:45	12 miles W of Warm Springs on Hwy 6	1.8		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Meyer	H + 8:08	18 miles W of Warm Springs on Hwy 6	1.3		2.0
Shipman	H + 5:02	22 miles W of Warm Springs on Hwy 6	1.8	H+5:00	1.8
Meyer	H + 8:22	28 miles W of Warm Springs on Hwy 6	1.3		
Shipman	H + 5:20	32 miles W of Warm Springs on Hwy 6	0.6		
Meyer	H + 8:34	38 miles W of Warm Springs on Hwy 6	1.3		
Shipman	H + 9:05	5 miles NE of Tonopah on Hwy 8A	0.3	H+5:00	
Shipman	H + 9:20	15 miles NE of Tonopah on Hwy 8A	0 45		
Shipman	H + 9:35	25 miles NE of Tonopah on Hwy 8A	0.45		
Shipman	H + 9:50	35 miles NE of Tonopah on Hwy 8A	0.3	H+5:00	
Spangler	H + 9:20	Ely	2.0	H+7:00	2.7
Jaworski	H + 27:20	Ely	0.3	H+7:00	1.5
Spangler	H + 9:10	8 miles S of Ely on Hwy 93	2.5	H+7:00	3.4
Jaworski	H + 27:45	10 miles S of Ely on Hwy 93	0.4	H+7:00	1.9
Spangler	H + 8:35	28 miles S of Ely on Hwy 93	6.5	H+6:30	8.9
Jaworski	H + 28:12	27 miles S of Ely on Hwy 93	0.8	H+6:30	4.2
Spangler	H + 8:25	38 miles S of Ely on Hwy 93	12.0	H+6:30	16.0
Jaworski	H + 28:25	35 miles S of Ely on Hwy 93	2.7	H+6:30	17.0
Spangler	H + 8:15	43 miles S of Ely on Hwy 93	15.0	H+6:00	22.0
Jaworski	H + 28:30	40 miles S of Ely on Hwy 93	1.7	H+6:00	9.0
Spangler	H + 8:00	52 miles S of Ely on Hwy 93	17.0	H+6:00	24.0
Jaworski	H + 28:53	52 miles S of Ely on Hwy 93	5.5	H+6:00	35.0
Spangler	H + 7:55	54 miles S of Ely on Hwy 93	25.0	H+6:00	35.0
Jaworski	H + 28:57	54 miles S of Ely on Hwy 93	6.0	H+6:00	35.0
Spangler	H + 7:30	55 miles S of Ely on Hwy 93	32.0	H+6:00	41
Jaworski	H + 29:00	55 miles S of Ely on Hwy 93	6.0	H+6:00	39

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Spangler	H + 7:25	56 miles S of Ely on Hwy 93	45.0	H+6:00	58
Jaworski	H + 29:05	56 miles S of Ely on Hwy 93	5.5	H+6:00	38
Spangler	H + 7:20	57 miles S of Ely on Hwy 93	35.0	H+6:00	44
Jaworski	H + 29:08	57 miles S of Ely on Hwy 93	2.7	H+6:00	19
Spangler	H + 7:15	59 miles S of Ely on Hwy 93	45.0	H+6:00	56
Jaworski	H + 29:10	59 miles S of Ely on Hwy 93	2.0	H+6:00	14
Spangler	H + 7:10	60 miles S of Ely on Hwy 93	40.0	H+6:00	49
Jaworski	H + 29:13	60 miles S of Ely on Hwy 93	1.0	H+6:00	6.8
Spangler	H + 6:57	64 miles S of Ely on Hwy 93	19.0	H+6:00	24.0
Jaworski	H + 29:20	65 miles S of Ely on Hwy 93	1.5	H+6:00	10
Stafford	H + 4:20 4:50	Duckwater	*	H+6:00	
Stafford	H + 5:50	Duckwater	0.15	H+6:00	
Stafford	H + 6:10	Duckwater	0.70	H+6:00	
Stafford	H + 6:20	Duckwater	1.5	H+6:00	
Williams	H + 6:30	Duckwater	2.0	H+6:00	
Stafford	H + 7:05	Duckwater	4.0	H+6:00	4.0
Stafford	H + 8:40	Duckwater	2.0	H+6:00	3.0
Williams	H + 10:50	Duckwater	1.0	H+6:00	2.0
Stafford	H + 12:40	Duckwater	0.7	H+6:00	
Williams	H + 6:50	10 miles S of Duckwater on Hwy 20	2.0	H+6:00	
Williams	H + 11:05	9 miles N of Duckwater on Hwy 20	0.8		
Henderson and Rowe	H + 1:30 4:15	From Crystal Springs (not Nevada 38) NW to Adaven 33 miles NW of Crystal Springs	*		
Henderson and Rowe	H + 4:15	From Crystal Springs (not Nevada 38) NW to Adaven 34 miles NW of Crystal Springs	0.8	H+4:00	
Henderson and Rowe	H + 4:30	From Crystal Springs (not Nevada 38) NW to Adaven 35 miles NW of Crystal Springs	1.6	H+4:00	1.8
Henderson and Rowe	H + 4:45	From Crystal Springs (not Nevada 38) NW to Adaven 36 miles NW of Crystal Springs	5.8	H+4:00	7.5

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Henderson and Rowe	H + 4:50	From Crystal Springs (not Nevada 38) NW to Adaven 37 miles NW of Crystal Springs	16	H + 4:00	20
Henderson and Rowe	H + 4:57	From Crystal Springs (not Nevada 38) NW to Adaven 39 miles NW of Crystal Springs	80		110
Henderson and Rowe	H + 5:05	From Crystal Springs (not Nevada 38) NW to Adaven 40 miles NW of Crystal Springs	120	H + 4:00	150
Henderson and Rowe	H + 5:25	From Crystal Springs (not Nevada 38) NW to Adaven 41 miles NW of Crystal Springs	140	H + 4:00	205
Henderson and Rowe	H + 5:30	From Crystal Springs (not Nevada 38) NW to Adaven 42 miles NW of Crystal Springs	120	H + 4:00	175
Henderson and Rowe	H + 5:35	From Crystal Springs (not Nevada 38) NW to Adaven 43 miles NW of Crystal Springs	100		145
Henderson and Rowe	H + 5:42	From Crystal Springs (not Nevada 38) NW to Adaven 45 miles NW of Crystal Springs	38	H + 4:15	60
Henderson and Rowe	H + 5:50	From Crystal Springs (not Nevada 38) NW to Adaven 48 miles NW of Crystal Springs	32	H + 4:15	38
Henderson and Rowe	H + 6:20	From Crystal Springs (not Nevada 38) NW to Adaven 53 miles NW of Crystal Springs	24	H + 4:15	35
Henderson and Rowe	H + 6:30	From Crystal Springs (not Nevada 38) NW to Adaven 55 miles NW of Crystal Springs	16	H + 4:15	25
Henderson and Rowe	H + 6:52	From Crystal Springs (not Nevada 38) NW to Adaven 60 miles NW of Crystal Springs	14	H + 4:15	25
Henderson and Rowe	H + 7:50	Adaven	11	H + 4:30	18

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Henderson and Rowe	H + 57:10	1 mile W Lincoln Mine to Groom Lake via Telephone Road	8	H + 1:40	520
Henderson and Rowe	H + 57:20	5 miles W Lincoln Mine to Groom Lake via Telephone Road	7	H + 1:40	480
Henderson and Rowe	H + 57:30	7 miles W Lincoln Mine to Groom Lake via Telephone Road	10	H + 1:40	650
Henderson and Rowe	H + 57:31	8 miles W Lincoln Mine to Groom Lake via Telephone Road	10	H + 1:40	650
Henderson and Rowe	H + 57:32	9 miles W Lincoln Mine to Groom Lake via Telephone Road	6	H + 1:40	400
Henderson and Rowe	H + 57:34	11 miles W Lincoln Mine to Groom Lake via Telephone Road	8	H + 1:40	520
Henderson and Rowe	H + 57:54	12 miles W Lincoln Mine to Groom Lake via Telephone Road	12	H + 1:40	800
Henderson and Rowe	H + 57:57	13 miles W Lincoln Mine to Groom Lake via Telephone Road	10	H + 1:40	650
Henderson and Rowe	H + 58:00	14 miles W Lincoln Mine to Groom Lake via Telephone Road	4	H + 1:40	290
Henderson and Rowe	H + 58:07	16 miles W Lincoln Mine to Groom Lake via Telephone Road	3	H + 1:40	200
Henderson and Rowe	H + 58:20	20 miles W Lincoln Mine to Groom Lake via Telephone Road	4	H + 1:40	290
Henderson and Rowe	H + 58:30	25 miles SW Lincoln Mine to Groom Lake via Telephone Road	5	H + 1:00	600

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Henderson and Rowe	H + 58:37	30 miles SW Lincoln Mine to Groom Lake via Telephone Road	18	H + 1:00	2500
Henderson and Rowe	H + 58:50	32 miles SW Lincoln Mine to Groom Lake via Telephone Road	32	H + 0:45	6000
Henderson and Rowe	H + 58:52	33 miles SW Lincoln Mine to Groom Lake via Telephone Road	23	H + 0:45	5000
Henderson and Rowe	H + 58:55	34 miles SW Lincoln Mine to Groom Lake via Telephone Road	8	H + 0:45	1400
Henderson and Rowe	H + 59:09	39 miles SW Lincoln Mine to Groom Lake via Telephone Road	0.0		

*Background.

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Inclosure 7

RADIATION DOSES FOR INFINITE TIME OF EXPOSURE

Location	Time of reading	Maximum ground level, mr/hr	Fall-out time	Infinite dose, mr
32 miles SW Lincoln Mine	H + 58:50	32	H + 0:45	23 r
Duckwater	H + 7:05	4	H + 6:00	180
Adaven	H + 7:50		H + 4:30	480
41 miles NW Crystal Springs toward Adaven	H + 5:25	140	H + 4:00	4 r
Hwy 93, 59 miles south of Ely	H + 7:15	45	H + 6:00	1.5 r
Sunnyside	H + 15:15	17	H + 5:00	900
8 miles NW Lincoln Mine	H + 9:00	85	H + 1:40	6 r
Warm Springs	H + 7:44	3	H + 5:00	125
Ely	H + 9:20	2	H + 7:00	90
Preston	H + 9:15	2	H + 6:00	160
Lund	H + 11:55	3	H + 6:00	200

Inclosure 8

AIR-BORNE RADIOACTIVE DUST CONCENTRATIONS*

Location	Time of sample	Concentration, $\mu c/M^3$
Duckwater	H+4:40 to H+6:40	1.8×10^{-2}
	H+6:40 to H+8:40	7.2×10^{-2}
	H+8:40 to H+12:40	1.6×10^{-3}
	Average for 24 hr	7×10^{-3}
Currant	H+4:38 to H+9:00	8.6×10^{-5}
	H+9:00 to H+11:00	3.0×10^{-3}
	H+12:20 to H+24:08	8.6×10^{-5}
	Average for 24 hr	1.7×10^{-4}
Ely	H+5 to H+7	1.6×10^{-2}
	H+7 to H+7:25	1.1×10^{-1}
	H+25 to H+8:15	5.9×10^{-2}
	H+8:15 to H+9	4.0×10^{-2}
	H+9 to H+11	4.1×10^{-2}
	H+11 to H+15	4.3×10^{-3}
	H+15 to H+29	7.5×10^{-3}
	Average for 24 hr	1.6×10^{-2}
Lincoln Mine (listed in Incl. 14)		
Tonopah	H+6:07 to H+11:07	0.72×10^{-6}
	H+11:30 to H+15:20	1.8×10^{-6}
	H+15:35 to H+32:35	2.3×10^{-6}
	Average for 24 hr	1.81×10^{-6}
Warm Springs	H+0:10 to H+2:30	Background
	H+2:30 to H+7:10	4.36×10^{-2}
	H+7:10 to H+12:10	0.18×10^{-2}
	H+12:15 to H+25:10	0.2×10^{-4}
	Average for 24 hr	9.0×10^{-3}
CP	H+0:40 to H+0:50	2.42
	H+1:00 to H+1:55	4.1×10^{-4}

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Location	Time of sample	Concentration, $\mu c/M^3$
CP	H+1:58 to H+3:28	4.4×10^{-2}
	H+3:30 to H+15:50	2.86×10^{-2}
	H+15:50 to H+27:05	1.36×10^{-5}
	Average for 24 hr	2×10^{-4}

*Cascade Impactor samples taken at Warm Springs showed a mass median diameter of 3.85 microns. The samples taken in the shot area showed a mass median diameter of 1.02 microns.

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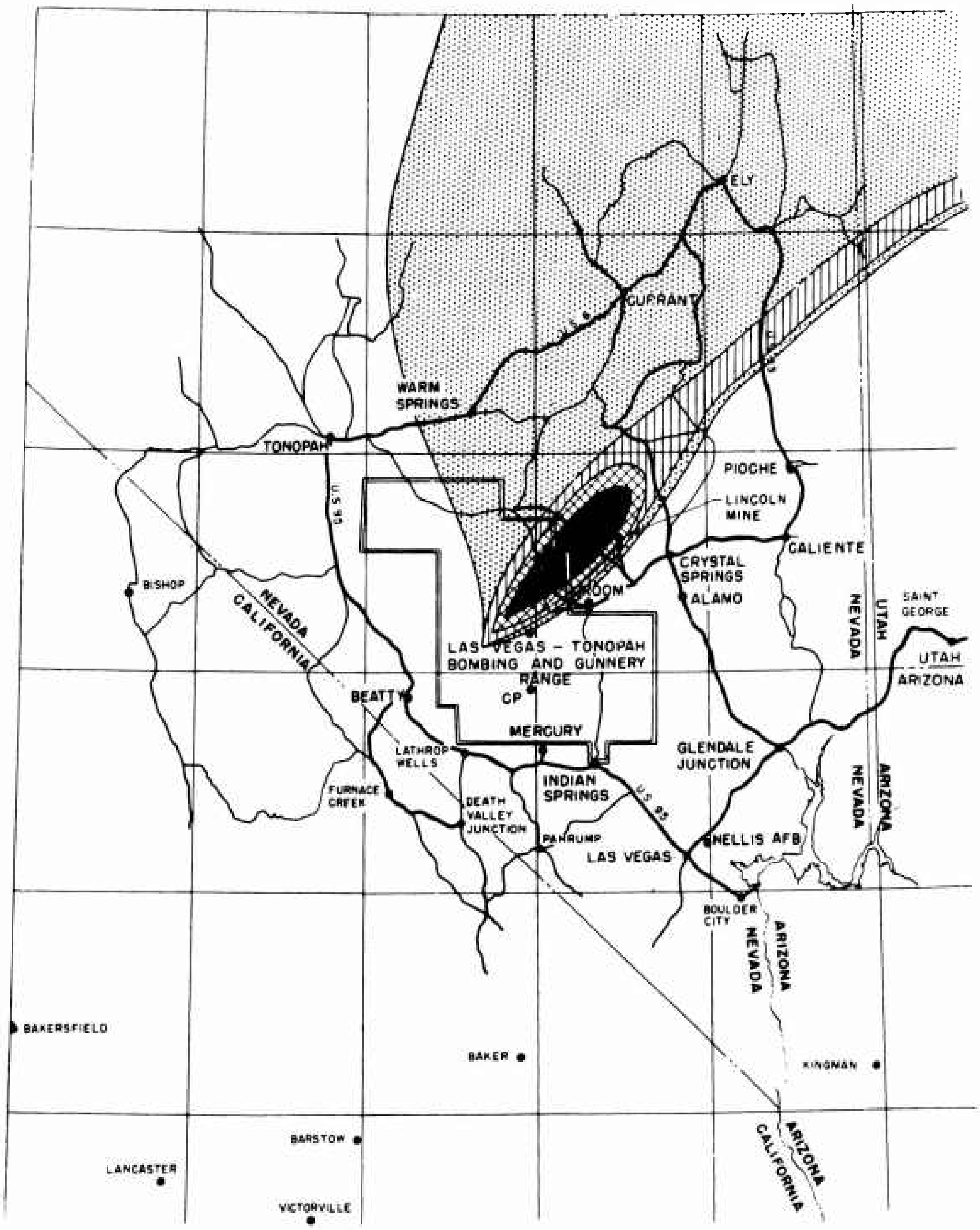
Inclosure 9

WATER SAMPLE RESULTS

Date	Time collected	Location	Activity when counted, μc/liter	Activity at time of collection, μc/liter
3/24/53	1220	56 miles N of Pioche irrigation ditch	5.96×10^{-2}	0.76
3/24	1500	Lake Meade	4.0×10^{-5}	3.32×10^{-4}
3/25	0800	Groom Mine	9.1×10^{-6}	2.3×10^{-5}
3/25	0630	Crystal Springs	Background	
3/25	1800 (H+37)	Mess hall Lincoln Mine	7.6×10^{-4}	1.31×10^{-3}
3/27	1400	Mess hall Lincoln Mine	2.51×10^{-4}	3.3×10^{-4}

Inclosure 10

GROUND MONITORING RESULTS, SHOT NANCY



Shot Nancy, spring 1953. [solid black], 400 mr/hr or above at time of fall-out. [cross-hatched], 200 to 400 mr/hr at time of fall-out. [vertical lines], 20 to 200 mr/hr at time of fall-out. [dotted], 2 to 20 mr/hr at time of fall-out. Heavy lines indicate the monitoring runs.

Inclosure 11

LOG OF EVENTS, LINCOLN MINE, MARCH 24, 1953

1. Lincoln Mine monitoring station was established at 1600, 3/23/53, with a Hi-Volume sampler, background recorder, fall-out trays, cascade impactors, jeep, and two monitors.

2. Bomb cloud debris became visible to Lincoln Mine station at 0550 PST. Bomb debris cloud passed directly overhead at 0615. At this time three separate clouds were apparent. All three layers were moving in a north-northeast direction. Low level clouds passed over station at 0625.

3. Fall-out became apparent at 0650 when a reading of 3 mr/hr was noted. By 0709 a peak reading of 580 mr/hr was found.

4. At 0650, the monitor in charge informed Mr. Perkins, Mine Supt., of the situation and asked about the possibility of the open pit miners taking cover. This suggestion was immediately followed. At 0720 fall-out appeared virtually complete, and Mr. Perkins was so informed. When (0730) the AN/PDR 39 reading outdoors was 350 mr/hr, the reading indoors in typical one-room frame house was 200 mr/hr.

Formal radio instructions confirming the above action received at 0704. At 0900 radio instructions advised resumption of normal activities.

5. At 0740 PST a low level dust and bomb debris cloud was observed 5 miles west of Lincoln Mine. The cloud, traveling north at approximately 10-15 mph, filled the width of Penoyer Valley, and appeared to have a maximum altitude of 2000 ft due to apparent temperature inversion. A single reading made at 1210 at Shadow Ranch, $4\frac{1}{2}$ miles northwest of mine, was 120 mr/hr, while reading at mine was 90 mr/hr. Transmitted message to CP via Groom Mine radio.

6. Mr. Joseph B. Sanders, AEC-LVFO, arrived at 0920 to consult with Mr. Perkins. Maj John Servis, Cml. C., AUS, and Mr. Duncan Holaday, PHS, visited at 1300.

H. J. L. RECHEN, Sanitary Engineer
U. S. Public Health Service
Off-Site Monitor-in-charge

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Inclosure 12

GAMMA EXPOSURE LEVELS AT LINCOLN MINE

Time	Mr/hr	Time	Mr/hr
March 24, 1953 0650	3.2	March 24, 1953 0920	160
0635	28	0930	140
0655	50	0945	130
0655	90	1000	140
0656	150	1015	130
0658	200	1035	120
0659	280	1045	105
0700	350	1100	110
0702	400	1110	105
0703	500	1140	100
0709	580	1210	90
0711	460	1240	80
0714	450	1310	70
0719	430	1340	60
0730	350	1405	60
0740	330	1440	50
0745	320	1510	45
0750	300	1540	44
0755	280	1610	44
0800	280	1640	40
0805	280	1710	37
0815	275	1810	35
0820	275	1910	30
0825	235	2010	28
0830	220	2210	25
0835	225	March 25, 1953 0510	15
0840	220	0910	14
0845	205	1510	11
0855	195	March 26, 1953 1410	60
0900	180	March 27, 1953 1310	5
0910	170	March 29, 1953 1510	1.5

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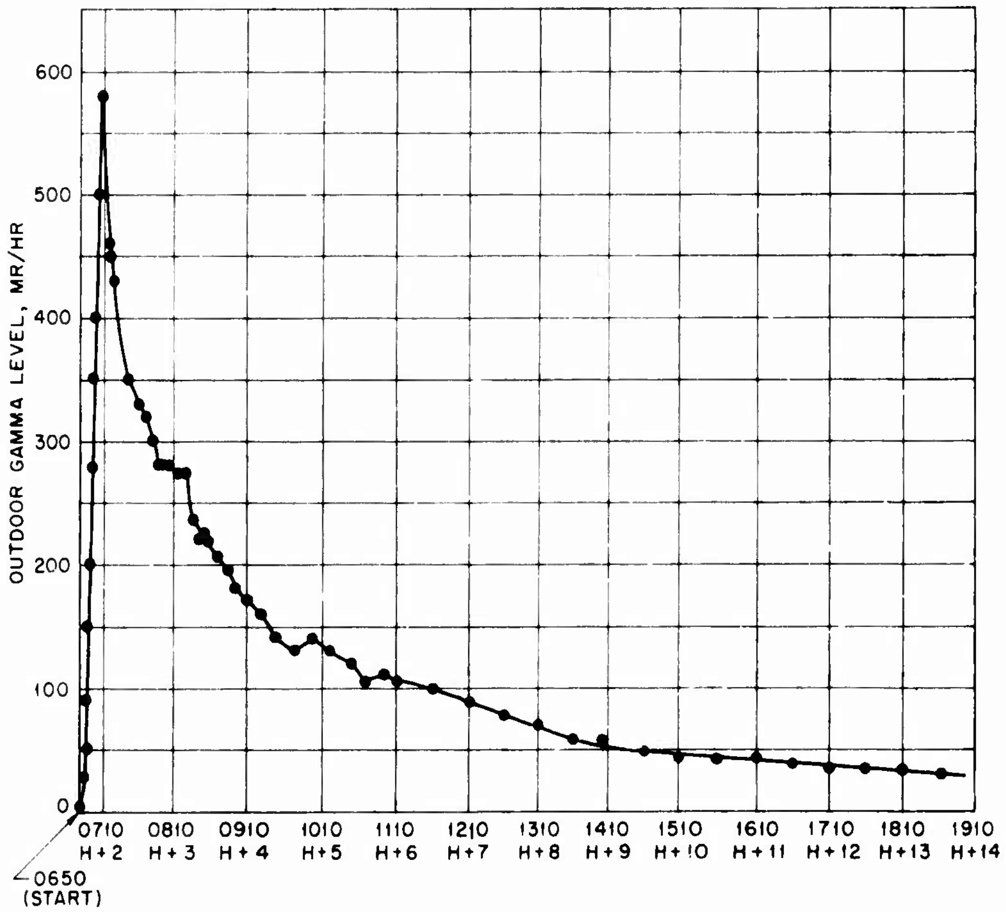

Outdoor gamma level, Shot Nancy. AN/PDR 39 readings. Fall-out commenced at 0650 PST, 24 March 1953. 1 sq in. = 0.167 r. Area (0650 to 1850, 12 hr) = 8.18 sq in. Equivalent dose = 1.36 r for first twelve hours (H + 1:40 to H + 13:40). Dose from 12 hr to infinity = 2.05 r. Total life dose = 3.41 r.

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Inclosure 13

FILM BADGE RESULTS AT LINCOLN MINE

Time worn	Badge No.	Reading, r	Name	Location
H−1 to H+29 hr	3455	1.275 (gamma only)	H. Rechen	90% indoors
H−1 to H+29 hr	3350	1.220 (gamma only)	E. Claborn	50% indoors
H−1 to H+29 hr	3394	1.825 (gamma only)	K. Frith	Outdoors
H−1 to H+29 hr	3451	1.040 (gamma only)	E. G. Woods	In mine office
H+27 to H+37		0.050	J. Fooks	Outdoors

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Inclosure 14

AIR SAMPLING RESULTS AT LINCOLN MINE

Type of sampler	Time of sample	Result
Cascade impactor	0550 to 0740, 3/24	Median size, 3.9 μ
Cascade impactor	0800 to 1000, 3/24	Median size, 3.3 μ
Cascade impactor	1015 to 1415, 3/24	Median size, approximately 12 μ
Cascade impactor	1425 to 2010, 3/24	Median size, 2.0 μ
Cascade impactor	2020 to 0505, 3/24 to 3/25	Median size, 1.5 μ
Cascade impactor	0530 to 1745, 3/25	Median size, 1.9 μ
Hi-Volume air sampler	1730 to 1835, 3/23	Background
Hi-Volume air sampler	0410 to 0555, 3/24	Background
Hi-Volume air sampler	0555 to 0720, 3/24	5.95 $\mu c/M^3$
Hi-Volume air sampler	0720 to 0805, 3/24	0.3 $\mu c/M^3$
Hi-Volume air sampler	0805 to 0835, 3/24	8.6×10^{-2} $\mu c/M^3$
Hi-Volume air sampler	0835 to 1035, 3/24	5.4×10^{-2} $\mu c/M^3$
Hi-Volume air sampler	1035 to 1305, 3/24	1.36×10^{-2} $\mu c/M^3$
Hi-Volume air sampler	1305 to 2005, 3/24	3.1×10^{-3} $\mu c/M^3$
Hi-Volume air sampler	2005 to 0505, 3/24 to 3/25	9.85×10^{-4} $\mu c/M^3$
Hi-Volume air sampler	0510 to 1745, 3/24 to 3/25	6.4×10^{-4} $\mu c/M^3$
Fall-out tray	0410 to 0910, 3/24	8.37×10^6 d/m/ft^2
Fall-out tray	0910 to 0510, 3/24 to 3/25	1.19×10^7 d/m/ft^2

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Inclosure 15

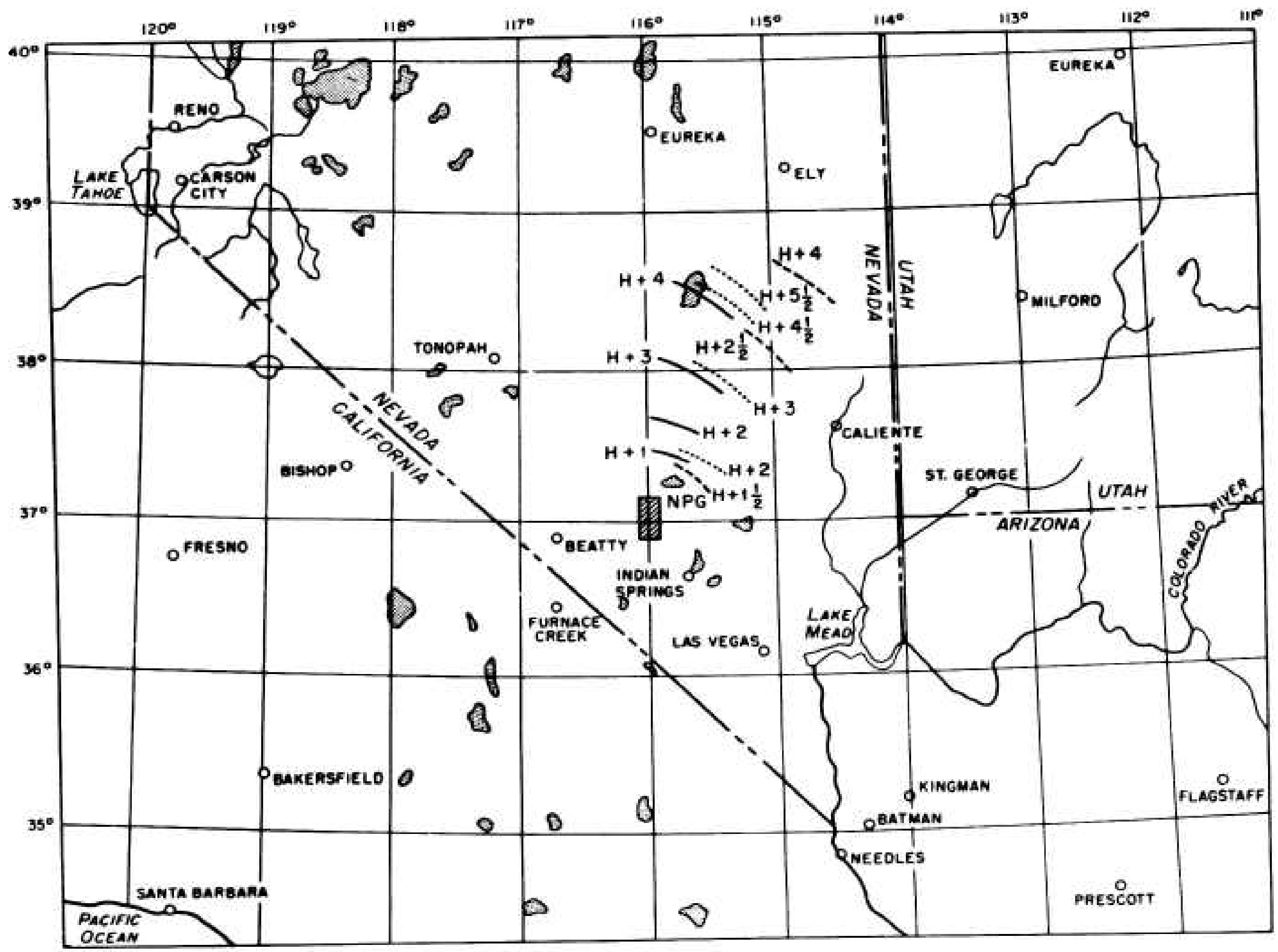
DATA FOR CLOUD TRACKING AIRCRAFT B-29 AND B-25

Position	Time	Altitude, ft	Direction of cloud	Meter readings, mr/hr MX-5	Meter readings, mr/hr T1B	Remarks
			Cook Book 1 (B-29)			
A 42	0530	22,000	Over aircraft	5	5	
E 41	0542	22,000		20	21	Background
C 41	0549	22,000	Directly overhead	20	26	
CA 40	0601	22,000	SW	20	28	
B 39	0609	22,000		11	10	Background
C 40	0615	22,000	Directly overhead	20	1500	Configuration ragged
B 40	0633	22,000	W	19	18	
D 38	0645	22,000	Directly above	20	21	
C 38	0700	22,000	W	19	18	
D 35	0716	22,000	S	20	65	
E 37	0725	22,000	S	20	73	
F 36	0741	22,000	Directly above	20	90	
E 36	0805	22,000	N	20	80	
I 36	0831	22,000	W to N	20	210	
H 33	0906	22,000	NE	20	200	Rosie below at D-36, above at J-32
G 33	0918	22,000	SE	20	200	
J 31	0950	25,000	NE	30	100	
Q 32	1005	25,000	W	20	50	
I 34	1041	25,000	NE	20	20	Background
L 29	1057	25,000	NE	20	29	
M 28	1100	25,000	NE	20	75	
S 28	1120	25,000		17	17	
			Cook Book 2 (B-29)			
ZA 41	0534	20,000	N	13	34	
A 41	0536	20,000	N	20	8000	
A 45	0543	20,000	N	20	300	
B 40	0604	18,000	SE	20	280	
A 40	0618	18,000	E	20	130	
C 37	0627	18,000	SE	20	100	Background count
A 40	0640	18,000	S	20	2000	Top of Rosie appears over 25000 NNE

Position	Time	Altitude, ft	Direction of cloud	Meter readings, mr/hr		Remarks
				MX-5	T1B	
A 40	0653	18,000	E	20	120	Rosie traveling approximately 12 knots
A 40	0709	18,000	W	20	140	Middle Rosie top approximately 18,000 stem to E and moving W at highest level
C 41	0726	18,000	NE	20	20	Background count
B 39	0743	18,000	NE	20	100	Heaviest portion Rosie at 18,000 thin at upper levels
B 37	0756	18,000	S	20	50	Background count
B 38	0800	18,000	S	20	180	
C 37	0809	18,000	W	20	125	One stem extends E
A 38	0820	18,000	SE	20	65	
C 37	0833	18,000	NNW	20	150	Rosie moving NE at 10 knots
G 36	0845	18,000	N	20	35	Background count
F 35	0849	18,000	W	20	75	
C 37	0859	18,000	N	20	60	
F 35	0909	18,000	W	20	80	
C 35	0931	18,000	NE	20	30	
C 34	0946	18,000	E	20	25	
D 33	0949	18,000	SSE	20	110	
F 30	0959	18,000	SSW	[illegible]	25	
CF 33	1009	18,000	WSW	20	60	
CE 32	1022	18,000	S	20	120	
D 33	1035	18,000	NE	20	40	Rosie moving approximately 20 knots at 20° appears to be dissipating
F 39	1053	18,000	W	8	19	Background
			Cook Book 3 (B-25)			
A 42	0547	12,000	N	20	480	
ZA 40	0600	12,000	Left	20	1800	
A 40	0601	12,000	S	20	100	
A 40	0630	12,000	SW	20	230	
A 40	0646	12,000	N	20	48	
B 39	0701	12,000	WNW	20	70	Background 10
B 38	0716	12,000	S	20	55	
B 38	0737	12,000	WSW	20	36	
B 38	0757	12,000	NW	20	30	Background 7
C 37-1	0810	12,000	WSW	18	22	
C 35.1	0827	12,000	E	20	50	Background 7
D 35	0848	12,000	N	20	24	
D 34	0901	12,000	WSW	17	20	
C 34	0920	12,000	E	11	13	Background; formation appears to settle

Inclosure 16

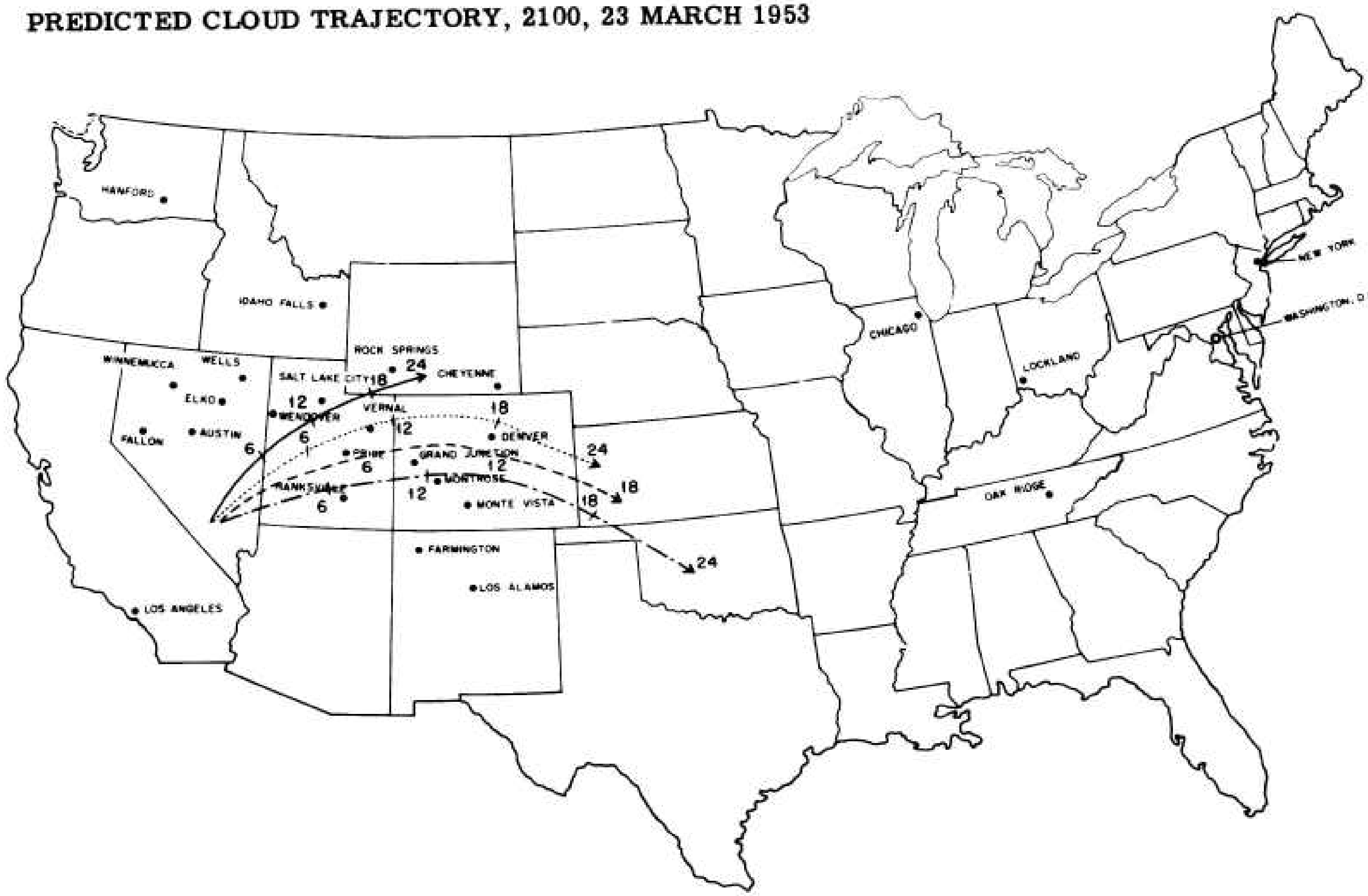
ACTUAL CLOUD TRACK, SHOT NANCY



Cloud position:——, 12,000 ft msl. ·····, 18,100 ft msl. - - - - -, 22,000 to 25,000 ft msl.

Inclosure 17

PREDICTED CLOUD TRAJECTORY, 2100, 23 MARCH 1953



Cloud position: ——, 10,000 ft msl. ·····, 20,000 ft msl. ----, 30,000 ft msl. – – , 40,000 ft msl.

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Inclosure 18

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 AND C-47

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	Calculated intensity at H+1 hr MX-5	T1B	"Scint"
			Ever Ready (L-20)					
C 42	0705	500	0.5	0.6	0	0	0	0
ZA/A 42	0719	500	>20	400	180	755	1000	500
ZC 42	0724	500	0.3	0.6	0	0	0	0
ZC 42/41	0726	500	0.2	0.6	0	0	0	0
ZA/A 41/42	0735	500	7	8	4.2	20	24	12
1/4A/B 41/42	0738	500	>20	40	17.5	760	120	50
D 41/42	0748	500	1.5	0.6	0	5	0.9	0
D 41	0751	500	0.3	0.3	0	0	0	0
A 41	0759	500	>20	100	31	770	340	100
A 41/40	0802	500	8	8	3.3	28	28	10
D 41/40	0818	500	0.5	0.5	0	0	0	0
E 41	0822	500	0.6	0.6	0	0	0	0
ZA 39	0933	500	0.55	0.5	0.59	0	0	0
			Rag Mop (C-47)					
E 43	0826	1000	0.025	0.02	0.012	0	0	0
F 40	0842	500	0.03	0.05	0	0	0	0
E 40	0847	800	0.05	0.03	0	0	0	0
D 40	0851	500	0.05	0.03	0	0	0	0
C 40	0854	900	0.035	0.03	0	0	0	0
B 40	0858	500	1.5	1.1	1.3	7	5	6
A 40	0900	500	2	1.6	1.55	10	8	8
ZA 40	0904	500	2	2	2.05	10	10	10
ZA/ZB 41	0916	700	0.2	0.2	0.13	1	1	0.7
ZB 41	0918	500	0.1	0.2	0.088	0.5	1	0.4
ZB1/2 40	0922	500	0.13	0.08	0.068	0.5	0	0
ZC 39	0926	500	0.08	0.08	0.06	0	0	0
ZB 39	0930	500	0.17	0.1	0.11	0.9	0.5	0.5
ZA 39	0933	500	0.55	0.5	0.59	3	3	4
A 39	0937	500	2	1.9	1.75	12	11	10
B 39	0938	500	4	3.3	3.0	25	20	19
C 39	0941	500	7	7	6.2	35	35	28
D1/2 39	0946	500	0.1	0.2	0.11	0.6	1.2	0.6
E 39	0953	500	0.07	0.2	0.01	0	0	0
F 39	0957	1000	0.05	0.3	0.01	0	0	0

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	Calculated intensity at H + 1 hr MX-5	T1B	"Scint"
G 39	0959	900	0.07	0.2	0.01	0	0	0
H 39	1024	500	0.25	0.4	0.012	1.5	2.5	0
I 38	1032	500	0.045	0.1	0.012	0	0	0
H 38	1035	500	0.06	0.1	0.01	0	0	0
G 38	1040	500	0.045	0.2	0	0	0	0
F 38	1042	500	0.075	0.1	0.01	0	0	0
E 38	1044	500	4	1	1	30	8	8
D 38	1047	500	1.2	1.2	1.15	8	8	8
C 38	1051	500	0.7	0.6	0.59	5	5	5
B 38	1055	500	1.5	1.1	0.95	12	9	8
A 38	1058	600	0.5	0.6	0.4	4	5	3
ZA 38	1100	500	0.7	0.4	0.46	6	3	3
AB 38	1103	500	0.3	0.2	0.25	2.5	1.5	2
AB 37	1112	500	0.35	0.3	0.29	2.5	2.5	2.5
A 36	1119	500	0.27	0.2	0.22	0	0	0
B 36	1122	500	0.15	0.1	0.06	0	0	0
C 36	1125	1000	0.1	0.3	0.048	0	0	0
D 36	1130	500	0.2	0.3	0.19	1.5	2	1.5
E 36	1132	500	1.7	1.6	1.3	15	14	13
F 36	1137	500	4.5	5.0	2.7	36	48	27
G 36	1150	500	0.06	0.3	0.01	0	0	0
H 36	1153	500	0.1	0.1	0.012	0	0	0
I 36	1156	500	0.07	0.4	0.012	0	0	0
J 36	1157	500	0.08	0.2	0.012	0	0	0
K 36	1201	500	0.06	0.2	0.01	0	0	0
L 36	1203	500	0.05	0.2	0.01	0	0	0
M 36	1205	500	0.04	0.1	0.01	0	0	0
L 37	1208	700	0.06	0.2	0.01	0	0	0
K 37	1213	500	0.08	0.2	0.01	0	0	0
J 37	1215	500	0.05	0.0	0.01	0	0	0
I 37	1219	600	0.055	0.2	0.01	0	0	0
H 37	1221	500	0.04	0.1	0.01	0	0	0
G 37	1224	500	0.08	0.1	0.012	0	0	0
F 37	1227	500	0.04	0.3	0.01	0	0	0
E 37	1231	500	0.03	0.2	0.096	0	0	0
D 37	1234	500	3	3	1.45	32	32	15
DC 37		500		4.5			50	
C 37	1238	500	0.8	0.8	0.64	8	8	7
B 37	1243	600	2	2.2	1.3	22	25	15
A 37	1247	500	2.5	4	1.55	28	45	17

*The grid system is that shown in Incl. 9, Chap. 2.

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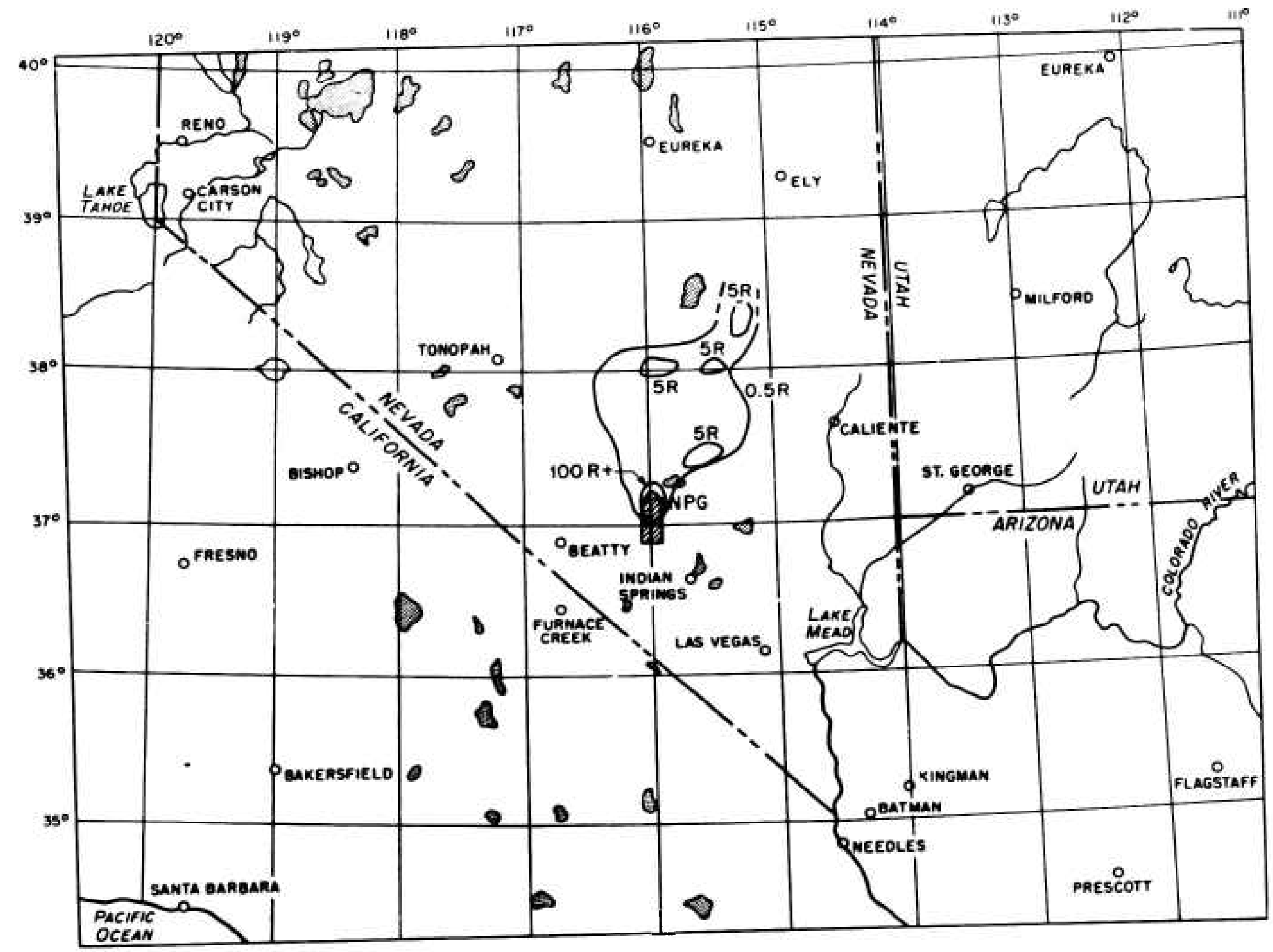


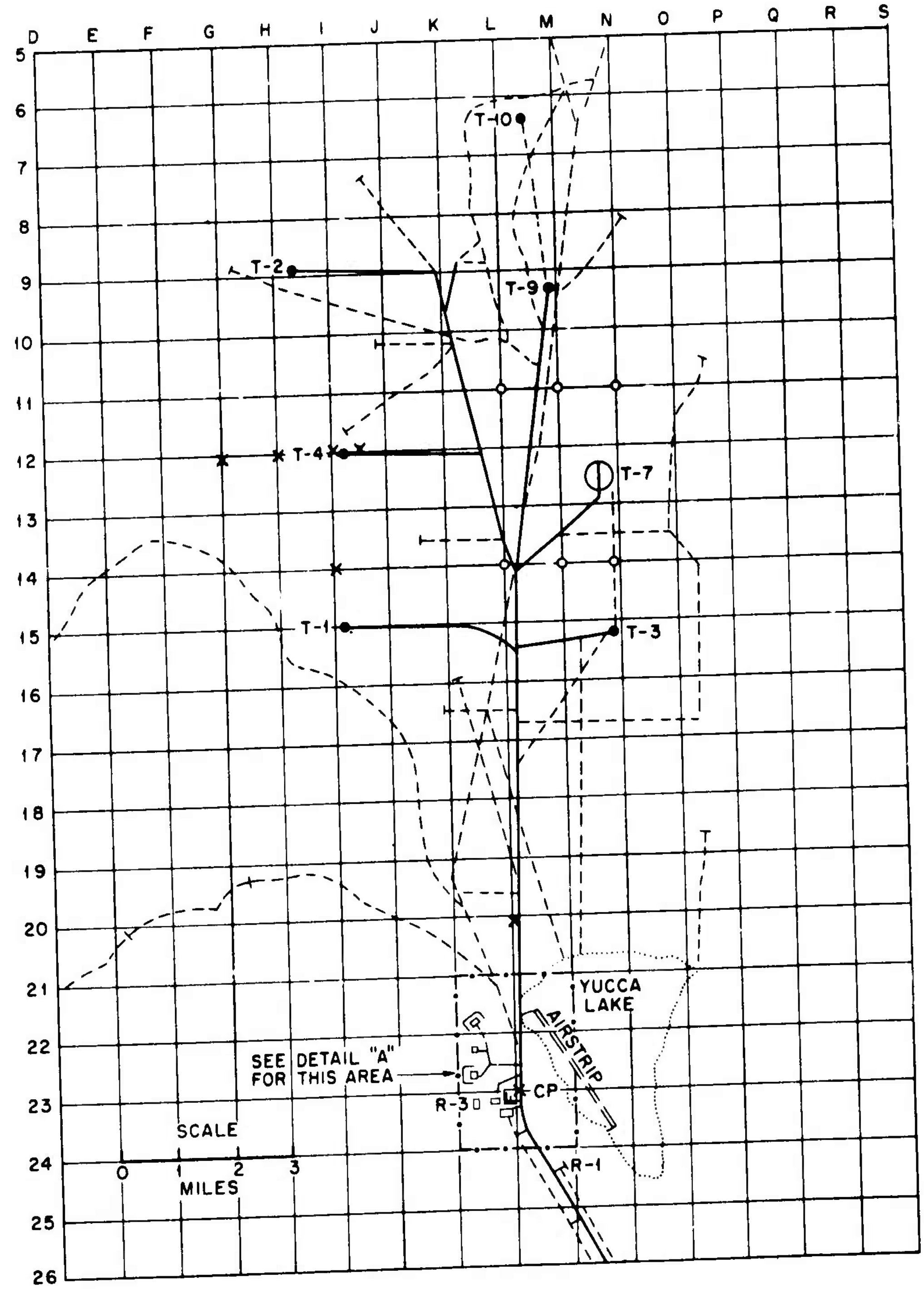
Infinite dose fall-out plot, aerial survey only. Shot Nancy, 24 March 1953.

Inclosure 19

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter reading, mr/hr
G 12	0832	500	20
H 12	0833	500	500
I 12	0834	500	20,000
I 14	0835	500	1
I 13	0837	500	30
I 12.5	0838	500	1,000
N 32	0527	50	0
L 23	0535	50	0
L 20	0538	50	0
L 17	0542	50	0
L 15.5	0545	50	0
L 14	0546	50	0
I 14	0550	50	0.2
G 14	0552	50	4
G 12	0555	50	2
G 10	0558	50	1,000
E 10	0600	50	500
I 10	0605	50	10,000
K 10	0615	50	40
K 12	0620	50	3
N 14	0626	50	0
O 12	0628	50	0
N 11	0630	50	0
M 12	0632	50	0
M 22	0640	50	1
R 33	0647	50	0†
M 26	0650	50	2

*Grid coordinates are shown on Security Map No. 1, LVFO, attached.
†Frenchman Flat reading.



Security map No. 1., LVFO Security Branch, showing coordinate system.

Inclosure 20

DATA ON LOCATION OF CATTLE (EXTRACTED FROM TERRAIN SURVEY AIRCRAFT C-47 LOG)

Position	Time	Remarks
F 40	0842	50 cattle; also 15 at F 41; 100 at Alamo
ZA/ZB 41	0916	40 cattle at $ZA\frac{1}{2}$ 40
$D\frac{1}{2}$ 39	0946	20 cattle at C 39
I 38	1032	6 horses and 200 cattle at H 39
A 38	1058	50 cattle here
E 37	1231	20 cattle here
B 37	1243	6 cattle here

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Chapter 4

SHOT RUTH*

4.1 INTRODUCTION

4.1.1 The third shot of the Upshot-Knothole series, Ruth, was detonated on a 300 ft tower in Area 7 of Yucca Flat, NPG, at 0500, 31 March 1953. The decision to fire was made at the 2100-hr weather briefing on 30 March 1953. The decision was made in spite of the fact that the prevailing winds were forecast to be in the direction of Indian Springs and Las Vegas. This decision was justified by the fact that nowhere outside of NPG was any fall-out detected.

4.1.2 The On-Site ground survey started at 0522 and was completed by 0711. Communications were very poor during this survey; however, owing to the small area and low intensities involved, this did not present as great a problem as might have been expected. "R" (general recovery) hour was announced at 0615. Prior to this time three projects had been released by the Test Director.

4.2 ON-SITE OPERATIONS

4.2.1 Two dry runs were conducted on D–4, and one was conducted on D–3. The initial survey for this shot was routine. Ground contamination was less than for any of the previous shots. Subsequent surveys were made daily through 3 April 1953. The initial survey plot and all subsequent plots for Shot Ruth are attached as Incl. 1. Inclosure 2 shows the general radiological situation on 2 April in the Yucca Flat Area as a result of the first three shots.

4.2.2 Communications on Shot Ruth were very poor. Plotting and Briefing was able to hear the survey teams, but transmission to the survey teams was for the most part unreadable. On other days during this period, communications ranged from satisfactory to very poor.

4.2.3 No particular problems with regard to monitoring were experienced owing to the small size of the contaminated area. However, valuable experience was gained since the survey teams took readings too early and a change in the fall-out pattern was noted when later readings were taken. The first reading for the initial survey for this shot was at 0522, 22 min after shot time.

4.2.4 Two hundred ninety-seven (297) persons in seventy-three (73) parties were briefed and cleared for entry into the controlled contaminated areas during this period (30 March through 5 April). Approximately 1200 film badges were processed, and one hundred fifty-two (152) vehicles were decontaminated during the period.

4.2.5 For this shot, "channel markers" were placed at the end of the stake lines to assist the survey teams in finding their designated area. These markers are pyramidal in shape, painted white, and 10 ft high. An additional wash rack with a long ramp was built to replace

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* Period covered, 30 March to 4 April 1953.

one of the old unsatisfactory ones. A "Signs" detail was organized to keep all access roads to contaminated areas properly marked with radiation signs. A danger radiation sign was posted at the 10 mr/hr line, and a sign stating "monitor required beyond this point" was posted at the 100 mr/hr iso-intensity line. This was done to reduce the number of check point monitors required for other than main access roads.

4.3 OFF-SITE OPERATIONS

4.3.1 The changes in the anticipated fall-out pattern resulting from this detonation are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Sec. II, WT-705). By shot time the areas of primary interest were Indian Springs and Las Vegas. Off-Site mobile teams and equipment were moved to provide maximum coverage in the communities in the path of fall-out.

4.3.2 Significant ground levels were detected only at the CP and Mercury with these values rapidly returning to normal background. At points other than the above, levels were residual radiation from previous detonations. A documentation of ground monitoring results is given in Incl. 3.

4.3.3 Air sampling results provided the only means of following the fall-out pattern in most communities. Levels of the order of 10^{-7} to 10^{-4} $\mu c/M^3$ were considered significant to indicate points of fall-out, as the low level of the fall-out did not permit its detection with survey meters. A tabulation of air concentrations is given in Incl. 4. A pictorial presentation of the fall-out pattern was not possible; however the specific locations where fall-out occurred are shown in Incl. 5.

4.3.4 The results of water samples analyzed for fission-product activity are presented in Incl. 6.

4.4 AIR PARTICIPATION

4.4.1 Weather information indicated that the radioactive air mass would move in the direction of Indian Springs and Las Vegas. Recommendations were made to close the air space at all altitudes for a radius of 50 miles from ground zero from 0430 to 0630 hr PST on D-day to all except test aircraft. In addition, the air space enclosed by the 90° and 160° vectors from ground zero out to a radius of 150 miles was recommended closed to all except test aircraft at 21,000 ft msl and below from 0630 to 1130 hr on D-day. At H+30 min Amber 2 and all areas east were cleared at all altitudes, as well as at all altitudes above 16,000 ft msl west of Amber 2. A warning area within 180 miles radius of Las Vegas in all directions and at all altitudes below 21,000 ft msl to be effective from 0430 to 1130 hr was recommended.

4.4.2 The cloud tracking aircraft, two B-29's (Cook Book 1 and 2) and one B-25 (Cook Book 3) were off from Indian Springs Air Force Base on schedule. The two B-29's were released and returned to base as the cloud had reached its maximum height of 14,300 ft msl. The B-25 tracked the cloud at 12,000 ft msl. The data it reported are attached as Incl. 7. These data are plotted and attached as Incl. 8. Inclosure 9 shows the predicted cloud trajectory. The procedure for tracking remained the same as for previous shots. The last position of the cloud was given by a sampler aircraft as over the south portion of Lake Mead. The maximum radiation intensity in the cloud was 50 mr/hr (at H+4½ hr).

4.4.3 The close-in aerial survey was performed by helicopter. It was off from Mercury at H+2 min and performed its mission in a highly satisfactory manner. Data from this flight are attached as Incl. 10.

4.4.4 The extended survey was performed by an L-20 and a C-47 aircraft. Communications were generally good, but the data were negative except for two readings obtained by the L-20 near ground zero. The L-20 data are attached as Incl. 11; the C-47 data are attached as Incl. 12. No plot was made of the data as negative results are indicated throughout. No

D + 1 day aerial survey was made.

4.5 LOGISTICS AND SUPPLY

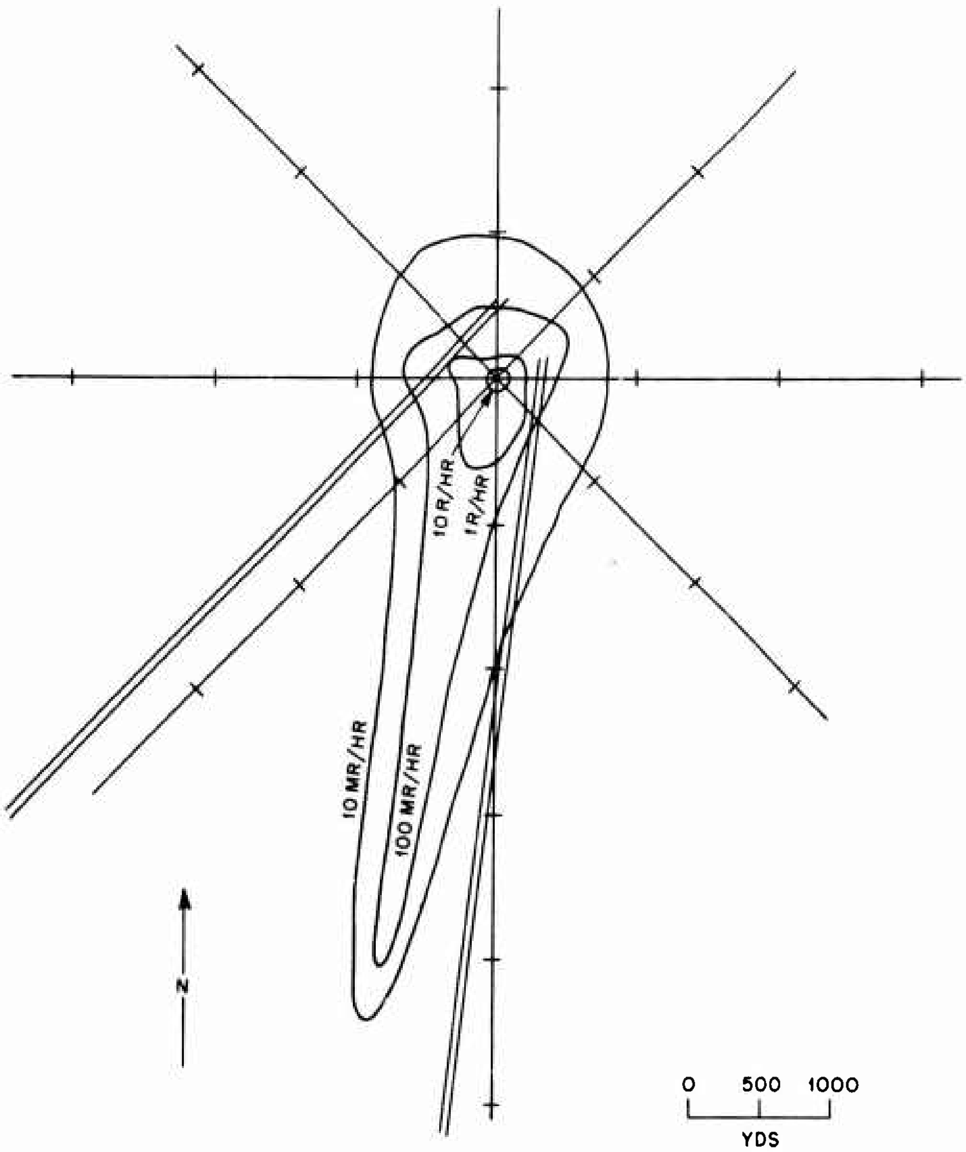
4.5.1 For the period of 30 March to 3 April, the Supply Section issued 131 shoe covers, 95 protective caps, 153 coveralls, 105 pairs of cotton gloves, 187 high intensity goggles, 17 protective goggles, and 80 respirators. The laundry serviced 204 shoe covers, 66 protective caps, 196 coveralls, 112 pairs of gloves, 69 respirators, 31 pillowcases, 62 sheets, and 63 towels. The Instrument Repair Section repaired 37 instruments and recalibrated 6 instruments. Fifty-five (55) radiac instruments were issued during this period. Second echelon maintenance was performed on 22 vehicles. Two vehicles were deadlined.

4.6 GENERAL

The radiological problem connected with shot Ruth was very minor. No great difficulty was expected. The cloud was tracked for 4½ hr, at which time the maximum intensity in it was 50 mr/hr. Ground contamination was so minor that it could not be detected on the ground by survey type instruments. This shot shows that a small yield shot from a high tower where the fireball does not touch the ground can be treated as an air burst with little extended contamination.

Inclosure 1

SURVEYS OF TEST AREA 7



Initial survey, 0600, 31 March 1953, Test Area 7-5A (H-hour, 0500).

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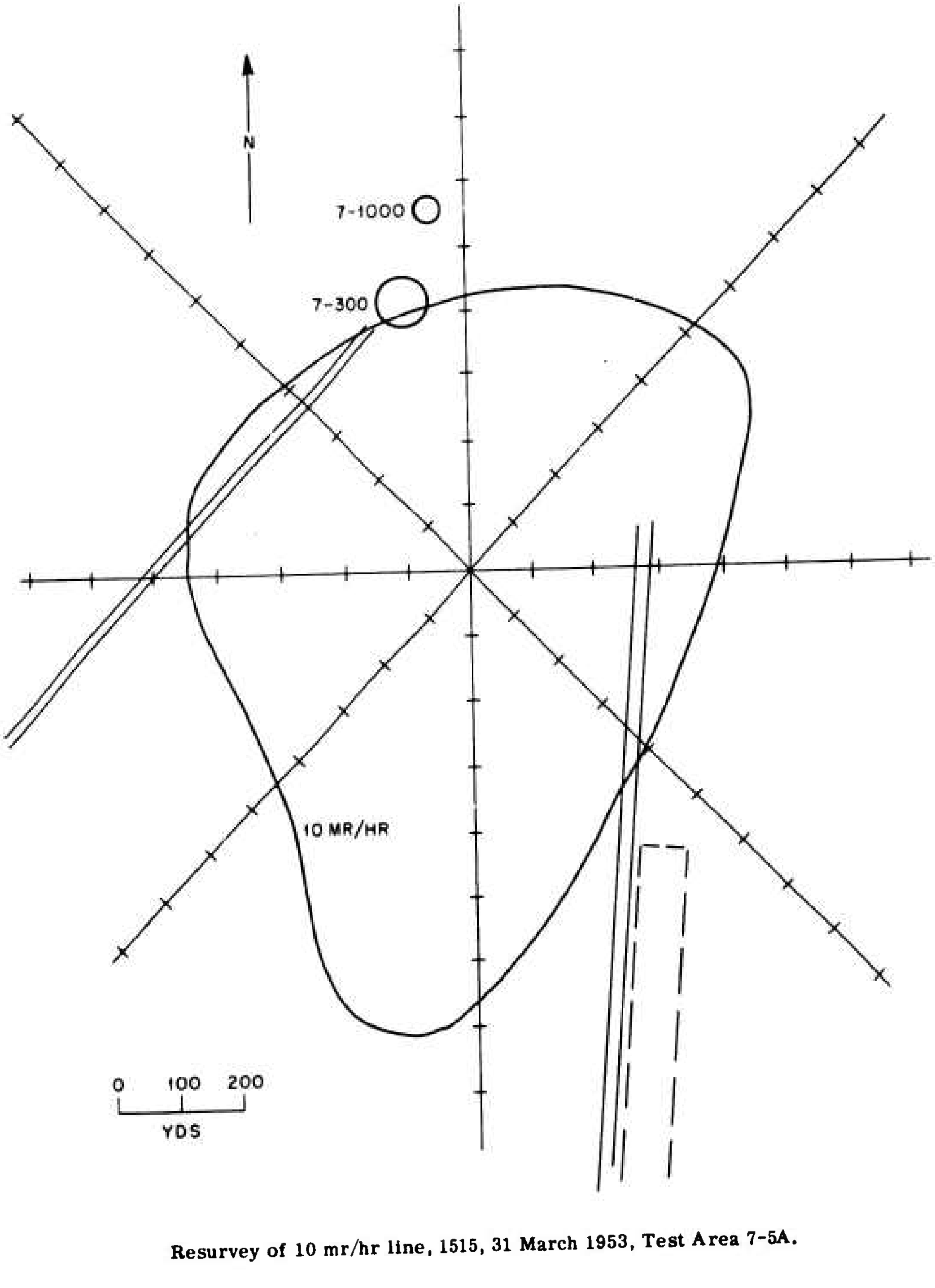
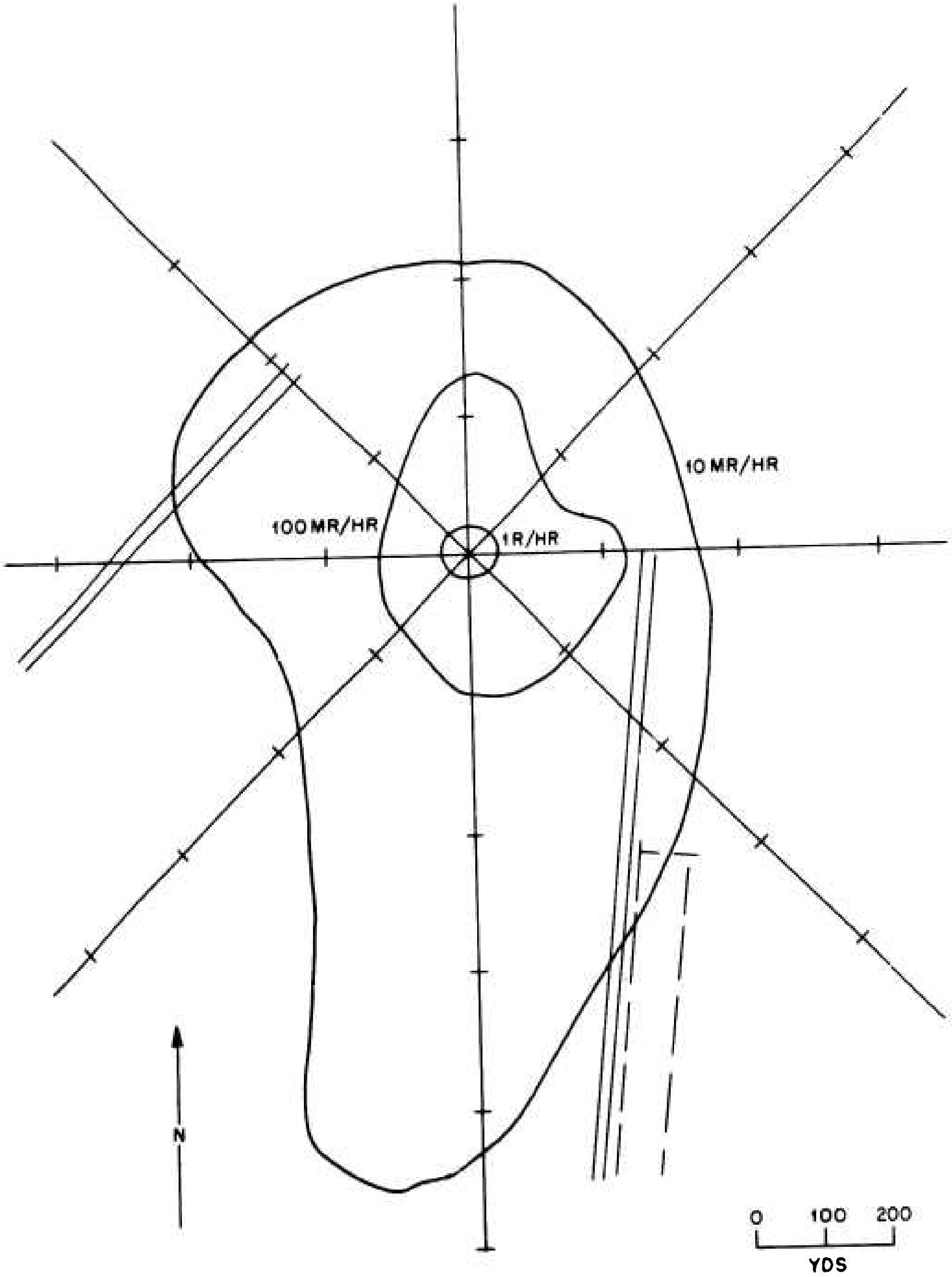
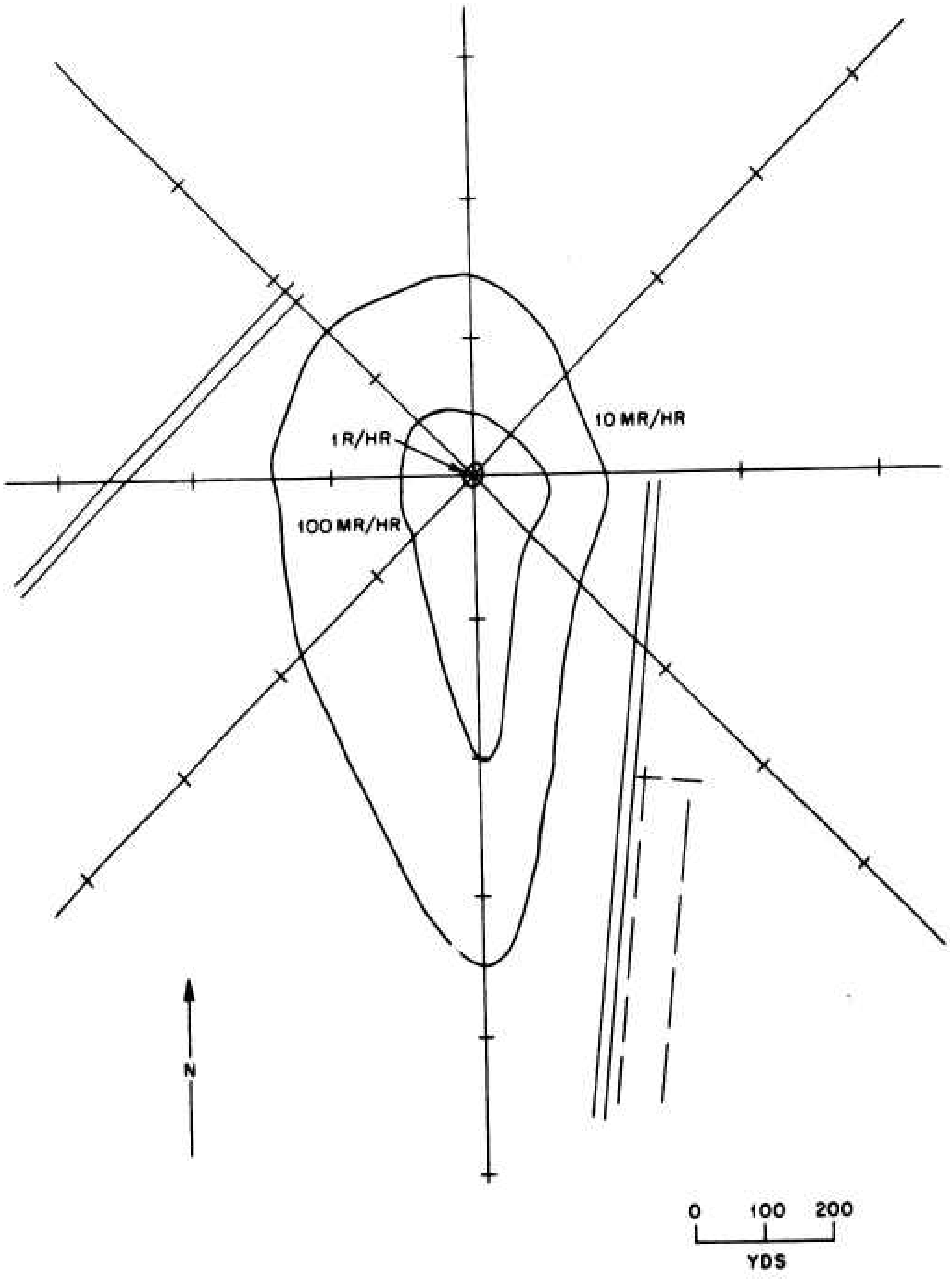


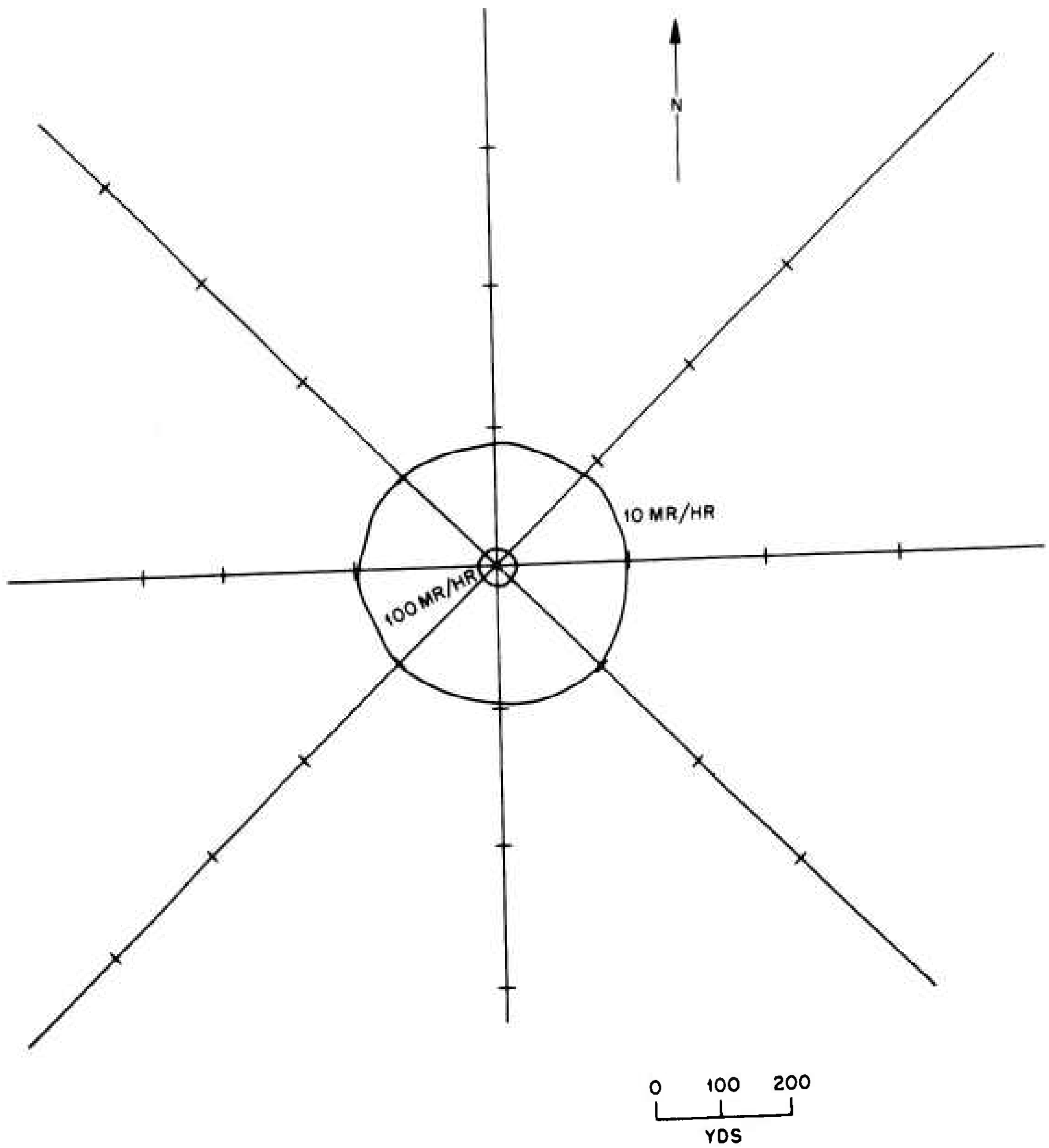
Resurvey of 10 mr/hr line, 1515, 31 March 1953, Test Area 7-5A.



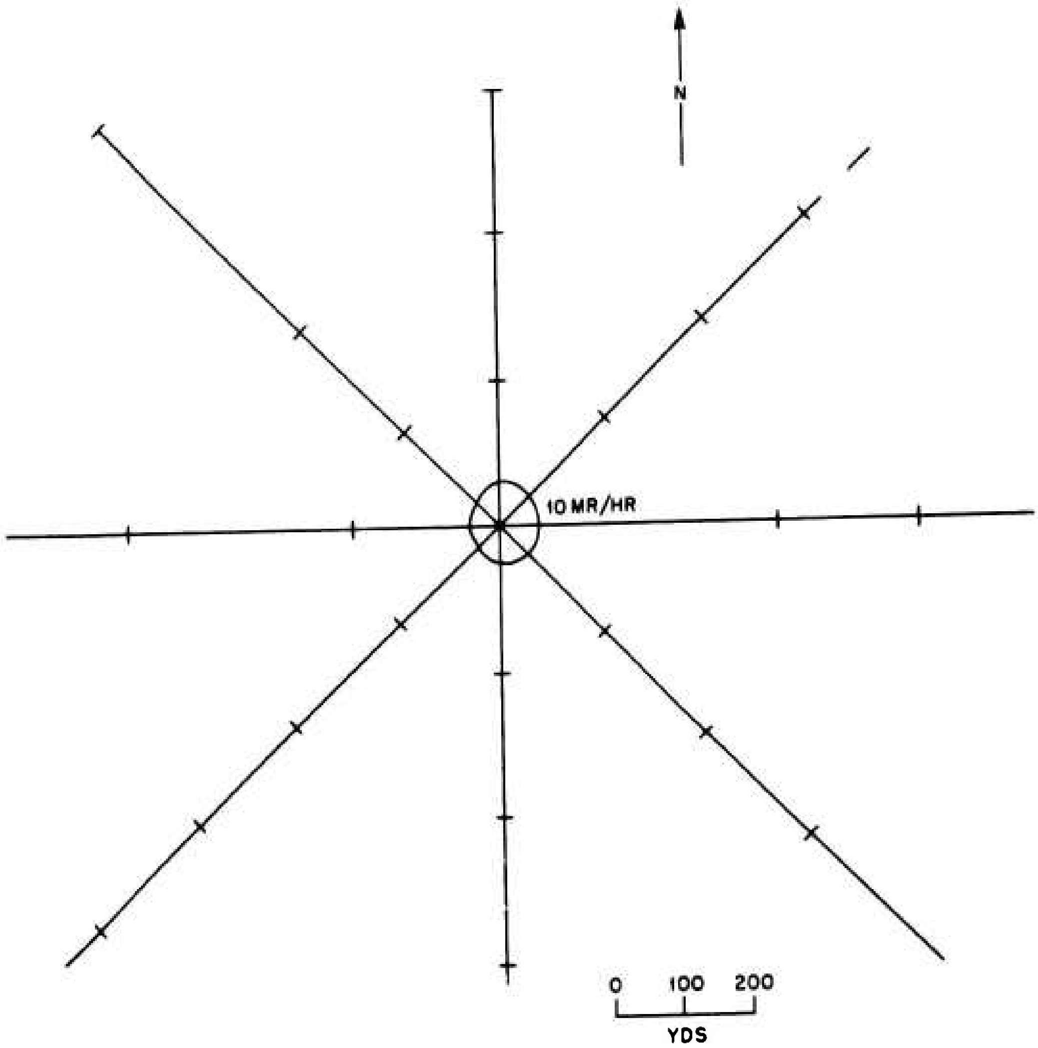
Resurvey, 0600, 1 April 1953. Test Area 7.



Resurvey, 0700, 2 April 1953. Test Area 7.



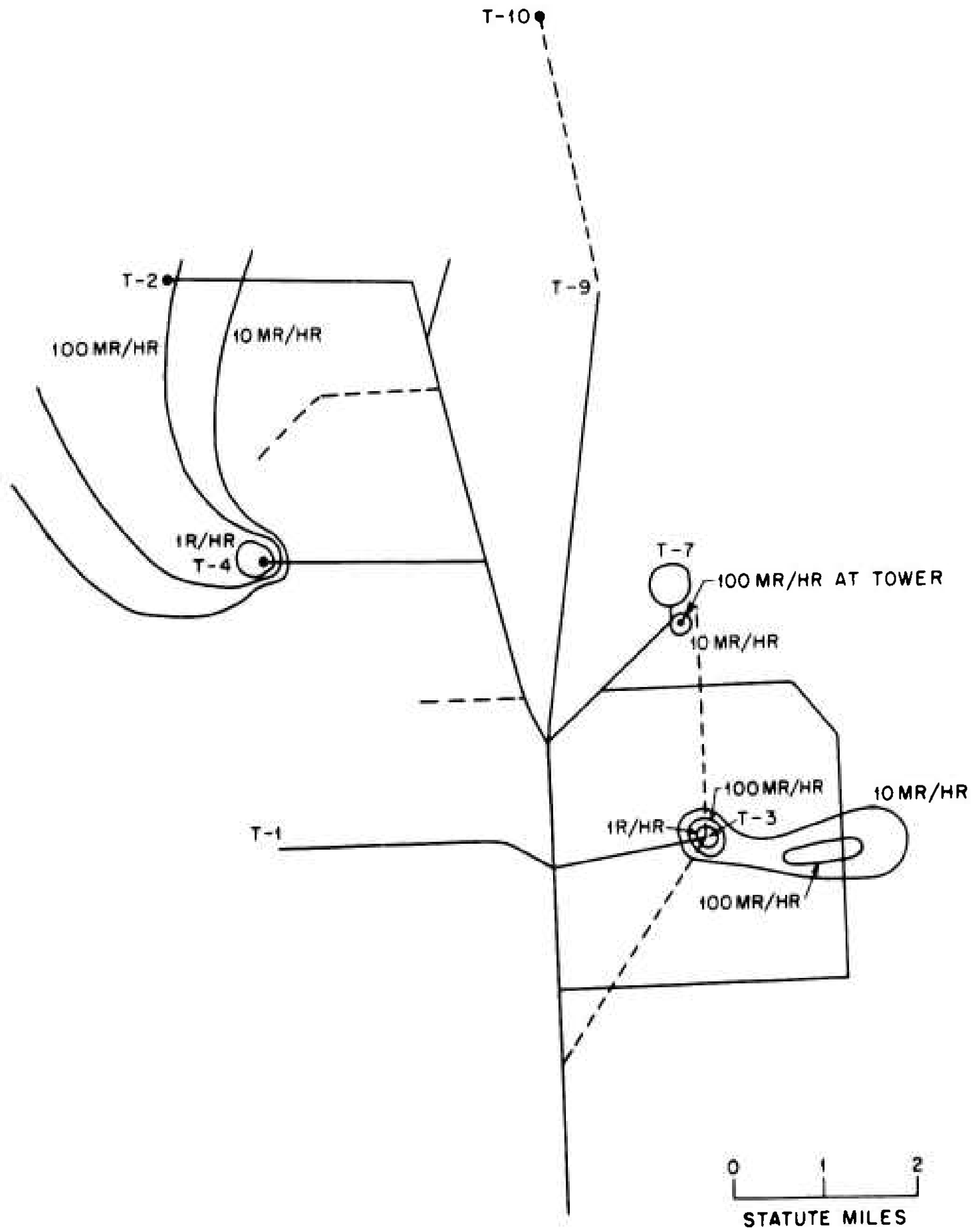
Resurvey, 0600, 3 April 1953. Test Area 7.



Resurvey, 9 April 1953. Test Area 7. Scale, 1 in. = 200 yd.

Inclosure 2

YUCCA FLAT RADIOLOGICAL SITUATION, 2 APRIL 1953



Based on data taken 2 April 1953, Yucca Flat.

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Inclosure 3

GROUND MONITORING SURVEY

Name of monitor	Time from H-hour, hr	Location	Level, mr/hr
Jaworski	H to H+24	Pioche, Panaca, and Caliente	Background
Payne	H to H+12	Glendale Junction, Las Vegas, Boulder City, and Nelson	Background
Wheeler	H to H+24	Lincoln Mine	0.8
Clausen	H to H+11	Beatty	Background
Stafford	H to H+24	Crystal Springs and Alamo	Background
Meyer	H to H+24	Warm Springs	Background
Henderson	H to H+24	Glendale Junction	
	H+10:25	25 miles N of Glendale, Hwy 93	0.20
	H+10:33	30 miles N of Glendale, Hwy 93	0.15
	H+10:42	35 miles N of Glendale, Hwy 93	0.50
	H+10:50	40 miles N of Glendale, Hwy 93	Background
Holy	H to H+24	Tonopah	Background
Fooks	H+1:55	6 miles N of Hwy 91 on U-18 near St. George	0.15
	H+2:17	1.5 miles N of Hwy 91 on U-18	0.90
	H+2:50	Dixie College, St. George, Utah	0.25
	H+3:19	0.5 miles W of U-18 on Hwy 91	0.50
	H+4:30	12 miles W of U-18 on Hwy 91	0.40
	H+6:05	2 miles E of U-18 on Hwy 91	0.25
	H+6:28	Washington	0.55
	H+6:49	10.5 miles E of U-18 on Hwy 91	0.30

Name of monitor	Time from H-hour, hr	Location	Level, mr/hr
	H+6:53	Junction of U. S. Hwys 89 and 91	0.20
	H+7:04	3 miles E of US 89 on Hwy 91	Background
	H+7:13	1 mile E of Hwy 91 on Hwy 89	0.25
	H+8:00	13 miles E of Hwy 91 on Hwy 89	Background
	H+12:15	0.5 mile S of Hwy 91 on Main Street	0.20
	H+12:28	2.5 miles S of Hwy 91 on Main Street	Background
	H+25:50	12.5 miles W of U-18 on Hwy 91	0.40
	H+26:08	16 miles W of U-18 on Hwy 91	0.07
	H+26:11	16.5 miles W of U-18 to Mesquite	Background
Holaday	H to H+24	Ely	Background
Ayer	H+7:30 to 9:00	Las Vegas to Mercury, Hwy 95	Background
Wolff	H+1 to H+9	Mercury, Indian Springs, Las Vegas, and Nellis AFB	Background
Rechen	H to H+24	Las Vegas and Nellis AFB	Background
Johnson, C. C.	H+1:15	Mercury	Background
	H+1:55	Mercury	0.1
	H+4:15	Mercury	Background

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Inclosure 4

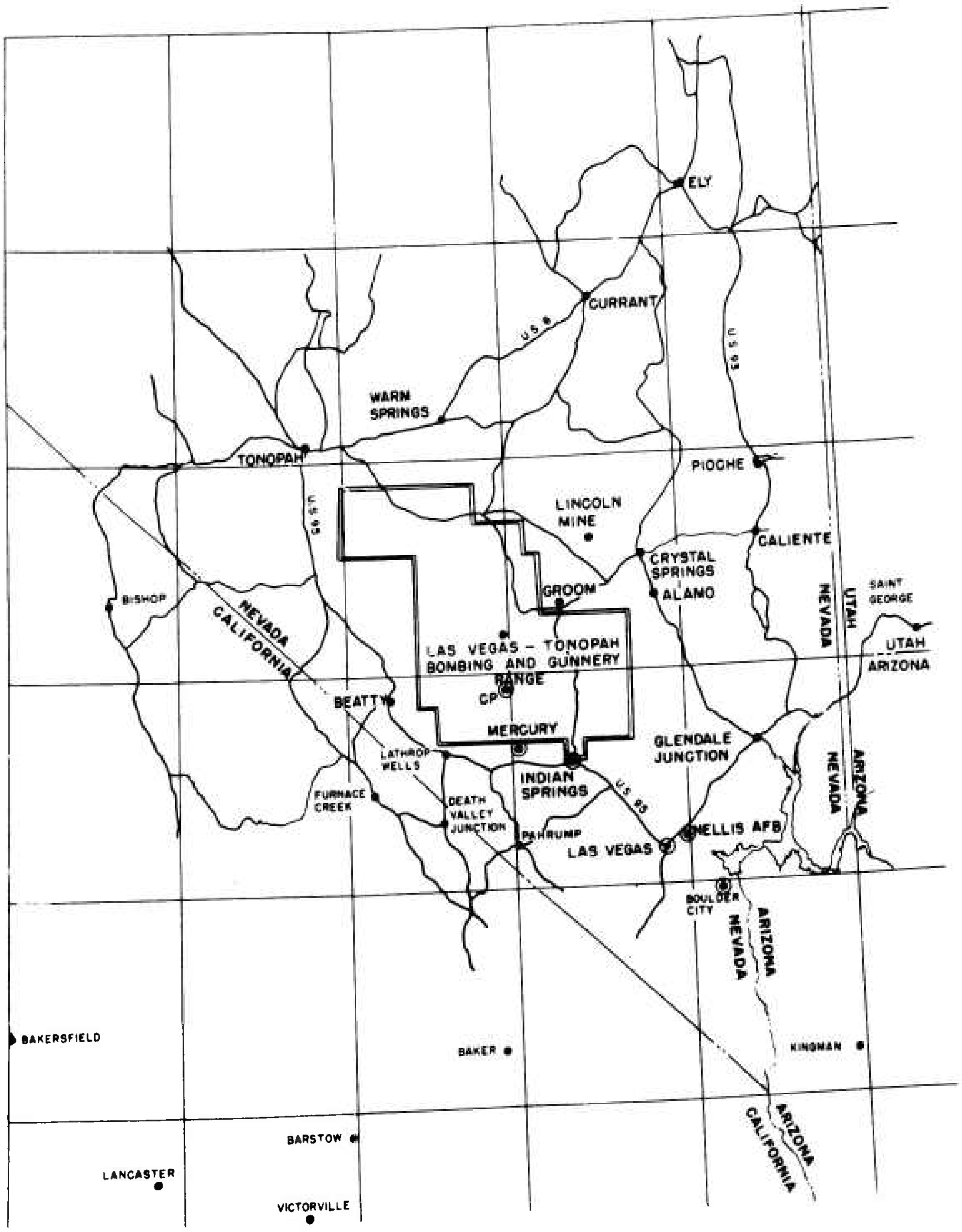
AIR SAMPLING RESULTS

Location	Time of sample	Activity, $\mu c/M^3$
CP	0400 to 0625, 3/31/53	6.2×10^{-3}
	0625 to 1000, 3/31/53	5.0×10^{-4}
	1005 to 1650, 3/31/53	9.4×10^{-4}
	1650 to 0900, 3/31 to 4/1	3.65×10^{-5}
	Average concentration for sampling period	8.1×10^{-4}
Mercury	0345 to 0545, 3/31/53	9.4×10^{-6}
	0545 to 0615, 3/31/53	9.4×10^{-5}
	0615 to 0630, 3/31/53	1.1×10^{-4}
	0630 to 0640, 3/31/53	2×10^{-4}
	0640 to 0655, 3/31/53	2.1×10^{-4}
	0655 to 0710, 3/31/53	2×10^{-3}
	0710 to 0720, 3/31/53	1.1×10^{-3}
	0720 to 0730, 3/31/53	4.1×10^{-4}
	0730 to 0745, 3/31/53	3.9×10^{-4}
	0800 to 0815, 3/31/53	2.1×10^{-4}
	0815 to 0915, 3/31/53	1.3×10^{-4}
	0915 to 1115, 3/31/53	4.3×10^{-5}
	1115 to 2015, 3/31/53	1.2×10^{-4}
	2015 to 0830, 3/31 to 4/1	3.8×10^{-4}
	Average concentration for sampling period	2.17×10^{-4}
	0745 to 0830, 3/31/53	MMD = 2.25 μ
Indian Springs	0606 to 0835, 3/31/53	9.4×10^{-5}
	0835 to 1135, 3/31/53	6.9×10^{-5}
	1200 to 1705, 3/31/53	2.9×10^{-4}
	1705 to 0740, 3/31 to 4/1	1.6×10^{-4}
	Average concentration for sampling period	4.8×10^{-4}
	0610 to 0740, 3/31 to 4/1/53	MMD = 1.46 μ
Las Vegas	0415 to 0810, 3/31/53	Background
	0810 to 1000, 3/31/53	Background
	1000 to 1230, 3/31/53	4.1×10^{-3}
	1230 to 1845, 3/31/53	9.2×10^{-5}
	1845 to 0415, 3/31 to 4/1	5.6×10^{-5}

Location	Time of sample	Activity, $\mu c/M^3$
	Average concentration for sampling period	4.8×10^{-4}
Nellis AFB	0520 to 0650, 3/31/53	Background
	0650 to 0915, 3/31/53	Background
	0915 to 1430, 3/31/53	5.4×10^{-4}
	1430 to 2020, 3/31/53	1.8×10^{-4}
	2020 to 0300, 3/31 to 4/1	3.9×10^{-4}
	Average concentration for sampling period	2.9×10^{-4}
Boulder City	1015 to 1445, 3/31/53	3.6×10^{-3}
	1015 to 1445, 3/31/53	MMD = $7.0\ \mu$
	0900 to 1445, 3/31/53	3.06×10^{6} d/m/ft^2
Shot Area (10 mr line)	0620 to 0630, 3/31/53	2.5×10^{-2}

Inclosure 5

AIR SAMPLING STATIONS RECORDING FALL-OUT, SHOT RUTH



Shot Ruth, spring 1953. ◉ , air sampling stations recording fall-out.

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Inclosure 6

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at time of collection, μc/liter
4/1/53	0600	St. George, Big Hand Motel	1.85×10^{-5}
3/31/53	1200	Lake Mead Recreational Area	4.35×10^{-5}
4/1/53	1315	Rad-Safe Building	Background
3/31/53	1700	Crystal Springs	Background

Inclosure 7

DATA FOR CLOUD TRACKING AIRCRAFT B-25 (COOK BOOK 3)

Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
B 42	0533	12,000	North	5	8	
B 43	0538	12,000	Northwest	5	17	
B 43	0546	12,000	Southeast	5	100	Cloud forming thin stratus patch at 12000; background over 80
D 44	0603	12,000	West	0	80	
B 44	0618	12,000	Northwest	0	60	Background 45; highest reading 800
D 44	0631	12,000	Northwest	0	60	Background 40; highest reading 80
C 45	0645	12,000	South	0	55	Background 35; highest reading 90
E 44	0700	12,000	West	0	35	Background 30; nighest reading 50
F 45	0710	12,000	North	0	35	Background 28; highest reading 60
G 45	0721	12,000	Northeast	0	31	Background 25; highest reading 38
G 46	0743	12,000	Northwest	0	26	Background 20; highest reading 37. Rosie still visible only faintly
G 46	0800	12,000	Southeast	18	32	Background 17; highest reading 120
G 46	0811	12,000	North	15	26	Background 21; highest reading 30
H 46	0815	12,000	West	17	34	Background 19; highest reading 42
G 46	0831	12,000	Southeast	13.5	24	
H 46	0837	12,000	West Northwest	13.5	24	Background 24
I 45	0844	12,000	South	13	23	Background 23; highest reading 34
M 47	0919	12,000	Above	10	26	Background 14; highest reading 36

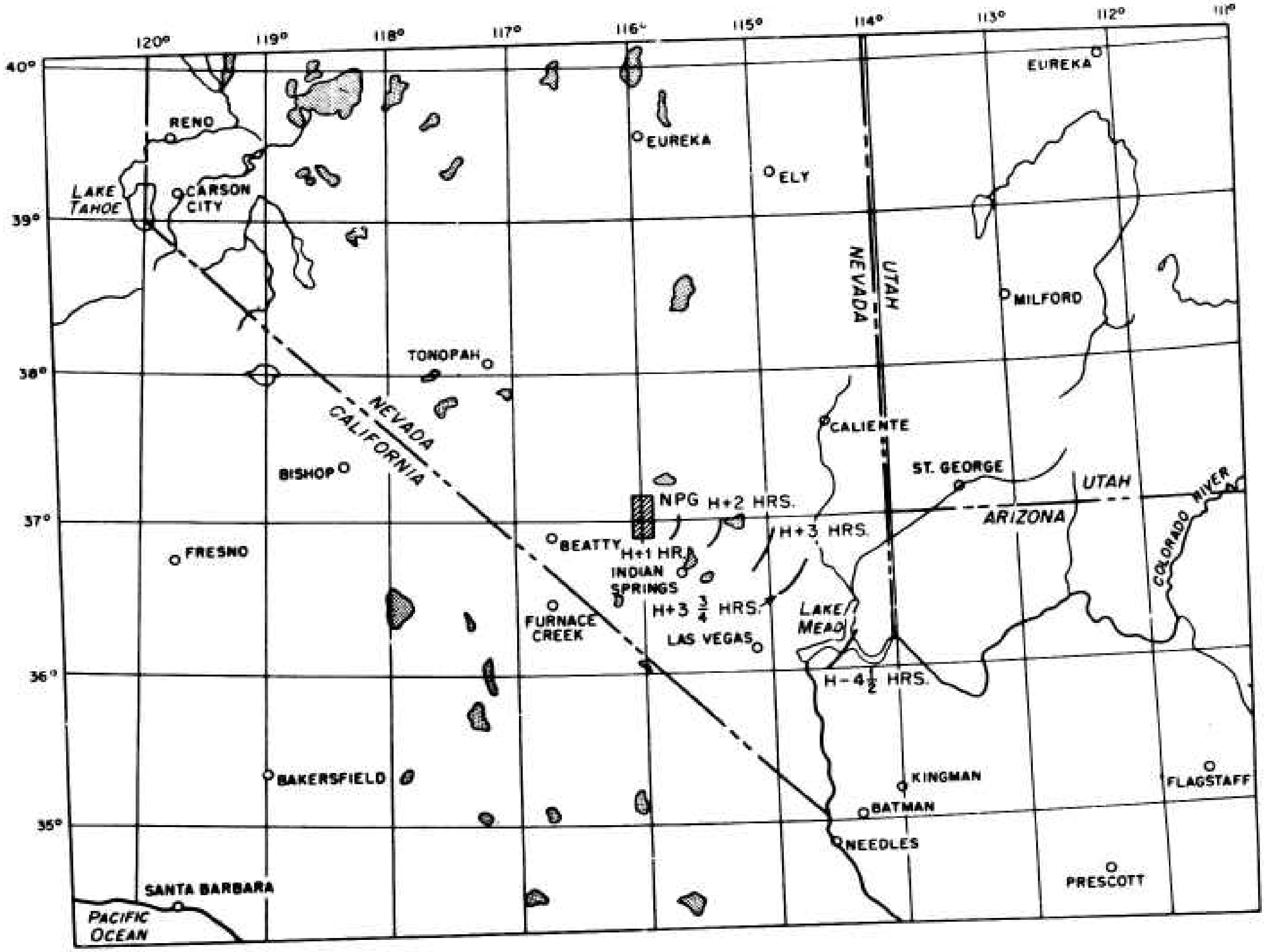
				Meter readings, mr/hr		
Position*	Time	Altitude	Direction of cloud	MX-5	T1B	Remarks
J 47	0925	12,000	Above	13	60	Background 13; highest reading 70; directly under visible portion returning to base

Notes: Sampler's position of cloud I-48 to J/K-47 at 0905, 13,000; maximum reading in cloud, 200 mr/hr.
Sampler's position of cloud I-49 to J/K-48 at 0930, 13,000; maximum reading in cloud, 50 mr/hr.

*The grid system is that shown in Incl. 9, Chap. 2.

Inclosure 8

ACTUAL CLOUD TRACK, SHOT RUTH



Shot Ruth, 31 March 1953. ———, cloud top (14,300 ft msl).

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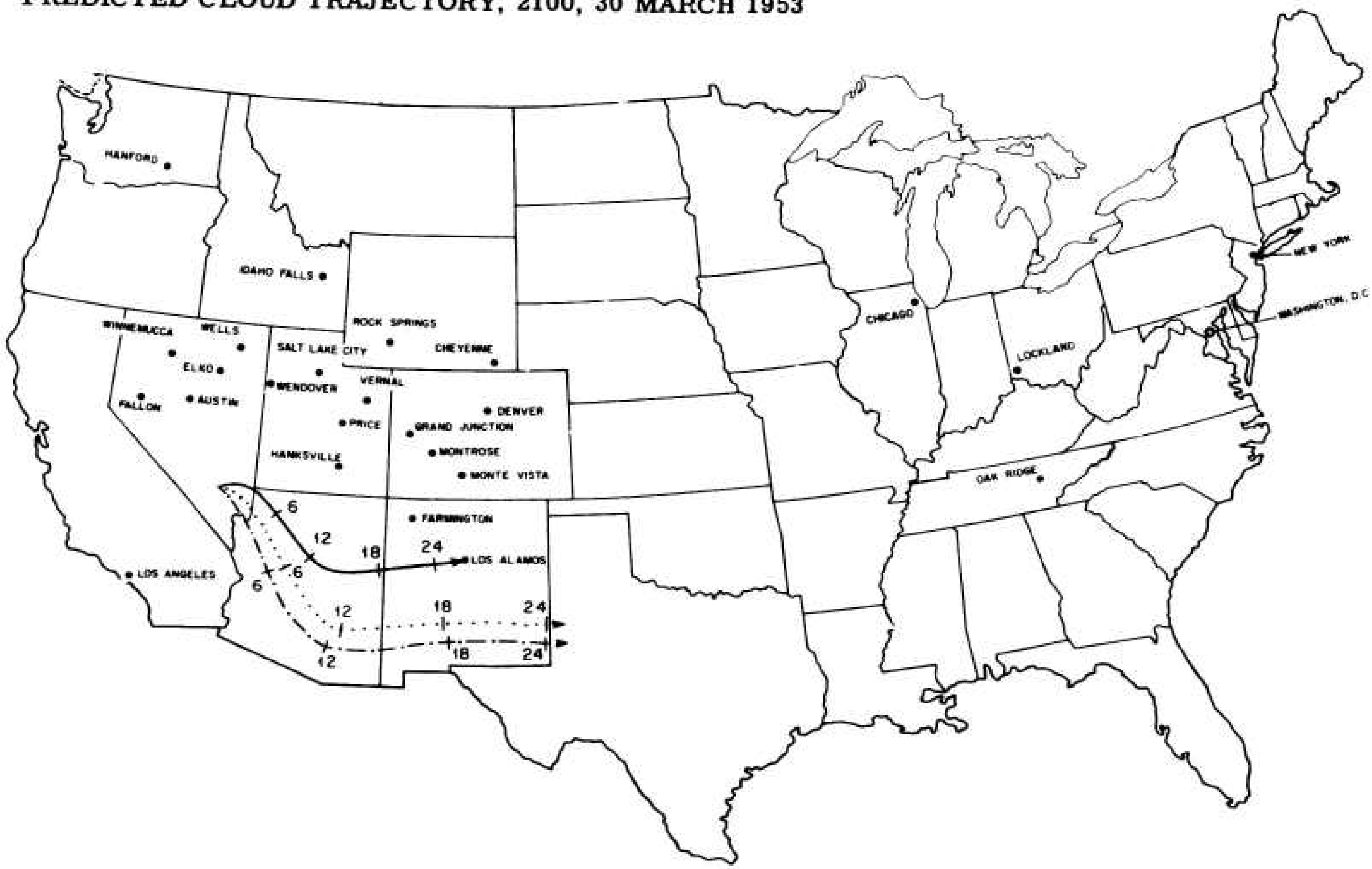
Inclosure 9

PREDICTED CLOUD TRAJECTORY, 2100, 30 MARCH 1953



Shot Ruth, 2100, 30 March 1953. ———, 10,000 ft msl. ········, 20,000 ft msl. – · – · –, 30,000 ft msl.

Inclosure 10

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter reading, mr/hr
N 33	0505	50	0
L 23	0515	50	0
L 19	0517	50	0
L 18	0520	50	20
L 15	0524	50	0
L 14	0525	50	0
M 11	0528	50	0
N 11	0530	50	0
P 11	0531	50	2
P 13	0534	50	4
P 14.5	0535	50	5
N 13.5	0537	50	200
7-300 Station	0545	50	175
B 29	0550	50	100
Stake 603	0555	10	1000
N 15	0559	50	10
N 15.5	0604	50	10
I 15	0607	50	0
M 22	0613	5	0
R 33	0625	50	0

* The grid coordinates are those shown in Incl. 19, Chap. 3.

Inclosure 11

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"
A ½44/45	0715	500	0.07	0	0.1
A 44	0718	500	0.06	0.1	0.105
A 43	0724	500	0.2	0.2	0.32
A ½42/43	0726	500	0.6	1.2	0.14
A 42	0728	500	0.14	0.1	0.105
½AB 42	0731	500	0.06	0	0.105
½AB 43	0735	500	0.05	0.1	0.078
½AB 44	0738	500	0.03	0.0	0.084
½AB 45	0742	500	0.08	0.0	0.092
B 45	0744	500	0.1	0.1	0.1
B 44	0747	500	0.04	0.0	0.105
B 43	0753	500	0.06	0.0	0.092
B ½42/43	0759	500	0.08	0.1	0.084
½BC 42	0802	500	0.05	0	0.078
½BC 43	0808	500	0.15	0.2	0.62
½BC 44	0813	500	0.04	0.0	0.07
½BC ½44/45	0816	500	0.08	0.1	0.092

* The grid system is that used in Incl. 9, Chap. 2.

Inclosure 12

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"
C ½43	0743	500	0.03	0.2	0.18
C ½44	0747	500	0.03	0.2	0.0
C ½45	0750	500	0.03	0.1	
C ½46	0753	500	0.02	0.1	
C 46	0754	500	0.05	0.1	
B 46	0757	500	0.02	0.2	
A 46	0801	500	0.0	0.2	
A 46/45	0802	500	0.03	0.2	0.0
B 46/45	0804	500	0.03	0.1	
C 46/45	0808	500	0.02	0.1	
D 46/45	0810	500	0.03	0.02	
D 46	0813	500	0.04	0.2	
D 47	0813	500	0.03	0.1	
C 47/46	0816	500	0.05	0.0	
D 47/46	0821	500	0.04	0.2	
E 47/46	0825	500	0.02	0.2	
E 47	0828	500	0.02	0.2	
E 48	0830	500	0.02	0.2	
E 49	0835	500	0.10	0.2	
ED 49	0838	500	0.03	0.1	
ED 48	0840	500	0.06	0.2	
ED 47	0844	500	0.02	0.2	
ED 46	0848	500	0.01	0.1	
E 46	0850	500	0.03	0.1	
F 46	0853	500	0.05	0.2	
F 47	0856	1000	0.03	0.2	
F 48	0859	500	0.04	0.2	
F 49	0903	500	0.0	0.1	0
E 49	0907	800	0.02	0.2	0
D 49	0911	700	0.01	0.1	0
C 49	0914	600	0.02	0.1	0
B 49	0917	500	0.05	0.1	

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"
A 48	0924	500	0.02	0.2	0.012
ZA 47	0932	500	0.03	0.2	0
ZA 46	0938	500	0.01	0.2	0
A 46/47	0941	500	0.01	0.2	0
B 46/47	0947	300	0.02	0.1	

* The grid system is that shown on Incl. 9, Chap. 2.

Chapter 5

SHOT DIXIE*

5.1 INTRODUCTION

5.1.1 The fourth shot of the Upshot-Knothole series, Dixie, an airdrop at about 6000 ft, was detonated at 0730, 6 April 1953 in Area 7, Yucca Flat, NPG. The prevailing winds were in the direction of Las Vegas and Indian Springs; but, because no fall-out was expected, the decision was made to drop on schedule.

5.1.2 The first data on the contamination in the shot area were received from the close-in helicopter survey. The area had been surveyed by 0810. Contamination was only slightly above background. Based on helicopter survey data the Test Director announced "R" (ground recovery) hour at 0812, before the ground survey had been completed. The On-Site ground survey teams' first report was received at 0805, and the survey of the area was completed at 0900.

5.2 ON-SITE OPERATIONS

5.2.1 There were no particular problems in connection with Shot Dixie. Ground contamination was very light. The initial survey team accomplished its mission without difficulty. A survey of the area is shown in Incl. 1. The general radiological situation for Yucca Flat on 7 April, after the first four shots, is shown in Incl. 2.

5.2.2 One hundred seventy-nine (179) persons in sixty (60) parties were briefed and processed for entry into the contaminated areas. Eleven hundred (1100) film badges were processed during the period. Many of these were used in areas contaminated by previous shots. Only six (6) vehicles were decontaminated. Several vehicles were found with contaminated objects collected as souvenirs, contrary to the Test Director's Order; so these objects were taken away from the parties. A sign was designed to warn people against this practice.

5.2.3 Since construction in Area 2 had been delayed by contamination from previous shots and since much construction and other preparatory work was still to be done there, a film badge distribution and clothing issue point was set up at the check point to this area, and monitors were assigned to the area as needed, rather than being assigned directly to parties. To decrease exposure to the working personnel, a section of the area most occupied by the construction personnel was decontaminated by fencing it off and by removing the top layer of soil. This reduced the exposure of personnel in the area considerably.

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* Period covered, 5 April to 9 April 1953.

5.3 OFF-SITE OPERATIONS

5.3.1 The changes in the anticipated fall-out pattern resulting from this detonation are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Sec. II, WT-705). By shot time, the area of primary interest was the sector around Glendale Junction, Overton, and Las Vegas. Off-Site mobile teams and equipment were moved to provide maximum coverage in the communities in the path of fall-out.

5.3.2 No ground levels were detected from this shot. A documentation of ground monitoring is given in Incl. 3.

5.3.3 Inclosure 4 is a tabulation of air concentrations encountered from this detonation. It is evident from these results and those in Incl. 3 that no detectable activity was collected by any of the equipment in use by the Off-Site Group, with one possible exception. This exception occurred at St. George, Utah, where a light shower for a brief period caused an increase in surface contamination as determined by radioautography and an MX-5 monitoring instrument.

5.3.4 The results of water samples analyzed for fission product activity are presented in Incl. 5.

5.4 AIR PARTICIPATION

5.4.1 Weather data indicated that the radioactive air mass would move in the direction of Indian Springs and Las Vegas. Little or no fall-out was expected; however, the radioactive air mass was considered to be hazardous to air traffic. To afford protection for this traffic, it was recommended that the air space at all altitudes for a radius of 50 miles from ground zero be closed to all except test aircraft from 0700 to 0830 PST on D-day. In addition, it was recommended that the air space enclosed by the vectors 90° and 180° from ground zero out to a distance of 100 miles be closed from 0830 to 0930 on D-day at 23,000 ft msl and below. Above 23,000 ft msl the air mass enclosed by a line connecting Las Vegas, Nevada, to Yuma, Arizona, to Nogales, Mexico, to Las Vegas was recommended closed from 0830 to 1330 PST. This was changed at 0945 PST to the area enclosed between 35° and 37° north latitude and between a line running north from Prescott and a line running north from Albuquerque. This change was necessary when it was determined that the cloud was going north of the predicted path. In addition to all of the above, a warning area was recommended to extend for a radius of 125 miles in all directions from Las Vegas at all altitudes from 0700 to 1330 PST.

5.4.2 The cloud left no visible stem. However, the cloud tracking aircraft, two B-29's (Cook Book 1 and 2) and a B-25 (Cook Book 3), were off from Indian Springs AFB on schedule. They were not able to find any activity at their respective altitudes of 22,000 ft, 18,000 ft, and 12,000 ft msl. They were then released and returned to base. The position of the mushroom was followed by sampler aircraft who followed the cloud for more than $4\frac{1}{2}$ hr. The data and cloud trajectory are shown in Incl. 6; the predicted path is attached as Incl. 7. The top of the cloud went to 42,500 ft msl, whereas the bottom of the mushroom was at 31,500 ft msl. No activity was detected outside the mushroom. By H + $4\frac{1}{2}$ hr the cloud had traveled more than 350 miles.

5.4.3 The close-in aerial survey was made by helicopter. It started at H + 15 min and by H + 40 min had completed the survey of the target area. The maximum reading in the target area was 1.5 mr/hr at 5 ft above the ground. The data are attached as Incl. 8.

5.4.4 The extended terrain survey was performed by an L-20 and a C-47 aircraft. No contamination was found during the survey. The L-20 data are attached as Incl. 9; the C-47 data are attached as Incl. 10. No D + 1 day survey was made.

5.5 LOGISTICS AND SUPPLY

5.5.1 For the period 5 to 9 April 1953, inclusive, the Supply Section issued 132 pairs of shoe covers, 73 protective caps, 83 coveralls, 113 pairs of cotton gloves, 268 high intensity goggles, and 51 respirators. The laundry serviced 444 pairs of shoe covers, 12 protective caps, 181 coveralls, 578 pairs of gloves, 92 respirators, 36 pillowcases, 72 sheets, and 35 towels. During the period, 41 instruments were issued and 52 repaired by the instrument repair section. Nineteen (19) vehicles were lubricated and given 2nd echelon maintenance; four (4) vehicles were deadlined during the period.

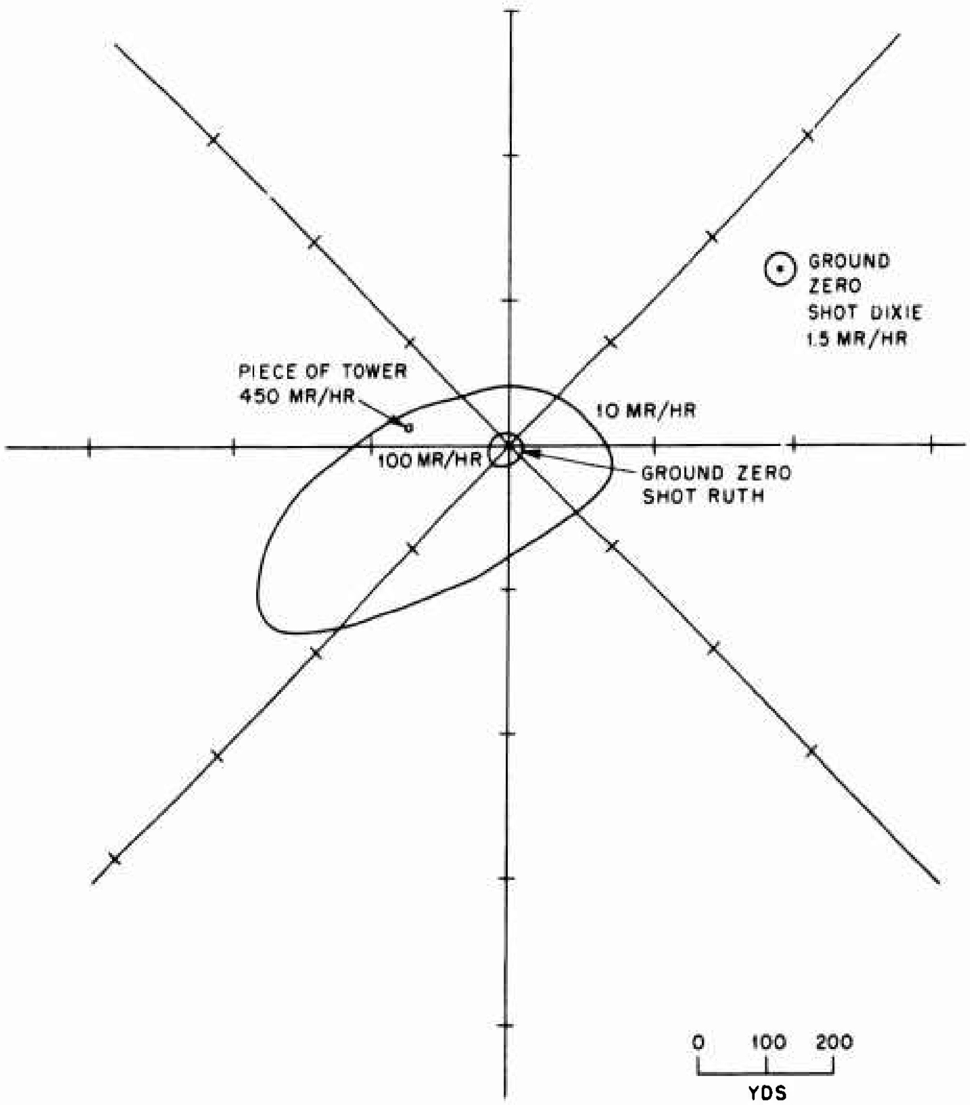
5.5.2 To improve communication for On-Site vehicles, isoplane antennas were installed on the five (5) $^3/_4$ ton trucks. This has somewhat improved radio transmission.

5.6 GENERAL

The radiological problem connected with Shot Dixie was almost nonexistent. No ground contamination was found anywhere, even at ground zero. There was no cloud stem to be found. All the activity was in the mushroom which went to an altitude of 42,500 ft. The winds were so great at this altitude that it was past the 200 mile zone by H + 3 hr.

Inclosure 1

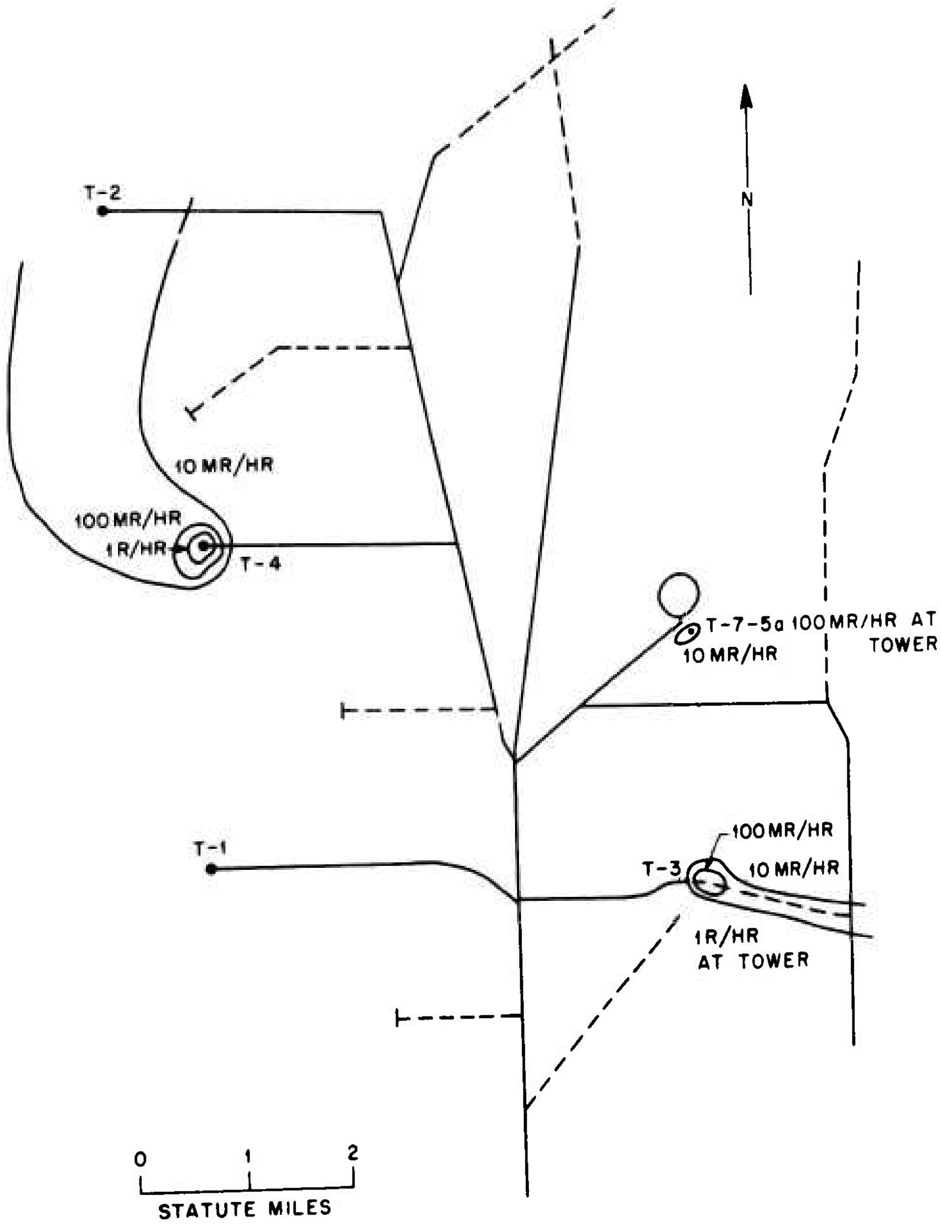
INITIAL SURVEY, SHOT DIXIE, 0800, 6 APRIL 1953



Initial survey of Test Area 7, Shot Dixie.

Inclosure 2

YUCCA FLAT RADIOLOGICAL SITUATION, 7 APRIL 1953



Data taken 7 April 1953, Yucca Flat.

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Inclosure 3

GROUND MONITORING DATA, SHOT DIXIE

Name of monitor	Time from H-hour, hr	Location	Level, mr/hr
Holaday	H+0:30 to H+24	Lincoln Mine	0.5
Holaday	H+1:00 to H+24	Airport at Lincoln Mine	0.6
Holaday	H+1:30 to H+24	7 miles W of Lincoln Mine	0.8
Ayer	H+0:55 to 3:10	Las Vegas to 5 miles E of Mesquite	Background
Ayer	H+7:0	24 miles N of Glendale on Hwy 93	0.1
Ayer	H+7:8	27 miles N of Glendale on Hwy 93	0.1
Ayer	H+7:25	36 miles N of Glendale on Hwy 93	0.3
Johnson, C. C.	H+2:30	Overton to 13 miles E on Hwy 12	Background
Clausen	H+0:30 to H+24	Beatty	Background
Stafford	H+0:30 to H+24	Groom Mine	Background
Wolff	H+0:30 to 11:30	15 miles W of Caliente to Caliente and then to Pioche	Background
Fooks	H+1:15 to 2:57	Mercury to 15 miles S of Indian Springs	Background
Fooks	H+3:15 to 3:55	Indian Springs to Mercury	Background
Fooks	H+6:15 to 6:42	Mercury to 20 miles NW on Hwy 95	Background
Wheeler	H+3:30 to 9:0	Boulder City	Background
Wheeler	H+9:0 to 10:0	Boulder City to Las Vegas	Background
Wheeler	H+10:30 to 12:30	Las Vegas to Mercury	Background
Rechen	H+1:40 to 2:33	Indian Springs to Las Vegas	Background
Rechen	H+6:24 to 7:45	Las Vegas to Mercury	Background
Skillern	H+0:30 to H+24	Ely	Background
Claborn	H+0:30 to H+24	Currant	Background
Claborn	H+5:45	Lund	Background
Payne	H+2:45	Dixie College, St. George, Utah	0.1
Payne	H+10:0	Dixie College, St. George, Utah	0.5 (during rain)

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Name of monitor	Time from H-hour, hr	Location	Level, mr/hr
Payne	H+10:15	Dixie College, St. George, Utah	0.1
Payne	H+5:45	Washington, Utah	Background
Payne	H+6:05	Hurricane, Utah	Background
Payne	H+7:30	Rockville, Utah	Background
Williams, D.	H+0:30 to H+24	Glendale	Background
Meyer	H+0:30 to H+24	Warm Springs	Background
Holy	H+0:30 to H+24	Tonopah	Background
Williams, G.	H+0:30 to H+24	Caliente	Background
Wolff	H+0:30 to H+24	Pioche	Background
Spangler	H+0:30 to H+24	Nellis AFB	Background
Spangler	H+10:30 to H+24	Las Vegas	Background
Skillern	H+24:00 to 27:00	Ely to Tonopah	Background
Meyer	H+24:00 to 27:00	Tonopah to Beatty	Background
Clausen	H+24:00 to 26:00	Beatty to Mercury	Background
Skillern	H+8:00 to 9:00	Hwy 93 to 20 miles S of Ely	Background
Christman	H+24:00 to 26:00	Alamo to Groom Mine	Background
Christman	H+0:30 to H+24	Alamo to Crystal Springs	Background
Payne	H+24:00 to 26:00	St. George to Glendale	Background
Christman	H+1:30 to 2:00	Alamo to 20 miles S on Hwy 93	Background
Christman	H+2:15	30 miles S of Alamo on Hwy 93	Background
Williams, D.	H+26:00 to 28:00	Glendale to Las Vegas	Background
Wolff	H+26:00 to 28:00	Caliente to Crystal Springs on Hwy 93	Background

Inclosure 4

AIR CONCENTRATIONS RESULTS

Location	Time of sample	Result
Glendale Junction	4/6 to 4/7/53, 0730-0730	Background
Currant	4/6/53, 0730-1645	Background
Tonopah	4/6 to 4/7/53, 0630-0730	Background
Ely	4/6 to 4/7/53, 0630-0730	Background
Boulder City	4/6/53, 1100-1600	Background
Warm Springs	4/6/53, 0700-1700	Background
Beatty	4/6 to 4/7/53, 0630-0730	Background
Alamo	4/6 to 4/7/53, 0710-0650	Background
Overton	4/6/53, 0930-1550	Background
Nellis AFB	4/6 to 4/7/53, 0600-0730	Background
Las Vegas	4/6 to 4/7/53, 0725-0800	Background
Pioche	4/6/53, 0700-1730	Background
Caliente	4/6 to 4/7/53, 0620-0800	Background
St. George	4/6/53, 0630-1720	Background
Crystal Springs	4/6/53, 0600-1640	Background
Groom Mine	4/6/53, 0630-1930	Background
CP	4/6 to 4/7/53, 0630-0730	Background
Mercury	4/6 to 4/7/53, 0630-0730	Background
Shot Area	4/6/53, 0745-0815	Background
Indian Springs	4/6 to 4/7/53, 0550-0815	Background
Lincoln Mine	4/6 to 4/7/53, 0730-0700	Background

Inclosure 5

WATER SAMPLE RESULTS

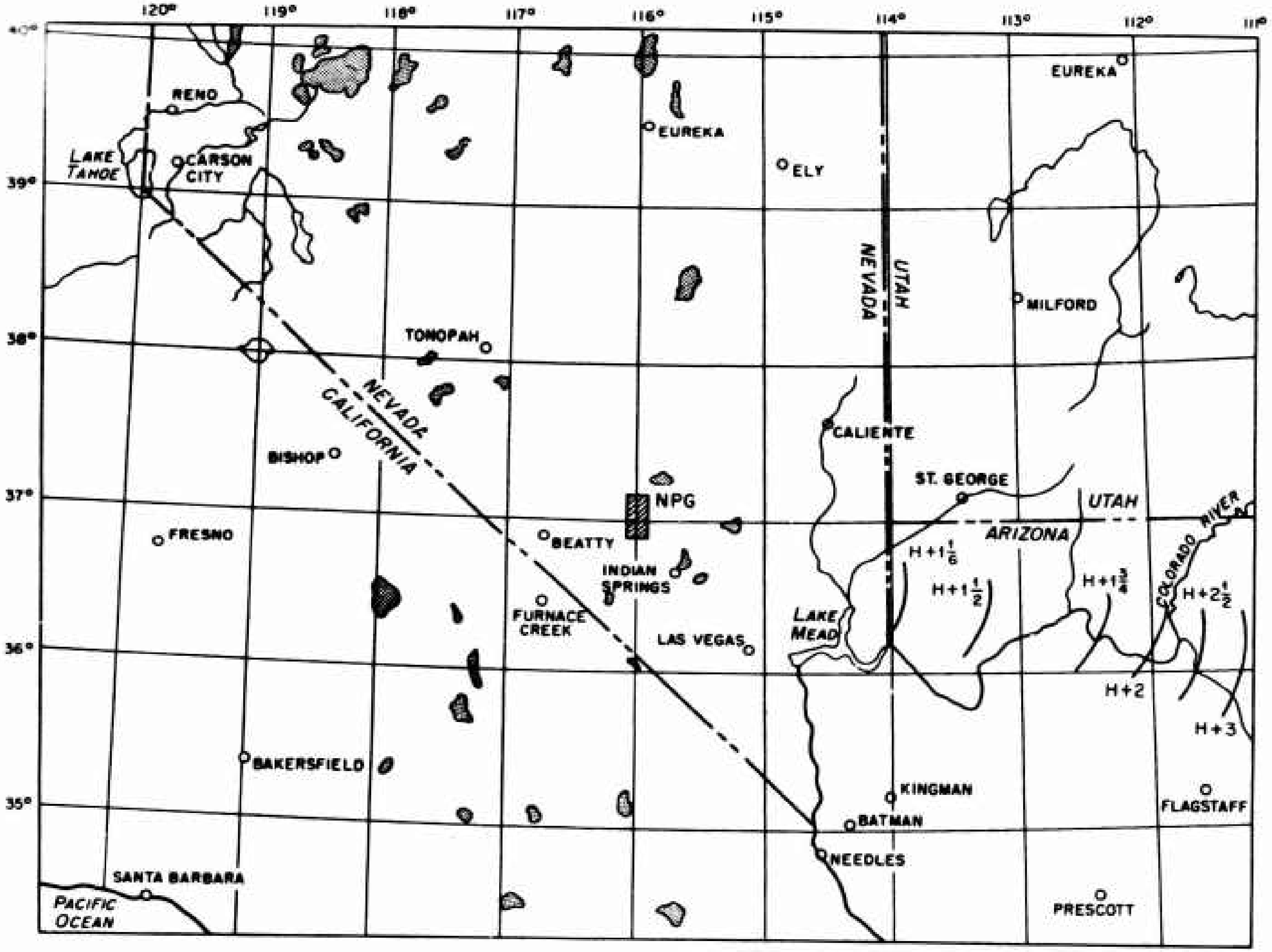
Date of collection	Time of collection	Location	Activity at time of collection, μc/liter
4/7/53	0915	Mercury, Building No. 200	8.0×10^{-5}
4/7/53	0815	Indian Springs Pump Station	5.37×10^{-5}
4/6/53	1530	Hoover Dam Recreation Area	5.37×10^{-5}
4/7/53	0800	Lincoln Mine Mess Hall	9.64×10^{-5}
4/6/53	1430	Crystal Springs	6.43×10^{-5}
4/7/53	0830	St. George Big Hand Motel	1.82×10^{-5}
4/6/53	1445	Lake Mead Overton Beach	1.82×10^{-5}

Inclosure 6

DATA FOR CLOUD TRACKING AIRCRAFT B-29, B-25, AND B-50

Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
			Cook Book 1 (B-29)			
N 47	0845	22,000	West	1	1	Rosie appears as thin cirrus
Q 48	0856	22,000	Above	0.1	0.1	Rosie thin and scattered
V 48	0913	22,000	Above	0	0	
W 49	0932	22,000	Above	0	0	
			Cook Book 2 (B-29)			
P 46	0845	18,000	Unknown	0	0	Completed run from ground zero with negative results
X 48	0910	18,000	Above	0	0	Rosie above scattered
			Cook Book 3 (B-25)			
A 42	0805	12,000	East	0.05	0	
J 46	0836	12,000	East	0	0	
N 46	0840	12,000	Under	0	0	Rosie above thin, scattered
			Skull Cap (B-50)			
AC 49	0950	40,000	Inside			By sampler aircraft
AD 49	1020	40,000	Inside			By sampler aircraft
AJ 51	1115	40,000	Inside			By sampler aircraft

* The grid system is that shown in Incl. 9, Chap. 2.



Actual cloud track, Shot Dixie. Top of mushroom, 42,000 ft. Bottom of mushroom, 31,500 ft. ———, track of mushroom cloud.

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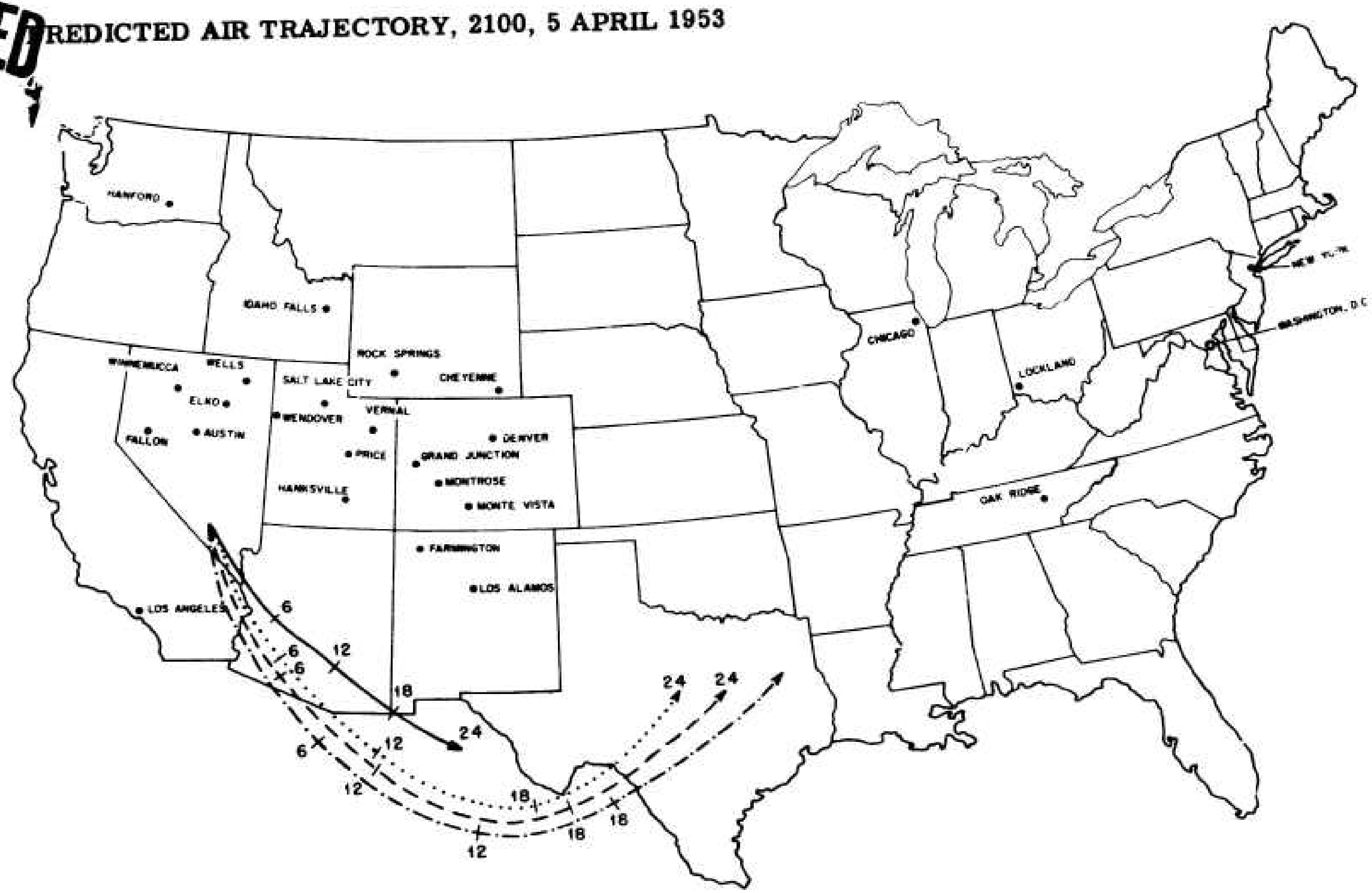
Inclosure 7

PREDICTED AIR TRAJECTORY, 2100, 5 APRIL 1953



———, 10,000 ft msl. ·······, 20,000 ft msl. -·-·-·-·, 30,000 ft msl. - - - - - -, 40,000 ft msl.

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Inclosure 8

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr	
			MX-5	T1B
L 18	0747	50		0
L 14	0750	50		0
N $12\frac{1}{2}$	0755	5		1.5
Stake 21-26	0759	5		1.0
Stake 11-14	0800	5		1.5
Stake 15-16	0802	5		1
Stake 11-43	0805	5		1.5
Stake 43-46	0806	5		1.0
ESE-GZ	0812	5		0
Stake 31-33	0808	5		1.0
Stake 34-36	0809	5		1.0
N 14	0816	5		0
N 15	0820	50		0
I 15	0825	50		0
I 13	0827	50		0
I 12	0827	50		2
I 11	0829	50	0	50
H 9	0831	25	0	35
O 13	0840	5		0
P 14	0843	5		0

*The grid system is that shown in Incl. 19, Chap. 3.

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Inclosure 9

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr	
			MX-5	T1B
A 45	0939	500	0.03	0.6
A 44	0945	500	0.06	0.6
A 43	0948	500	0.03	0.5
A 42	0955	500	0.04	0.5
B 42	0959	500	0.04	0.4
B 43	1003	500	0.1	0.5
B 44	1011	500	0.06	0.6
B 45	1015	500	0.04	0.4
C 45	1019	500	0.02	0.4
C 44	1025	500	0.02	0.4
C 43	1030	500	0.08	0.4
C 42	1035	500	0.03	0.5
C 41½	1039	500	0.04	0.2
D 41½	1044	500	0.03	0.4
D 42	1047	500	0.01	0
D 43	1054	500	0.03	0.4
D 44	1100	500	0.02	0.3
D 45	1105	500	0.01	0.2
D 46	1110	500	0.02	0.2

*The grid system is that shown in Incl. 9, Chap. 2.

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Inclosure 10

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	Meter readings, mr/hr T1B	C-1 air foil
D 45	0949	500	0.1	0.4	0
½DE 44	09	500	0.06	0.038	
½DE 43	1000	1200	0.05	0.3	
½DE 44	1004	1200	0.03	0.2	0.1
E ½42/43	1007	500	0.03	0.3	
F 43	1011	500	0.04	0.2	
F 44	1016	800	0.03	0.3	
E 45	1021	1200	0.04	0.2	0.1
E 46	1026	500	0.05	0.2	0
F 47	1028	500	0.03	0.3	0
G 46	1031	500	0.04	0.2	0
G 45	1042	500	0.02	0.3	0.1
G 44	1045	500	0.02	0.3	0
G 43	1050	500	0.03	0.3	0.4
G ½42/43	1052	500	0.06	0.2	
H 43	1055	500	0.04	0.2	0
H 44	1059	500	0.05	0.2	0
H 45	1103	1000	0.03	0.3	0
H 46	1109	500	0.02	0.3	0.4
H 47	1114	500	0.05	0.3	
H 48	1119	500	0.03	0.4	0
H 49	1128	500	0.03	0.2	0
H 50	1131	800	0.02	0.3	
H 51	1134	600	0.05	0.2	
I 51	1137	800	0.04	0.2	
I 50	1140	1000	0.02	0.2	
I 49	1143	1000	0.03	0.2	
I 48	1147	1000	0.01	0.2	
I 47	1150	1000	0.03	0.3	
I 46	1153	1000	0.02	0.3	

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Position*	Time	Altitude above ground, ft	Meter readings, mr/hr		C-1 air foil
			MX-5	T1B	
I 45	1158	900	0.02	0.3	
I 44	1200	600	0.03	0.3	
I 43	1205	500	0.02	0.2	
I 42	1210	500	0.02	0.2	
J 42	1213	700	0.02	0.2	
K 42	1215	500	0.02	0.2	
K 43	1219	800	0.03	0.2	
K 44	1223	500	0.02	0.2	0.15
K 45	1229	500	0.02	0.2	
K 46	1235	500	0.02	0.2	
K 47	1240	500	0.02	0.2	
K 48	1245	500	0.02	0.2	
K 49	1249	500	0.02	0.2	
K 50	1253	500	0.02	0.2	
K 51	1258	500	0.02	0.2	

*The grid system is that shown in Incl. 9, Chap. 2.

Chapter 6

SHOT RAY*

6.1 INTRODUCTION

6.1.1 Shot Ray, the fifth shot of the Upshot-Knothole series, was detonated on a 100 ft tower in Area 4, Yucca Flat, NPG, at 0445, 11 April 1953. The winds at shot time were to the south at all levels up to 20,000 ft msl. It was not expected that the cloud would reach this altitude. The decision was made to fire even though there was a possibility that the CP might become contaminated.

6.1.2 The helicopter was able to verify that the fall-out was in a southerly direction in a narrow strip west of the Control Point at 0515. The On-Site ground monitors radioed their first report about this time. The survey was not completed and transmitted back to the CP until 0630 hr. This delay was in part due to the ruggedness of the terrain in this area. Communications for On-Site work were somewhat better than usual. "R" hour was announced by the Test Director at 0624.

6.2 ON-SITE OPERATIONS

6.2.1 In preparation for Shot Ray, two dry runs were completed on D-3, one was completed on D-2, and one on D-1. Communications were excellent for all dry runs except on D-2 when the power repeater station was off.

6.2.2 The contamination pattern determined by the initial survey for Shot Ray is shown in Incls. 1 and 2. Radio communication was excellent. One hundred eighteen (118) parties and work details, consisting of 521 individuals, were processed. Approximately 1100 film badges were processed during the period 10 April to 16 April 1953. Sixty-six (66) vehicles were decontaminated during the period.

6.3 OFF-SITE OPERATIONS

6.3.1 The changes in the anticipated fall-out pattern resulting from Shot Ray are delineated in the weather maps provided by the Air Weather Service Unit attached to the NPG (Sec. II, WT-705). Immediately following the detonation, it became evident that the forecast pattern from the early wind would not be realized. Off-Site personnel and equipment were moved as described in the events listed in Incl. 3.

6.3.2 Significant ground levels were detected by ground survey teams along U. S. Highway 95 west of Mercury; a desert road about 15 miles south of Highway 95; Nevada Highway 52 between Pahrump, Nevada, and Shoshone, California; and on the road east of Tecopa, California.

*Period covered, 10 to 16 April 1953.

Shoshone, Tecopa, Tecopa Hot Springs, California, and Pahrump, Nevada, were the only communities in which fall-out of a detectable nature occurred. Results of the ground survey teams are given in Incl. 4. At points other than the above, contamination detected was residual from previous detonations.

6.3.3 Air sampling results confirm the pattern of fall-out shown by the ground survey teams. Samples collected at CP, Mercury, Indian Springs, Las Vegas, Nellis AFB, and Death Valley Junction indicate further that minor quantities of activity from Shot Ray were present at these locations. A tabulation of air concentrations from this shot is given in Incl. 5.

6.3.4 The results of water samples analyzed for fission product activity are presented in Incl. 6.

6.3.5 A pictorial presentation of the pattern is shown in Incl. 7.

6.4 AIR PARTICIPATION

6.4.1 The cloud was anticipated to reach only 15,000 ft msl. This precluded closing of the air space above 20,000 ft msl. The air space below 20,000 ft msl was closed for a radius of 50 miles between the 90° vector left to the 180° vector from 0430 to 0700 on D-day. In addition, the air space below 20,000 ft msl and between the 90° and 180° vectors (changed to 90° to 200° vectors at 0510) out to the west side of Amber 2 was closed from 0430 to 0700. The warning circle extended for a radius of 125 miles in all directions from Las Vegas, Nevada.

6.4.2 The cloud reached an altitude of 14,000 ft msl. This low altitude, plus the fact that it immediately passed over terrain 7,500 ft msl, left less than seven thousand (7,000) ft of cloud to track. Consequently, cloud tracking aircraft were not used. The position of the cloud was determined by the cloud sampling aircraft. Their data are given in Incl. 8. The actual cloud track and the predicted cloud path are plotted in Incl. 9.

6.4.3 The helicopter again made a close-in aerial survey. It was off at H+15 min and by H+30 min had delineated the general area of the close-in fall-out. The last part of the mission was spent tracing the south position of the ground contamination. From the data it submitted (Incl. 10), the limits of contamination could be determined. This agreed with the ground monitor data taken some time later.

6.4.4 The L-20 and C-47 were off on the extended terrain survey at H+2 hr and H+2 hr and 15 min, respectively. The data from the L-20 are attached as Incl. 11; the C-47 data are attached as Incl. 12. The fall-out pattern was so narrow that no plot was made since it would appear almost as a line. No survey was necessary on D+1.

6.5 LOGISTICS AND SUPPLY

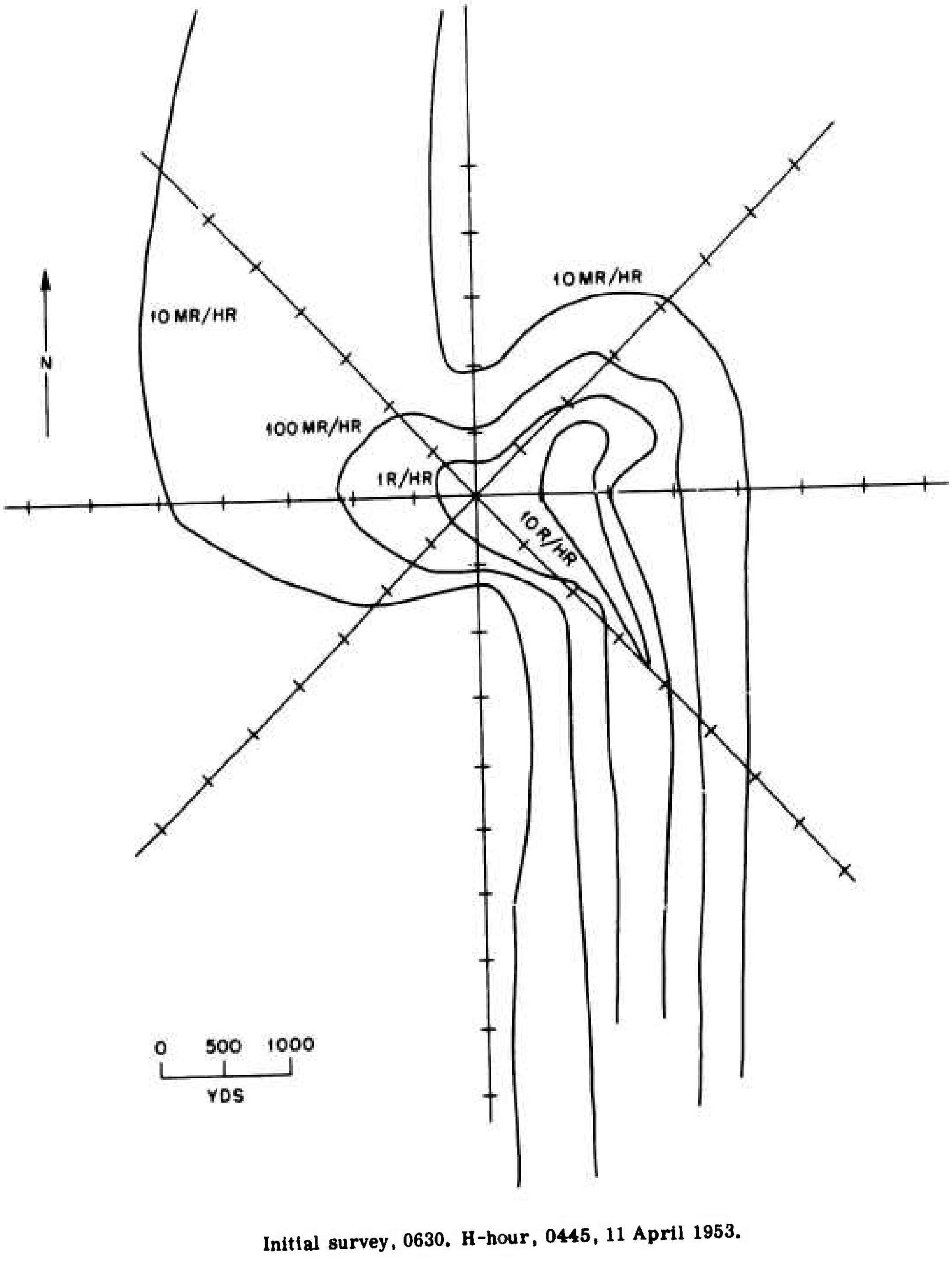
For the period 10 to 16 April 1953, inclusive, the Supply Section issued 516 pairs of shoe covers, 181 protective caps, 215 pairs of coveralls, 154 pairs of cotton gloves, 289 high intensity goggles, 12 pairs of rubber gloves, and 53 respirators. The laundry serviced 511 pairs of shoe covers, 95 protective caps, 351 pairs of coveralls, 322 pairs of cotton gloves, 42 respirators, 90 pillowcases, 180 sheets, and 88 towels. During the period, 143 instruments were issued and 79 repaired. Second echelon maintenance was performed on 23 vehicles. Twenty-three vehicles were lubricated and weekly maintenance pulled. Seven (7) vehicles were deadlined.

6.6 GENERAL

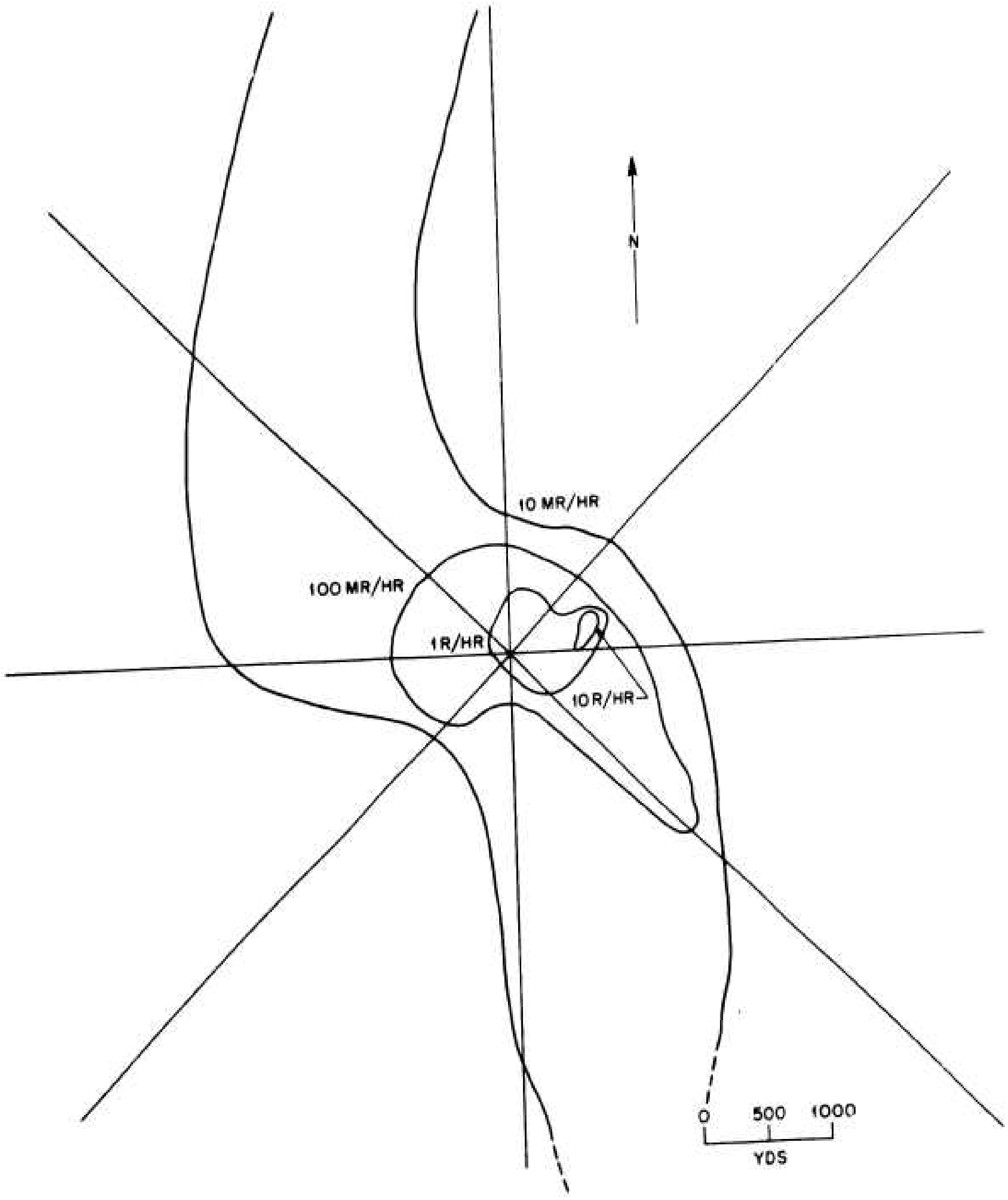
The radiological problem for this shot was much greater than for Shot Ruth. The use of a 100 ft tower instead of a 300 ft tower was the main factor in this increase of contamination. The fall-out pattern was very narrow. It proceeded just west of the Control Point and extended approximately 45 miles to the south. No populated area was in the fall-out path. This minimized the Rad-Safe problem.

Inclosure 1

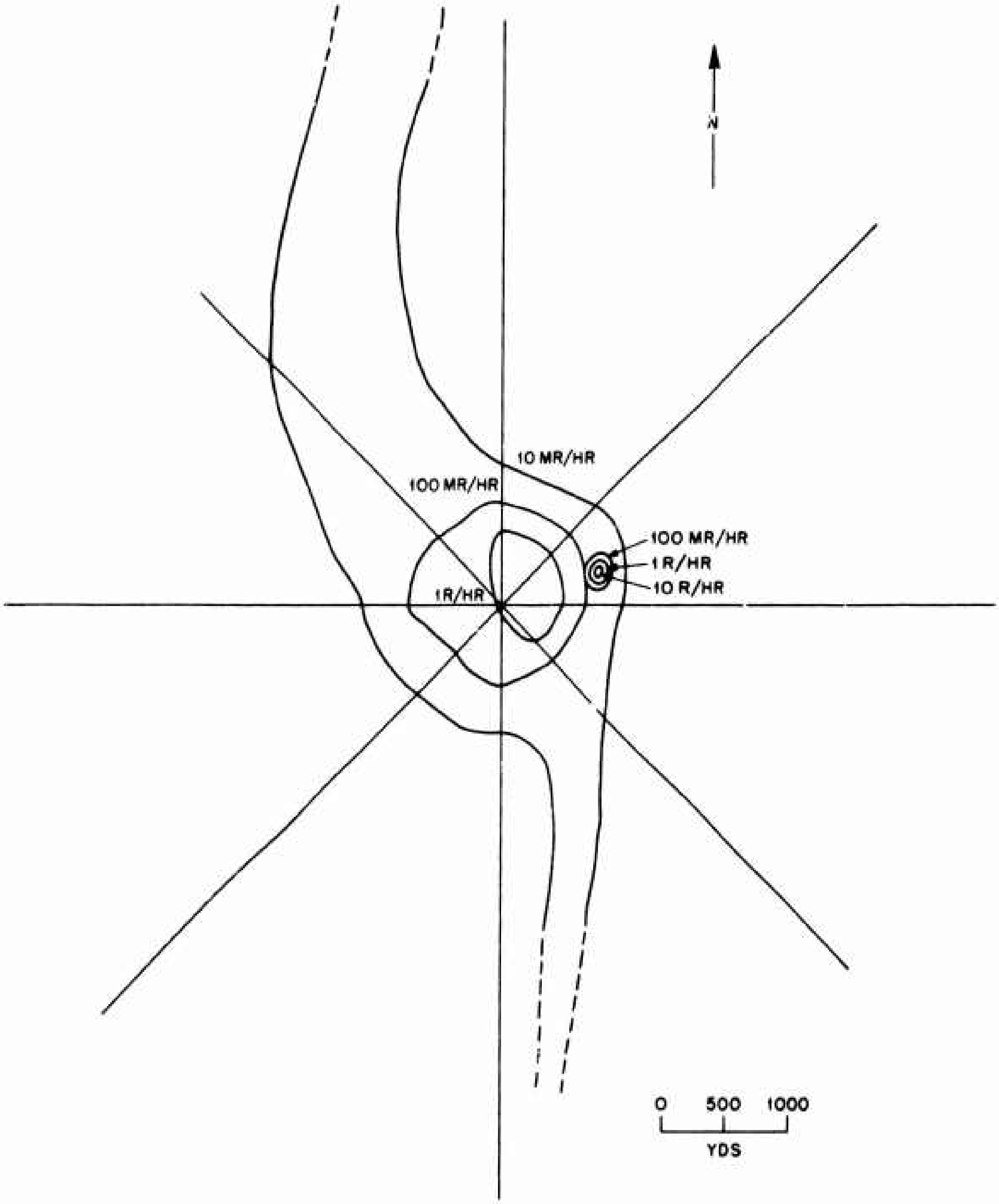
SURVEYS OF TEST AREA 4



Initial survey, 0630. H-hour, 0445, 11 April 1953.



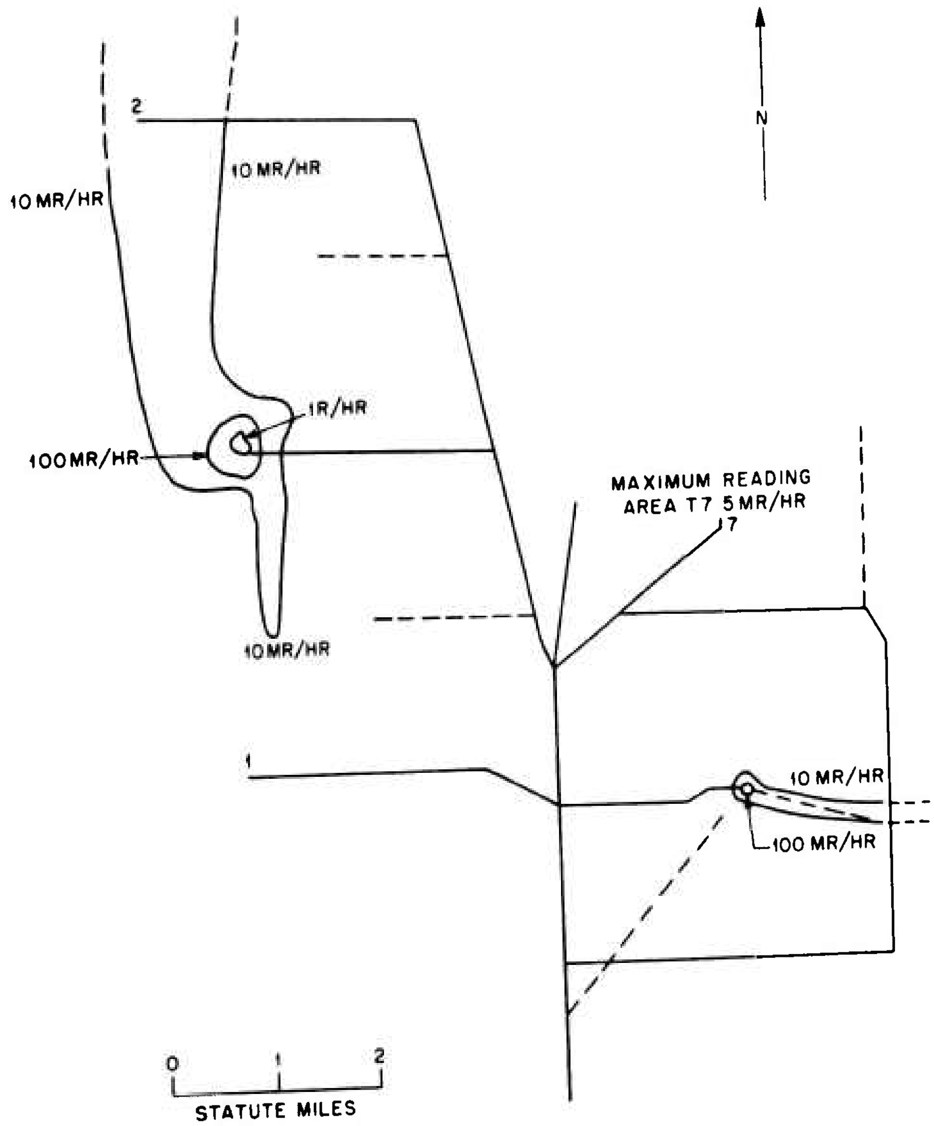
Resurvey, 0700, 12 April 1953.



Resurvey, 0700, 13 April 1953.

Inclosure 2

YUCCA FLAT RADIOLOGICAL SITUATION, 0700, 14 APRIL 1953



Data taken 0700, 14 April 1953, Yucca Flat.

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Inclosure 3

OFF-SITE ACTIVITY JOURNAL, SHOT RAY

10 April 1953

1100 – 1300	All teams departed for their respective stations. As a result of the latest wind forecast, it did not appear practical to move any of the mobile units out of the Mercury area at this time.
1530	Vehicle trouble reported by Beatty unit; advised military of this situation for action.
1630	Radio difficulty experienced, which prevented transmission from CP control units.
1700	Complete radio communications reinstated at the CP control units.
2000	Status report given to Rad-Safe Operations Officer; all teams but one reported arrival on station via radio.
2200	In view of the 2100 weather forecast, mobile units were instructed to continue standing by at Mercury.
2230	Secured CP radio until 0400.

11 April 1953

0400	Radio control established.
0415	One mobile monitoring unit was instructed to depart at shot time and proceed to Las Vegas monitoring between Indian Springs and Las Vegas while the road is re-monitored by the other member; the second mobile monitoring unit was assigned to monitor the highway between Mercury and Indian Springs. One mobile air sampling unit dispatched to Pahrump Valley and the other to Boulder City.
0450	Boulder City mobile air sampling unit instructed to proceed to junction of Mercury road with Highway 95 and stand by.
0455	Las Vegas mobile monitoring unit instructed to proceed to Highway 95 and Mercury road junction and stand by.
0515	Pioche and Caliente reported via telephone; they had been unable to receive CP on the radio. The area of interest was outlined to them and they were told they would be instructed when to secure their stations.
0555	Mobile air sampling unit instructed to proceed to Death Valley Junction and set up station and monitor from Death Valley Junction to Furnace Creek Ranch. Mobile monitoring unit to proceed to Mercury Junction and monitor from the junction to Lathrop Wells and report via telephone or radio.
0600	Radio in CP control unit transmitting weakly and not receiving at all.
0615	Radio at CP control unit not transmitting or receiving.
0625	Radio at CP control unit now receiving and transmitting.

0630	Mobile air sampling unit enroute to Pahrump contacted and instructed to proceed to Shoshone, California.
0700	Mobile monitors reported readings along Highway 95 from Lathrop Wells via telephone and instructed to proceed to Beatty, Stovepipe Wells, Furnace Creek, and Death Valley Junction.
0720	General situation report broadcasted to all teams in the field. Acknowledgments received from only one team via HF.
0740	Mobile air sampling unit at Death Valley Junction called in reading via telephone and instructed to monitor Death Valley Junction to Ash Meadows and return. Secure station at 1500 and return to Mercury.
0745	Mobile monitoring unit returned from Indian Springs and contacted Off-Site via telephone from Mercury. Instructed to proceed to Lathrop Wells and Pahrump, then return to Mercury.
0800	Mobile air sampling unit at Shoshone called in readings via telephone. Has set up station there. Instructed to stay there until 1500 and then return to Mercury via same route, monitoring on the way. Prior to starting return trip, monitor on road east of Tecopa and between Shoshone and Death Valley Junction.
0925	Mobile monitoring unit reported from Lathrop Wells via telephone that radio is out. Previous instructions changed to route them across desert road north of Death Valley Junction before returning to Mercury.
1000	General situation report broadcasted to all teams in the field. Acknowledgment received from only one team via HF.
1030	Mobile monitoring unit, routed through Death Valley National Monument, reported in via telephone from Death Valley. They had experienced a generator failure. Will stand by at present location until picked up by mobile air sampling unit located at Death Valley Junction to return to Mercury in company with them.
1100	Team at Ely experienced vehicle difficulty due to a blown-out tire.
1150	Radio control and Off-Site headquarters transferred to CP Building No. 2.
1200	General situation report broadcasted to all teams in the field. Acknowledgment received from only one team via HF.
1500	Monitoring report received from mobile unit marking east-west run south of Shoshone, California, closing the pattern from this shot.
1600	General situation report broadcasted to all teams in the field. Acknowledgments received from three teams via HF.
2200	Radio secured.

12 April 1953

0830	Radio control reinstated.
0900	Teams returning from the field began processing data for shot report.
1700	All teams returned to Mercury.

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Inclosure 4

GROUND MONITORING DATA, SHOT RAY

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stafford	H+12:20	Pahrump	0.08	H+2:00	0.56
Williams	H+5:35	Pahrump	0.20	H+2:00	0.68
Henderson	H+8:53	Pahrump	0.07	H+2:00	0.40
Henderson	H+9:55	13 miles N of Pahrump on Hwy 16	0.09	H+2:00	0.60
Stafford	H+12:50	15 miles N of Pahrump on Hwy 16	0.08	H+1:45	0.74
Henderson	H+10:15	23 miles N of Pahrump on Hwy 16	0.20	H+1:45	1.7
Stafford	H+13:05	25 miles N of Pahrump on Hwy 16	0.10	H+1:45	1.1
Henderson	H+10:27	28 miles N of Pahrump on Hwy 16	0.02	H+1:45	
Henderson	H+3:15 to 3:30	Mercury Junction with Hwy 95 to 99 miles W	Background		
Henderson	H+3:30	9.9 miles W of Mercury Junction with Hwy 95	0.3	H+1:30	0.83
Jaworski	H+1:20 to 1:40	Mercury Junction with Hwy 95 to 11 miles W	Background		
Jaworski	H+1:40	11 miles W of Mercury Junction with Hwy 95	0.2	H+1:30	0.26
Jaworski	H+11:40	11 miles W of Mercury Junction with Hwy 95	0.1	H+1:30	1.20
Wolff	H+1:30 to 1:43	Mercury Junction with Hwy 95 to 12 miles W	Background		
Wolff	H+8:38	11 miles W of Mercury Junction with Hwy 95	0.1	H+1:30	0.8
Spangler	H+27:15	11 miles W of Mercury Junction with Hwy 95	0.07	H+1:30	1.8
Meyer	H+32:02	11 miles W of Mercury Junction with Hwy 95	Background	H+1:30	
Henderson	H+3:36	11.9 miles W of Mercury Junction with Hwy 95	1.2	H+1:30	3.2
Wolff	H+1:43	12 miles W of Mercury Junction with Hwy 95	0.5	H+1:30	0.66
Wolff	H+8:33	12 miles W of Mercury Junction with Hwy 95	3.0	H+1:30	24.0
Jaworski	H+11:38	12 miles W of Mercury Junction with Hwy 95	0.2	H+1:30	2.3
Spangler	H+27:10	12 miles W of Mercury Junction with Hwy 95	0.17	H+1:30	5.3
Meyer	H+31:58	12 miles W of Mercury Junction with Hwy 95	0.06	H+1:30	20.0
Jaworski	H+11:36	13 miles W of Mercury Junction with Hwy 95	3.0	H+1:30	35.0
Spangler	H+27:15	13 miles W of Mercury Junction with Hwy 95	1.35	H+1:30	38.0

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Jaworski	H+1:45	13.4 miles W of Mercury Junction with Hwy 95	3.0	H+1:30	3.7
Meyer	H+31:54	13.5 miles W of Mercury Junction with Hwy 95	0.5	H+1:30	18.0
Henderson	H+3:42	13.7 miles W of Mercury Junction with Hwy 95	12.0	H+1:30	32.0
Jaworski	H+11:34	14 miles W of Mercury Junction with Hwy 95	3.5	H+1:30	40.0
Wolff	H+1:45	14 miles W of Mercury Junction with Hwy 95	21.0	H+1:30	26.0
Wolff	H+8:29	14 miles W of Mercury Junction with Hwy 95	4.0	H+1:30	33.0
Spangler	H+27:10	14 miles W of Mercury Junction with Hwy 95	1.05	H+1:30	33.0
Wolff	H+8:26	15 miles W of Mercury Junction with Hwy 95	6.0	H+1:30	48.0
Meyer	H+31:52	15 miles W of Mercury Junction with Hwy 95	0.4	H+1:30	15.0
Spangler	H+27:07	15 miles W of Mercury Junction with Hwy 95	1.6	H+1:30	48.0
Henderson	H+3:48	15.7 miles W of Mercury Junction with Hwy 95	9.0	H+1:30	28.0
Jaworski	H+1:48	15.8 miles W of Mercury Junction with Hwy 95	9.0	H+1:30	12.0
Wolff	H+8:20	16 miles W of Mercury Junction with Hwy 95	1.0	H+1:30	7.8
Jaworski	H+11:31	16 miles W of Mercury Junction with Hwy 95	1.5	H+1:30	17.0
Spangler	H+27:02	16 miles W of Mercury Junction with Hwy 95	0.85	H+1:30	27.0
Henderson	H+3:51	16.7 miles W of Mercury Junction with Hwy 95	4.0	H+1:30	13.0
Wolff	H+8:17	17 miles W of Mercury Junction with Hwy 95	0.3	H+1:30	2.3
Jaworski	H+11:28	17 miles W of Mercury Junction with Hwy 95	0.3	H+1:30	3.3
Spangler	H+26:55	17 miles W of Mercury Junction with Hwy 95	0.12	H+1:30	3.3
Henderson	H+3:54	17.7 miles W of Mercury Junction with Hwy 95	0.5	H+1:30	1.5
Jaworski	H+1:49	17.7 miles W of Mercury Junction with Hwy 95	1.3	H+1:30	1.6
Wolff	H+8:15	20 miles W of Mercury Junction with Hwy 95	0.1	H+1:30	0.77
Jaworski	H+1:51	23 miles W of Mercury Junction with Hwy 95	1.3	H+1:30	1.6
Wolff	H+2:07	Lathrop Wells	2.0	H+1:30	2.9
Wolff	H+8:13	Lathrop Wells	0.08	H+1:30	0.57

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Jaworski	H+1:57	Lathrop Wells	0.2	H+1:30	0.28
Jaworski	H+11:20	Lathrop Wells	Background	H+1:30	
Meyer	H+31:39	Lathrop Wells	Background	H+1:30	
Stafford	H+8:02	18 miles E of Tecopa on Beck Springs road	0.10		
Stafford	H+11:10	Shoshone	Background		
Williams, G.	H+3:45	Shoshone	Background		
Stafford	H+11:30	4 miles E of Shoshone on Hwy 52	0.40	H+2:30	2.4
Williams, G.	H+4:05	4 miles E of Shoshone on Hwy 52	0.40	H+2:30	0.7
Stafford	H+11:33	5 miles E of Shoshone on Hwy 52	1.10	H+2:30	6.9
Williams, G.	H+4:10	5 miles E of Shoshone on Hwy 52	1.5	H+2:30	2.7
Stafford	H+11:42	7 miles E of Shoshone on Hwy 52	1.0	H+2:30	6.2
Williams, G.	H+4:25	7 miles E of Shoshone on Hwy 52	4.0	H+2:30	7.9
Stafford	H+11:47	10 miles E of Shoshone on Hwy 52	0.85	H+2:30	5.4
Williams, G.	H+4:35	10 miles E of Shoshone on Hwy 52	1.0	H+2:30	2.1
Stafford	H+11:52	13 miles E of Shoshone on Hwy 52	0.55	H+2:30	3.5
Williams, G.	H+4:45	13 miles E of Shoshone on Hwy 52	0.90	H+2:30	1.9
Stafford	H+12:0	17 miles E of Shoshone on Hwy 52	1.55	H+2:30	11.0
Williams, G.	H+4:50	17 miles E of Shoshone on Hwy 52	4.0	H+2:30	8.8
Stafford	H+12:05	19 miles E of Shoshone on Hwy 52	1.45	H+2:30	9.3
Williams, G.	H+4:55	19 miles E of Shoshone on Hwy 52	3.0	H+2:30	6.9
Stafford	H+12:10	21 miles E of Shoshone on Hwy 52	1.0	H+2:30	6.6
Williams, G.	H+5:10	21 miles E of Shoshone on Hwy 52	1.0	H+2:30	2.4
Stafford	H+12:15	24 miles E of Shoshone on Hwy 52	0.2	H+2:30	1.4
Williams, G.	H+5:15	24 miles E of Shoshone on Hwy 52	0.4	H+2:30	0.95
Stafford	H+2:40	15 miles W of Pahrump on Hwy 52	0.45		Fall-out occurring
Stafford	H+2:45	20 miles W of Pahrump on Hwy 52	0.15		Fall-out occurring
Stafford	H+2:48	22 miles W of Pahrump on Hwy 52	0.40		Fall-out occurring
Stafford	H+2:51	25 miles W of Pahrump on Hwy 52	0.20		Fall-out occurring
Stafford	H+2:55	Shoshone, ½ mile E of station	0.10		
Stafford	H+3:15 to 3:45	Shoshone station at Hwy intersection	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stafford	H+3:55	Shoshone station at Hwy intersection	0.15	H+4:00	0.15
Stafford	H+4:15	Shoshone station at Hwy intersection	0.15	H+4:00	0.16
Stafford	H+5:15	Shoshone station at Hwy intersection	0.12	H+4:00	0.17
Stafford	H+6:15	Shoshone station at Hwy intersection	0.12	H+4:00	0.20
Stafford	H+7:45	Shoshone station at Hwy intersection	0.05	H+4:00	0.11
Stafford	H+8:45	Shoshone station at Hwy intersection	0.08	H+4:00	0.21
Stafford	H+9:20	Shoshone station at Hwy intersection	0.15	H+4:00	0.41
Stafford	H+9:32	10 miles N of Shoshone on Hwy 127	0.05		
Stafford	H+9:45 to 9:55	20 miles N of Shoshone to Death Valley Junction	Background		
Stafford	H+6:58	Shoshone station	0.15		
Stafford	H+7:03	5 miles S of Shoshone station on Hwy 127	0.06		
Stafford	H+7:06	Tecopa, Hwy 127 intersection	0.10		
Stafford	H+7:13	3 miles E of intersection	0.10		
Stafford	H+7:15	Tecopa Hot Springs	0.10	H+3:00	0.29
Stafford	H+7:18	Tecopa	0.12	H+3:00	0.34
Stafford	H+7:27	4 miles E of Tecopa	0.55	H+3:00	1.6
Stafford	H+7:34	8 miles E of Tecopa	0.40	H+3:00	1.2
Stafford	H+7:40	10 miles E of Tecopa on Beck Springs road	0.40	H+3:00	1.3
Stafford	H+7:49	Intersection of Beck Springs road and Smith Mine road	0.20		
Stafford	H+7:57	17 miles E of Tecopa on Beck Springs road	0.20		
Melton	H+0:35 to 8:30	Currant	Background		
Melton	H+9:30	Preston	Background		
Melton	H+9:35	Lund	Background		
Ayer	H+27:15 to 34:30	Ely to Warm Springs	Background		
Fooks	H+3:05 to 4:05	Alamo to 25 miles S on Hwy 93	Background		
Fooks	H+4:07	25.8 miles S of Alamo on Hwy 93	0.06		
Fooks	H+4:15	26.8 miles S of Alamo on Hwy 93	0.40		
Fooks	H+4:43	29.6 miles S of Alamo on Hwy 93	0.65		
Fooks	H+4:47	0.5 miles W of Hwy 93	0.37		
Fooks	H+5:02	3.1 miles W of Hwy 93	0.15		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Fooks	H+8:50 to 9:15	Crystal Springs to Alamo	Background		
Fooks	H+10:42 to 12:05	Crystal Springs to Caliente	Background		
Fooks	H+27:15 to 28:50	Crystal Springs to Groom Lake	Background		
Johnson, C. C.	H+2:15 to 3:00	Las Vegas to Nellis AFB	Background		
Johnson, C. C.	H+3:40	Las Vegas	Background		
Johnson, C. C.	H+3:40 to 4:10	Las Vegas to 20 miles S on Hwy 91	Background		
Holy	H+3:15 to 13:15	Groom Mine	Background		
Rechen	H+2:30 to 11:50	Lincoln Mine	0.5		
Henderson	H+5:40 to 6:34	23 miles S of Lathrop Wells on California Hwy 127 to Ash Meadows	Background		
Henderson	H+6:46	14.2 miles E of Nevada 29	0.07		
Henderson	H+6:55	16.2 miles E of Nevada 29	0.50	H+1:45	2.6
Henderson	H+7:06	17.2 miles E of Nevada 29	3.0	H+1:45	16.0
Henderson	H+7:15	18.2 miles E of Nevada 29	4.0	H+1:45	22.0
Henderson	H+7:21	19.2 miles E of Nevada 29	2.5	H+1:45	9.0
Henderson	H+7:28	20.2 miles E of Nevada 29	1.0		5.8
Henderson	H+8:13	28.0 miles E of Nevada 29	0.1		
Henderson	H+8:30	5 miles E of intersection toward Pahrump	0.08		
Fetz	H+3:0 to 4:45	Tonopah	Background		
Fetz	H+4:45 to 5:13	Tonopah to Goldfield on Hwy 95	Background		
Fetz	H+9:10 to 9:45	Tonopah to 30 miles N of junction on U. S.-6 and Nevada 8A	Background		
Weathersbee	H+1:45 to 24:00	Glendale Junction	Background		
Weathersbee	H+2:15	25 miles S of Glendale Junction on Hwy 91	Background		
Weathersbee	H+28:00 to 29:00	Glendale to Nellis AFB	Background		
Claborn	H+3:0 to 12:0	St. George, Utah	0.1		
Meyer	H+4:50 to 5:24	Warm Springs to 30 miles E of Warm Springs	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Meyer	H+6:28 to 7:02	Warm Springs to 30 miles W of Warm Springs	Background		
Meyer	H+7:12	40 miles W of Warm Springs	0.15		
Meyer	H+7:22 to 7:34	46.8 miles W of Warm Springs to 50 miles W of Warm Springs	Background		
Wheeler	H+3:0 to 3:40	Pioche to Caliente	Background		
Jaworski	H+2:07	12 miles S of Lathrop Wells on Hwy 29	0.2		
Jaworski	H+2:12	16 miles S of Lathrop Wells on Hwy 29	0.08		
Wolff	H+2:25	14 miles NW of Lathrop Wells on Hwy 95	0.4		
Wolff	H+2:45	24 miles NW of Lathrop Wells on Hwy 95	0.2		
Spangler	H+26:00 to 26:33	Beatty to Lathrop Wells	Background		
Wolff	H+3:00	1 mile E of Beatty	0.15		
Spangler	H+3:00 to 7:00	Beatty	Background		
Wolff	H+3:25	8 miles SW of Beatty on Hwy 58	0.1		
Wolff	H+3:40	17 miles SW of Beatty on Hwy 58	Background		
Spangler	H+9:55 to 10:20	Beatty to 20 miles SW on Hwy 58	Background		
Wolff	H+4:05	Stovepipe Wells	0.06		
Wolff	H+5:45	Death Valley Junction	Background		
Jaworski	H+2:45	Death Valley Junction	0.04		
Jaworski	H+3:15	Death Valley Junction	0.10		
Jaworski	H+3:45	Death Valley Junction	0.04		
Jaworski	H+6:25	Death Valley Junction	0.03		
Stafford	H+9:55	Death Valley Junction	Background		
Jaworski	H+3:22 to 3:45	1 mile E of Death Valley Junction to 8 miles E of Death Valley Junction toward Ash Meadows	Background		
Platz	H+25.00 to 27:00	St. George to Glendale	Background		
Johnson, C. C.	H+26:00 to 27:30	Las Vegas to Indian Springs	Background		

Inclosure 5

AIR SAMPLING RESULTS

Location	Time of sample	Activity, $\mu c/M^3$
CP	0345 – 0545, 4/11/53	2×10^{-3}
	0545 – 0645, 4/11/53	4.8×10^{-2}
	0645 – 0830, 4/11/53	3.0×10^{-3}
	0830 – 1030, 4/11/53	2.94×10^{-4}
	1030 – 1430, 4/11/53	1.98×10^{-4}
	1430 – 2100, 4/11/53	2.04×10^{-4}
	2100 – 0825, 4/11 – 4/12/53	1.18×10^{-5}
	Average concentration for sampling period	2.09×10^{-3}
	0525 – 0655, 4/11/53	MMD = 0.3 μ
Mercury	0330 – 0530, 4/11/53	1.10×10^{-5}
	0630 – 0745, 4/11/53	4.1×10^{-5}
	0745 – 1005, 4/11/53	9.6×10^{-4}
	1005 – 1240, 4/11/53	4.8×10^{-5}
	1240 – 1745, 4/11/53	7.2×10^{-4}
	1745 – 2045, 4/11/53	1.34×10^{-5}
	2045 – 1000, 4/11 – 4/12/53	7.75×10^{-5}
	Average concentration for sampling period	2.4×10^{-4}
	1025 – 2045, 4/11/53	MMD = 0.76 μ
Indian Springs	0550 – 0720, 4/11/53	Background
	0720 – 1055, 4/11/53	Background
	1100 – 1330, 4/11/53	12.9×10^{-6}
	1330 – 1725, 4/11/53	5.86×10^{-4}
	1725 – 2150, 4/11/53	16×10^{-3}
	2155 – 0945, 4/11 – 4/12/53	27×10^{-6}
	Average concentration for sampling period	1.6×10^{-4}
	1110 – 2155, 4/11/53	MMD = 0.94 μ
Las Vegas	0345 – 0600, 4/11/53	Background
	0600 – 1900, 4/11/53	4.23×10^{-4}
	1900 – 0830, 4/11 – 4/12/53	2.77×10^{-4}
	Average concentration for sampling period	3.15×10^{-4}

Location	Time of sample	Activity, $\mu c/M^3$
Nellis AFB	0430–0645, 4/11/53	Background
	0645–1815, 4/11/53	1.19×10^{-4}
	1815–0715, 4/11–4/12/53	2.09×10^{-4}
	Average concentration for sampling period	1.34×10^{-4}
	0645–0715, 4/11–4/12/53	MMD = 1.3 μ
Glendale Junction	0545–0450, 4/11–4/12/53	Background
St. George	0550–0700, 4/11–4/12/53	Background
Alamo	0420–0500, 4/11–4/12/53	Background
Crystal Springs	0430–2210, 4/11–4/12/53	Background
Groom Mine	0430–0445, 4/11–4/12/53	Background
Lincoln Mine	0440–0630, 4/11–4/12/53	Background
Caliente	0345–0745, 4/11–4/12/53	Background
Pioche	0445–0845, 4/11–4/12/53	Background
Ely	0403–0712, 4/11–4/12/53	Background
Currant	0515–0620, 4/11–4/12/53	Background
Warm Springs	0445–1245, 4/11/53	Background
Tonopah	0405–0612, 4/11–4/12/53	Background
Beatty	0345–0545, 4/11–4/12/53	Background
Death Valley Junction,	0710–0925, 4/11/53	29×10^{-6}
California	0922–1200, 4/11/53	0.79×10^{-3}
	1200–1510, 4/11/53	8.4×10^{-6}
	Average concentration for sampling period	3.19×10^{-4}
Shoshone, California	0815–0915, 4/11/53	2.11×10^{-3}
	0915–1115, 4/11/53	1.1×10^{-2}
	1115–1315, 4/11/53	8.35×10^{-4}
	1330–1530, 4/11/53	6.03×10^{-4}
	Average concentration for sampling period	3.87×10^{-3}
	0815–1520, 4/11–4/12/53	MMD = 1.55 μ

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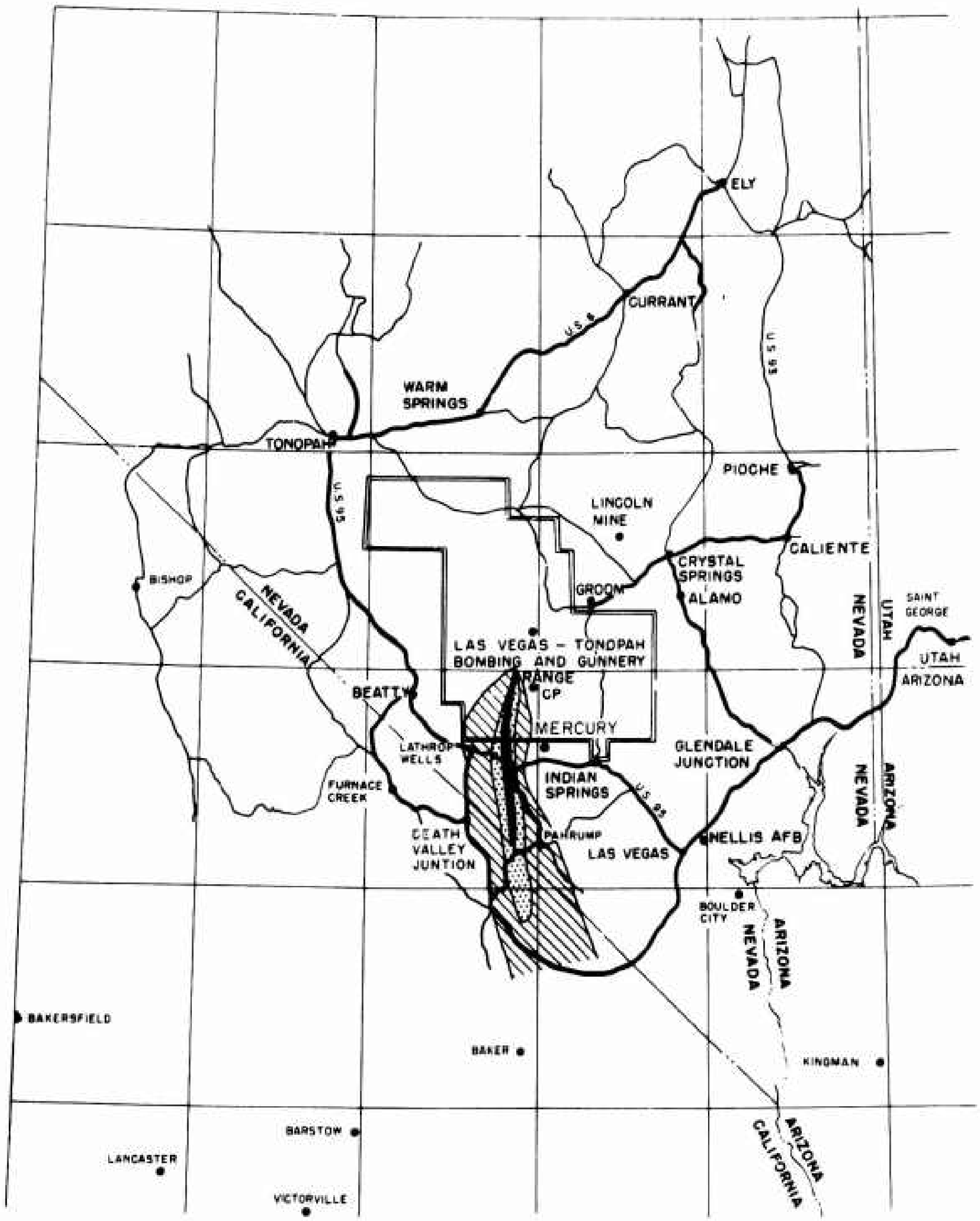
Inclosure 6

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at time of collection, μc/liter
4/11/53	2100	Groom Mine Supply	2.67×10^{-4}
4/12/53	0745	Ash Springs	7.8×10^{-4}
4/12/53	0600	Lower Pahranagat Lake	1.92×10^{-4}
4/12/53	0530	Upper Pahranagat Lake	2.31×10^{-4}

Inclosure 7

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT RAY



■, 20 to 200 mr/hr. ░, 2 to 20 mr/hr. ▧, 0.2 to 2 mr/hr. Heavy lines indicate the monitor runs.

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Inclosure 8

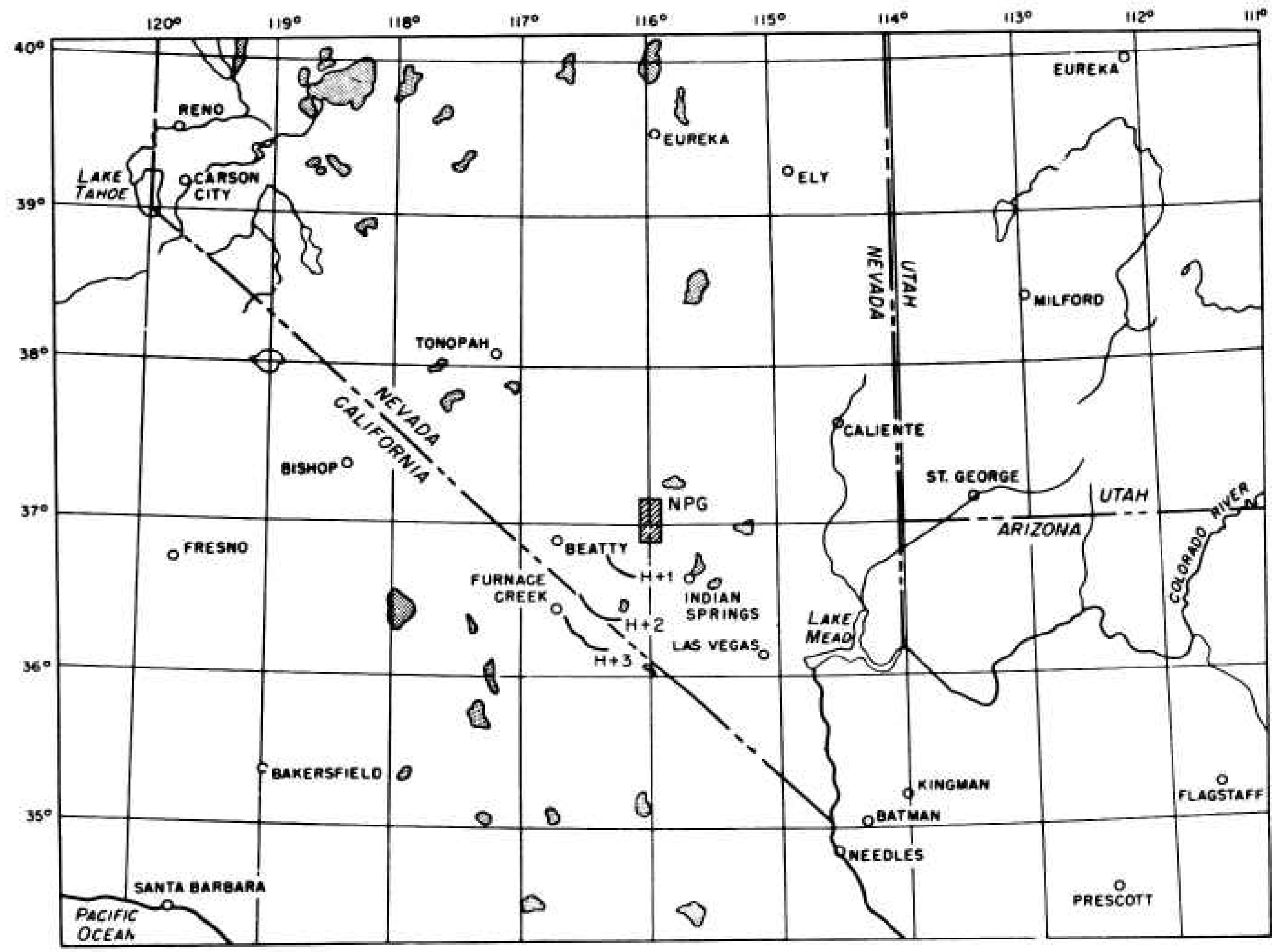
DATA FOR CLOUD SAMPLER AIRCRAFT B-50 (SKULL CAP)

Position*	Time	Altitude	Remarks
ZB 45	0554	14,000	By cloud sampler
ZC 47	0715	14,000	By cloud sampler
ZD 47	0733	14,000	By cloud sampler; maximum intensity inside Rosie, 500 mr/hr
ZD/ZE 47/48	0755	14,000	By cloud sampler; maximum intensity inside Rosie, 500 mr/hr

*The grid coordinates used are those shown in Incl. 9, Chap. 2.

Inclosure 9

CLOUD TRACKING DATA, SHOT RAY



Cloud track, 11 April 1953. ———, top of cloud 14,000 ft msl.

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Predicted trajectory, 2100, 11 April 1953. ———, 8,000 ft msl. ...., 10,000 ft msl. —·—·—, 15,000 ft msl.

Inclosure 10

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter, mr/hr
L 18		50	0
L 15	0502	50	0
L 14	0505	50	0
K 12	0506	50	0
Station 26	0510	10	3,000
Station 16	0515	5	100
Stake line 15	0516	10	3,000
Stake line S46	0520	5	2,000
Stake line 45	0521	5	2,000
Stake line 26	0525	5	35,000
J 13	0530	50	7,000
J 14	0537	50	25,001
I 15	0538	50	20
Slight J 15	0535	50	500
J 15	0539	50	10
I/J 16	0545	50	175
I 16	0547	50	1,800
I 17	0553	50	1,800
I/J 17		50	300
K 18	0554	5	100
J 18	0555	5	2,500
I 18	0557	5	1,000
G 19	0606	25	200
H 19	0605	25	1,000
I 19	0607	25	100
J 19	0608	25	20
K 20	0611	50	10
J 20	0612	50	10
I 20	0614	50	800
I 21	0615	50	300

Position*	Time	Altitude above ground, ft	T1B meter, mr/hr
J 21	0616	50	50
N 15	0627	50	12
H 9	0635	50	40
I 12	0646	1,000	2,000

*Coordinates are those listed in Incl. 19, Chap. 3.

Inclosure 11

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	Meter readings, mr/hr T1B
A 44/45	0700	500	0.03	0
A 42	0713	500	0.03	0
ZA 42	0715	500	1.1	1
ZA 42/43	0717	500	0.03	0
½ZA ½42/43	0720	500	Fullscale	50
A 42/43	0722	500	0.03	0
A 43	0724	500	0.03	0
ZA 43	0728	500	5	5
ZA 43/44	0730	500	0.4	0.5
A 43/44	0733	500	0.03	0.02
B 43/44	0736	500	0.03	0
B 44	0740	500	0.03	0
ZB 44	0747	500	0.03	0
AB 45	0750	500	0.05	0.02
B 45	0759	500	0.03	0
B 44/45	0802	500	0.03	0
ZA 44/45	0806	500	0.03	0
A 45	0811	500	0.03	0

*The coordinates used are those shown in Incl. 9, Chap. 2.

Inclosure 12

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	C-1 air foil	Remarks
C 45	0704	500	0.05	0		
B 45	0708	500	0.03	0	0.2	
A 45	0712	500	0.05	0.2		
ZA 45	0715	500	0.4	0.6		
ZB 45	0718	500	0.08	0.2		ZA 45+1 min B 3 and W 3.6
ZC 45	0720	500	0.06	0.2		
ZD 45	0723	500	0.07	0.4		
ZE 45	0728	700	0.05	0.4	20	
ZE 45/46	0730	700	0.05	0.4		
ZD 45/46	0732	700	0.09	0.4		
ZC 45/46	0735	600	0.03	0.2		
ZB 45/46	0738	500	0.05	0.2		
ZA 45/46	0741	500	1	1.6		ZA 45/46 minus 45 sec B 1.5, W-2
A 45/46	0745	700	0.07	0.2		
A 46	0747	500	0.13	0.2		
ZA 46	0750	700	0.3	0.4		
ZB 46	0753	500	0.1	0.2		ZA 46 + 45 sec B 0.9, W 1.0
ZC 46	0756	500	0.1	0.2	20	
ZD 46	0803	500	0.12	0.2		W Bg 1.5
ZE 46	0810	700	0.07	0.4		
ZE 46/47	0812	500	0.07	0.2		
ZE 47	0814	500	0.07	0.2		
ZE 47/48	0816	500	0.05	0.2		
ZE 48	0819	500	0.15	0.2		
ZD 46/47	0831	700	0.07	0.2		
ZC 46/47	0834	1000	0.1	0.2		
ZB 46/47	0837	700	0.1	0.2		
ZA 47/47	0840	700	1.1	0.6		
A 46/47	0843	500	0.12	0.2		
A 47	0846	700	0.09	0.4		

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	C-1 air foil	Remarks
ZA 47	0851	600	0.2	0.6		ZA 47 minus 45 sec, B 0.7, W 0.8
ZB 47	0854	700	0.1	0.2		
ZC 47	0857	500	0.06	0.2	20	Green No. 2 Bg 7 mr
ZD 47	0901	600	0.05	0.4		
ZD 47/48	0902	500	0.05	0.4		
ZC 47/48	0906	800	0.15	0.3		
ZB 47/48	0909	500	0.1	0.2		
ZA 47/48	0913	500	0.2	0.3		ZA 47/48 minus 45 sec, B 0.4, W 0.4
A 47/48	0917	500	0.1	0.2		
A 48	0919	500	0.15	0.2	13	
ZA 48	0925	500	0.3	0.4		
ZB 48	0930	800	0.13	0.3		
ZC 48	0933	500	0.1	0.3		
ZD 48	0939	700	0.08	0.1		
ZD 49	0944	700	0.1	0.2	20	
ZC 49	0948	700	0.1	0.1	2	
ZB 49	0952	700	0.1	0.1		
ZA 49	0955	800	0.15	0.2		
A 49	1001	700	0.1	0.1	20	

*The grid coordinates used are those shown in Incl. 9, Chap. 2.

Chapter 7

SHOT BADGER*

7.1 INTRODUCTION

7.1.1 The sixth shot of the Upshot-Knothole series, Badger, was detonated on a 300 ft tower in Area 2 of Yucca Flat, NPG, at 0435 PST, 18 April 1953. The winds were from the west and forecast to remain in that general direction when the decision to fire was made at the 2100 PST weather briefing on 17 April 1953.

7.1.2 Initial radiation survey reports were received from On-Site at 0450. The survey was completed at 0730. The long time required for this survey was caused by the rough terrain over which some of the monitor teams had to travel. Normal access routes to the north and northeast of the area were blocked by radiation fields higher than 50 r/hr.

7.1.3 Mercury Highway south of the CP was cleared at 0505. Frenchman Flat was declared open at 0520. Five projects were released at 0630, and two projects were released at 0639. R hour was not declared until 0710.

7.2 ON-SITE OPERATIONS

7.2.1 Six stake lines were laid along the roads in the T-2 area for this shot. As contamination fell southeast across Mercury Highway, it was necessary for the survey teams to enter the shot area from the west without use of the highway or the main access road to the area. The teams started their survey at 0450 and did not complete it until 0730. Survey plots are given in Incl. 1.

7.2.2 Generally,, recovery parties were not allowed to cross the 10 r/hr line; however, on this shot parties in vehicles were allowed to use Mercury Highway to reach the recovery area which was contaminated by fall-out of intensity greater than 50 r/hr. This led some parties to the belief that they could recover test data in areas greater than 10 r/hr without specific permission from the Test Director's Staff and resulted in some overexposures.

7.2.3 One hundred thirty-three (133) recovery parties, consisting of 396 personnel, were processed into the contaminated areas during this period. Approximately 1,600 film badges were processed. Ninety-two (92) vehicles were decontaminated.

7.2.4 Owing to the overexposures on this shot, a special training program for monitors was initiated by the On-Site Operations Officer.

7.2.5 A group of 16 FCDA personnel were conducted on a guided tour of the Rad-Safe Building on 23 April. Discussions were held with each section, and considerable time was spent instructing these personnel in the calibration of survey instruments.

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*Period covered, 17 to 23 April, 1953.

7.3 OFF-SITE OPERATIONS

7.3.1 The changes in the anticipated fall-out pattern resulting from Shot Badger are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). The actual pattern was not clear until after the detonation. This resulted in the movement of mobile personnel and equipment.

7.3.2 Significant ground levels were detected in the sector from south of Glendale Junction, Nevada, to Mercury, Nevada, and as far east as Arizona Highway 64 between Williams, Arizona, and the South Rim of the Grand Canyon of the Colorado River. A documentation of ground monitoring results is given in Incl. 2. Maximum fall-out occurred in the region between U. S. Highway 91, Lake Mead, and east. The report of a special survey of this area for inhabitants, domestic animals, and other pertinent data has been compiled in Incl. 3. Infinite doses for localities of interest are given in Incl. 4. It will be noted that the monitoring logs indicate a duration of fall-out considerably longer than previously experienced.

7.3.3 Air sampling results confirm the pattern of paragraph 7.3.2. Samples collected at Glendale Junction and Overton, Nevada, showed further that minor quantities of activity from Shot Badger were found at these locations. The extended period of fall-out was also observed in the air samples. A tabulation of air concentrations from this shot is given in Incl. 5.

7.3.4 The pictorial presentation of the pattern is shown in Incl. 6.

7.3.5 The results of water samples analyzed for fission product activity are presented in Incl. 7.

7.4 AIR PARTICIPATION

7.4.1 The cloud was forecast to go to the East South East. This affected the closing of the air space enclosed by the 45° and 120° vectors from ground zero to Amber 2 Airway at all altitudes from 0400 to 0530 PST. In addition, the air space enclosed by the 45° vector left to the 120° vector for a 50 mile radius was closed at all altitudes from 0400 to 0530 PST. At 21,000 ft msl and above, the area enclosed by a line from Las Vegas to Albuquerque to Grand Junction to Milford to Las Vegas was closed from 0500 to 1100 PST. The altitude was increased from 21,000 to 27,000 ft at 0523. The enclosed area was changed to Las Vegas to El Paso to Albuquerque to Durango to Las Vegas at 0610. So much activity was still in the cloud at 1100 PST that the area bounded by Durango to Albuquerque to El Paso to Fort Worth to Durango was closed above 27,000 ft msl from 1100 to 1700 PST. The warning circle was a 200 mile radius from Las Vegas in all directions from 0400 to 0530 PST.

7.4.2 The maximum cloud height was 37,200 ft msl as determined by cloud sampling aircraft. The three cloud tracking aircraft, two B-29's and one B-25, determined the position of the stem at 22,000, 18,000, and 12,000 ft msl, while the position of the top was determined by sampling aircraft. The data are listed in Incl. 8. These data are plotted in Incl. 9. The predicted path is shown in Incl. 10.

7.4.3 The helicopter made the close-in terrain survey. The data collected (Incl. 11) were satisfactory. The pilot and monitor were overexposed, however, due to poor decisions on the part of the monitor.

7.4.4 The L-20 and C-47 performed the extended terrain survey as usual. Communications were never established with the L-20; consequently a late change made in the pattern was not effected. Its original pattern and the data collected by this aircraft are shown in Incl. 12. The changed pattern for the C-47 was received. This pattern and the data collected are shown in Incl. 13. On D+1 a resurvey was made by the C-47. The data for this flight are shown in Incl. 14. The final plot of the fall-out area using all the data collected above along with data from Off-Site ground monitors shows a fall-out area that was narrow but extended more than 135 miles (Incl. 15). The second maximum west of Lake Mead had a time of fall of $3\frac{1}{2}$ to 4 hours' duration. This was at least one hour longer than was expected.

7.5 LOGISTICS AND SUPPLY

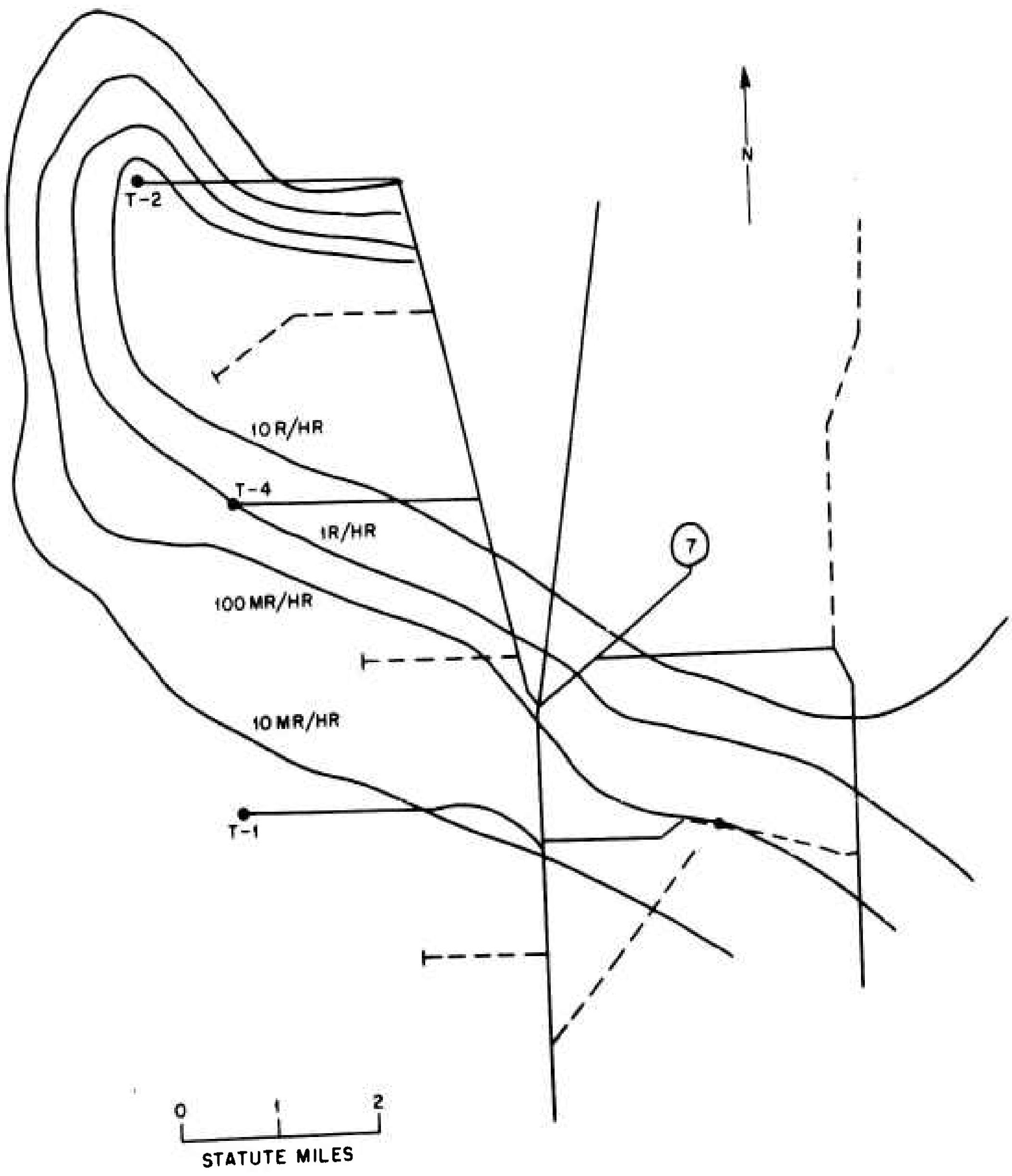
For the period, the Supply Section issued 238 protective caps, 274 pairs of shoe covers, 261 pairs of coveralls, 117 respirators, 133 pairs of cotton gloves, and 527 high intensity goggles. The laundry serviced 108 protective caps, 402 pairs of shoe covers, 369 pairs of coveralls, 145 respirators, 161 pairs of cotton gloves, 72 towels, 56 sheets, and 28 pillowcases. The laundry also serviced 3 bags of contaminated clothing for Indian Springs. Sixty-three (63) instruments were issued and 54 repaired. Twelve (12) vehicles received second echelon maintenance. Five (5) vehicles were deadlined during the period.

7.6 GENERAL

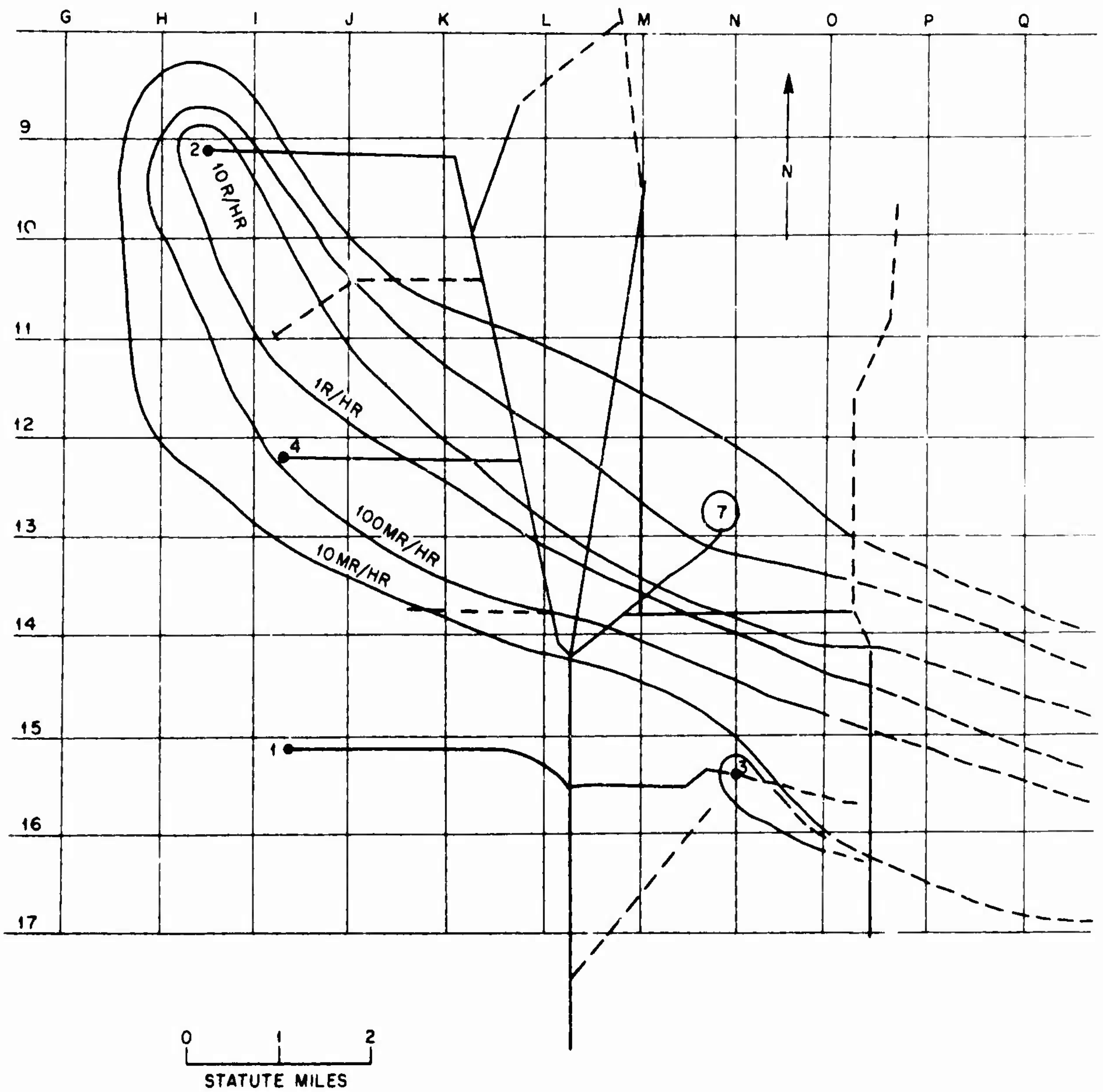
The radiological problem with this shot was greater than for any of the previous shots. As routes to the test area were highly contaminated, early recoveries could not be made without high exposure to monitors and project personnel. The Off-Site picture shows that the 100 r integrated dose line extended for some 35 miles from ground zero. A 10 r integrated dose was found in the second maximum some 110 miles from ground zero. Owing to the narrowness of the pattern and the exact geographical placement, no populated area was in the fall-out path. Any cattle in the path are included in Incl. 14.

Inclosure 1

SHOT BADGER SURVEYS

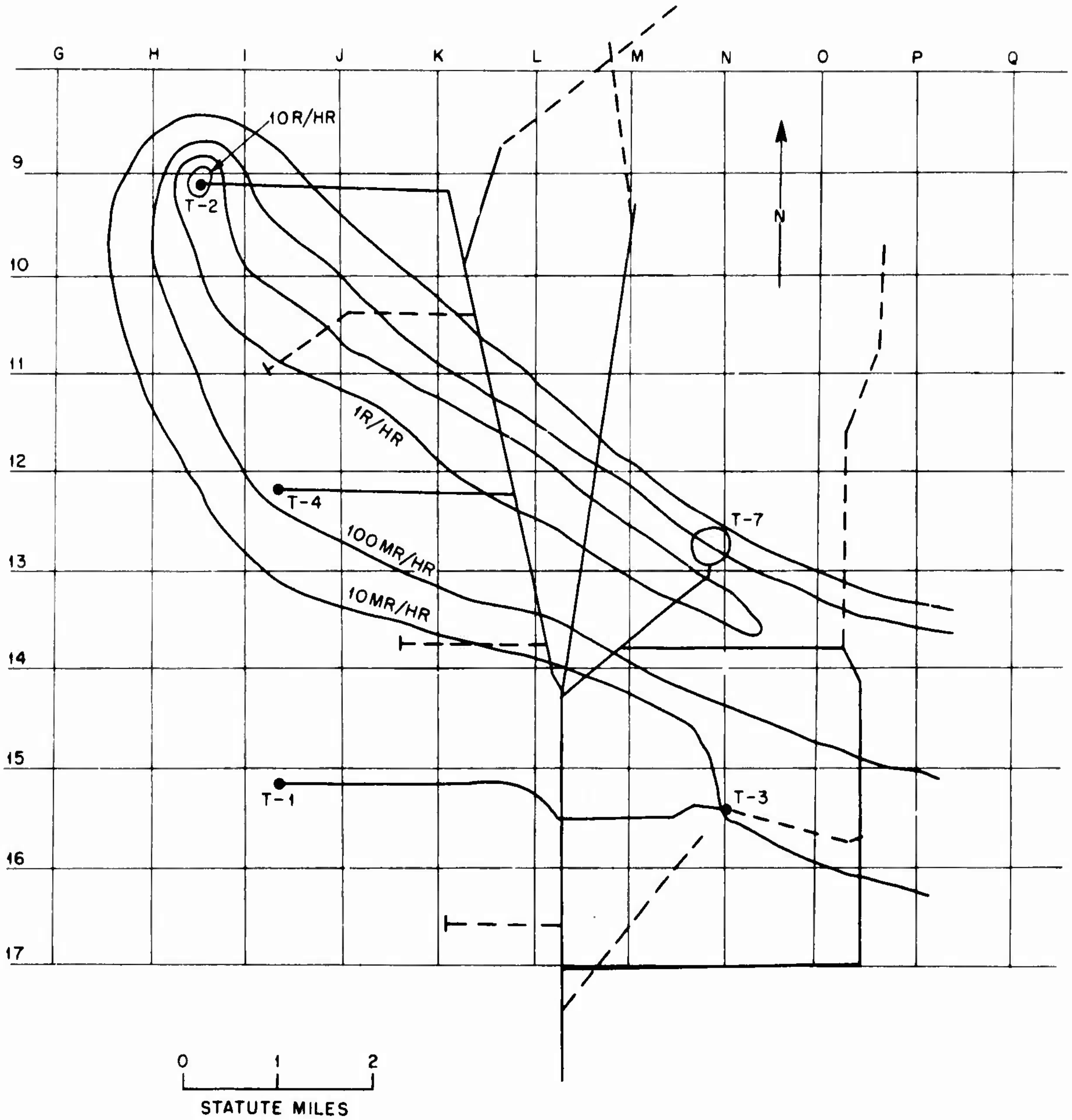


Initial survey, 0800, 18 April 1953. Area T-2, H-hour, 0435.



Resurvey, 0630, 19 April 1953.

[redacted]



Resurvey, 0730, 20 April 1953.

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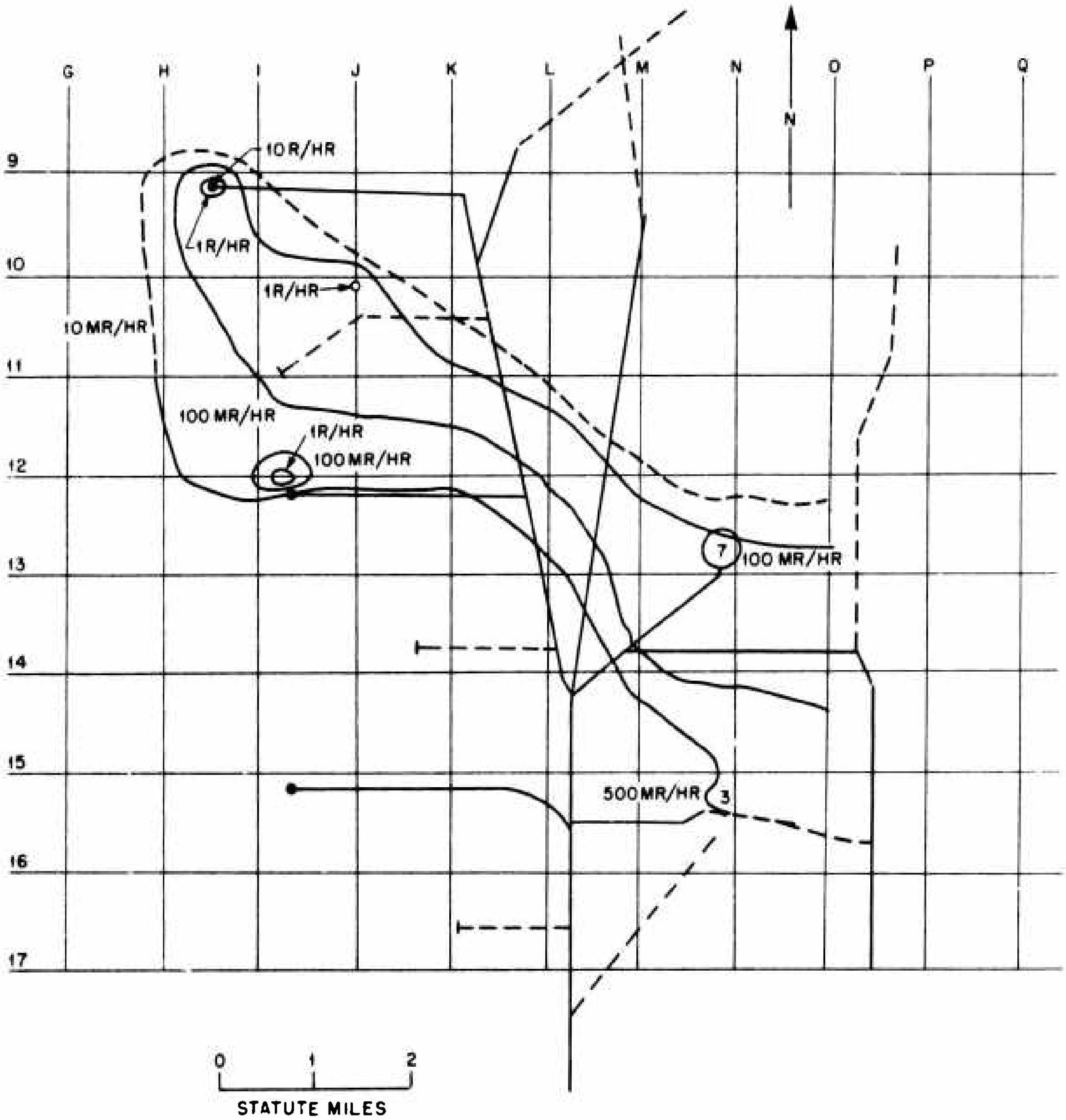
[redacted]



Resurvey, 0730, 23 April 1953.

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Inclosure 2

GROUND MONITORING DATA, SHOT BADGER

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H+1:40 to 2:18	Glendale Junction to 15 miles SW on Hwy 91	Background		
Melton	H+3:26 to 3:45	Glendale Junction to 10 miles SW on Hwy 91	Background		
Platz	H+29:00 to 31:10	Mesquite to Glendale Junction	Background		
Platz	H+31:10 to 31:25	From Glendale Junction to 10 miles SW of Glendale Junction on Hwy 91	Background		
Williams, G.	H+3:50 to 9:50	Glendale	Background		
Williams, G.	H+26:00	Glendale	Background		
Melton	H+3:51	12 miles SW of Glendale Junction on Hwy 91	0.8		Fall-out occurring
Melton	H+3:58	13.6 miles SW of Glendale Junction on Hwy 91	5.0		Fall-out occurring
Platz	H+31:28	14.0 miles SW of Glendale Junction on Hwy 91	0.4	5	3.5
Melton	H+4:00	14.3 miles SW of Glendale Junction on Hwy 91	13.0		Fall-out occurring
Platz	H+31:30	14.5 miles SW of Glendale Junction on Hwy 91	3.6	5	38.0
Platz	H+31:33	15 miles SW of Glendale Junction on Hwy 91	16.0	5	180.0
Williams	H+28:08	15 miles SW of Glendale Junction on Hwy 91	35.0	5	270.0
Melton	H+8:20	15 miles SW of Glendale Junction on Hwy 91	180.0	5	325.0
Melton	H+4:03	15.2 miles SW of Glendale Junction on Hwy 91	40.0		Fall-out occurring
Melton	H+4:04	15.3 miles SW of Glendale Junction on Hwy 91	50.0		Fall-out occurring
Melton	H+4:05	15.4 miles SW of Glendale Junction on Hwy 91	100.0		Fall-out occurring
Melton	H+4:07	15.6 miles SW of Glendale Junction on Hwy 91	100.5		Fall-out occurring
Melton	H+4:08	15.7 miles SW of Glendale Junction on Hwy 91	99.0		Fall-out occurring
Platz	H+31:36	16.0 miles SW of Glendale Junction on Hwy 91	26.0	5	240.0
Melton	H+4:13	16.4 miles SW of Glendale Junction on Hwy 91	115.0		Fall-out occurring
Melton	H+8:13	16.8 miles SW of Glendale Junction on Hwy 91	60.0	5	110.0
Platz	H+31:39	17.0 miles SW of Glendale Junction on Hwy 91	38.0	5	320.0
Larsen	H+13:05	17.0 miles SW of Glendale Junction on Hwy 91	60.0	5	180.0
Larsen	H+31:42	18.0 miles SW of Glendale Junction on Hwy 91	31.0	5	270.0

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Larsen	H+13:10	18.0 miles SW of Glendale Junction on Hwy 91	110.0	5	350.0
Melton	H+8:11	18.2 miles SW of Glendale Junction on Hwy 91	40.0	5	72.0
Melton	H+4:22	18.5 miles SW of Glendale Junction on Hwy 91	100.0		Fall-out occurring
Rowe	H+2:29	19.0 miles SW of Glendale Junction on Hwy 91	2.0		Fall-out occurring
Platz	H+31:45	19.0 miles SW of Glendale Junction on Hwy 91	14.0	5	120.0
Melton	H+4:25	19.5 miles SW of Glendale Junction on Hwy 91	80.0		Fall-out occurring
Rowe	H+2:33	20 miles SW of Glendale Junction on Hwy 91	22.0		Fall-out occurring
Williams	H+28:05	20 miles SW of Glendale Junction on Hwy 91	7.0	5	55.0
Platz	H+31:47	20 miles SW of Glendale Junction on Hwy 91	10.0	5	88.0
Larsen	H+13:14	20 miles SW of Glendale Junction on Hwy 91	90.0	5	280.0
Melton	H+4:26	20 miles SW of Glendale Junction on Hwy 91	60.0		Fall-out occurring
Rowe	H+2:39	21 miles SW of Glendale Junction on Hwy 91	9.5		Fall-out occurring
Platz	H+31:50	21 miles SW of Glendale Junction on Hwy 91	3.0	5	26.0
Melton	H+4:29	21.5 miles SW of Glendale Junction on Hwy 91	12.0		Fall-out occurring
Rowe	H+2:41	22.0 miles SW of Glendale Junction on Hwy 91	5.0		Fall-out occurring
Platz	H+32:00	22.0 miles SW of Glendale Junction on Hwy 91	2.2	5	19.0
Melton	H+8:10	23 miles SW of Glendale Junction on Hwy 91	19.0	5	35.0
Melton	H+8:09	24 miles SW of Glendale Junction on Hwy 91	13.5	5	23.0
Platz	H+32:05	24 miles SW of Glendale Junction on Hwy 91	1.0	5	9.0
Melton	H+8:08	25 miles SW of Glendale Junction on Hwy 91	8.5	5	15.0
Williams	H+28:25	26 miles SW of Glendale Junction on Hwy 91	0.6	5	5.0
Melton	H+8:07	26 miles SW of Glendale Junction on Hwy 91	5.0	5	8.5
Melton	H+8:04	27 miles SW of Glendale Junction on Hwy 91	3.8	5	6.5
Rowe	H+2:48	27 miles SW of Glendale Junction on Hwy 91	2.1		Fall-out occurring
Melton	H+4:39	28 miles SW of Glendale Junction on Hwy 91	5.0		Fall-out occurring
Larsen	H+13:52	28 miles SW of Glendale Junction on Hwy 91	4.0	5	11.0
Platz	H+32:10	29 miles SW of Glendale Junction on Hwy 91	0.8	5	7.0
Melton	H+8:00	30 miles SW of Glendale Junction on Hwy 91	2.5	5	4.5
Melton	H+7:56	33 miles SW of Glendale Junction on Hwy 91	1.9	5	3.2
Platz	H+32:20	34 miles SW of Glendale Junction on Hwy 91	1.0	5	9.0

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Melton	H+7:52	36 miles SW of Glendale Junction on Hwy 91	2.5	5	4.5
Melton	H+7:51	37 miles SW of Glendale Junction on Hwy 91	2.4	5	4.4
Larsen	H+13:44	37 miles SW of Glendale Junction on Hwy 91	3.5	5	4.1
Rowe	H+2:59	37 miles SW of Glendale Junction on Hwy 91	1.5		Fall-out occurring
Platz	H+32:25	39 miles SW of Glendale Junction on Hwy 91	0.08	5	0.65
Melton	H+7:47	39 miles SW of Glendale Junction on Hwy 91	1.6	5	2.90
Melton	H+7:45	41 miles SW of Glendale Junction on Hwy 91	1.5	5	2.50
Williams, G.	H+28:55	41 miles SW of Glendale Junction on Hwy 91	0.09	5	0.70
Rowe	H+3:13	42 miles SW of Glendale Junction on Hwy 91	1.5		Fall-out occurring
Weathersbee	H+1:05	Las Vegas	Background		Fall-out occurring
Weathersbee	H+4:00	Las Vegas	Background		Fall-out occurring
Rowe	H+4:17	Las Vegas	0.8		Fall-out occurring
Weathersbee	H+5:55	Las Vegas	0.18	5	0.23
Weathersbee	H+7:10	Las Vegas	0.35	5	0.50
Melton	H+7:25	Las Vegas	0.65	5	0.95
Weathersbee	H+7:55	Las Vegas	0.6	5	1.0
Weathersbee	H+10:10	Las Vegas	0.18	5	0.38
Weathersbee	H+19:45	Las Vegas	0.14	5	0.72
Weathersbee	H+26:55	Las Vegas	Background		
Williams, G.	H+29:25	Las Vegas	Background		
Platz	H+32:30	Las Vegas	Background		
Forsythe, C.	H+6:55	Junction of Nevada 12 and Nevada 40	0.4		Fall-out occurring
Melton	H+10:14	Junction of Nevada 12 and Nevada 40	0.6	8	0.80
Rossano	H+12:42	Junction of Nevada 12 and Nevada 40	0.2	8	0.36
Williams, G.	H+26:15	Junction of Nevada 12 and Nevada 40	Background		
Forsythe, C.	H+7:0	1 mile W of junction of Hwys 12 and 40 on Hwy 40	4.0		Fall-out occurring
Williams, G.	H+26:17	1 mile W of junction of Hwys 12 and 40 on Hwy 40	0.5	8	2.0
Forsythe, C.	H+7:05	2 miles W of junction of Hwys 12 and 40 on Hwy 40	12.0		Fall-out occurring
Melton	H+9:50	2 miles W of junction of Hwys 12 and 40 on Hwy 40	30.0	8	110.0
Rossano	H+12:47	2 miles W of junction of Hwys 12 and 40 on Hwy 40	6.0	8	11.0

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Williams, G.	H+26:25	3 miles W of junction of Hwys 12 and 40 on Hwy 40	3.0	8	12.0
Forsythe, C.	H+7:10	3 miles W of junction of Hwys 12 and 40 on Hwy 40	22.0		Fall-out occurring
Forsythe, C.	H+7:13	4 miles W of junction of Hwys 12 and 40 on Hwy 40	24.0		Fall-out occurring
Williams, G.	H+26:30	4 miles W of junction of Hwys 12 and 40 on Hwy 40	5.0	8	19.0
Rossano	H+12:57	5 miles W of junction of Hwys 12 and 40 on Hwy 40	42.0	8	73.0
Williams, G.	H+26:35	5 miles W of junction of Hwys 12 and 40 on Hwy 40	7.0	8	27.0
Williams, G.	H+26:40	6 miles W of junction of Hwys 12 and 40 on Hwy 40	19.5	8	80.0
Williams, G.	H+26:45	7 miles W of junction of Hwys 12 and 40 on Hwy 40	19.5	8	80.0
Melton	H+9:29	7.7 miles W of junction of Hwys 12 and 40 on Hwy 40	100.0	8	125.0
Forsythe, C.	H+7:35	8 miles W of junction of Hwys 12 and 40 on Hwy 40	140.0		Fall-out occurring
Rossano	H+13:03	8 miles W of junction of Hwys 12 and 40 on Hwy 40	85.0	7	180.0
Williams, G.	H+26:50	8 miles W of junction of Hwys 12 and 40 on Hwy 40	27.0	7	130.0
Williams, G.	H+26:53	8.5 miles W of junction of Hwys 12 and 40 on Hwy 40	28.0	7	135.0
Williams, G.	H+26:55	9 miles W of junction of Hwys 12 and 40 on Hwy 40	24.0	7	120.0
Rossano	H+13:10	9.5 miles W of junction of Hwys 12 and 40 on Hwy 40	40.0	7	86.0

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Williams, G.	H+27:05	10 miles W of junction of Hwys 12 and 40 on Hwy 40	16.0	7	75.0
Rossano	H+13:12	11 miles W of junction of Hwys 40 and 12 on Hwy 40	70.0	7	150.0
Williams, G.	H+27:10	11 miles W of junction of Hwys 40 and 12 on Hwy 40	22.0	7	110.0
Melton	H+9:14	11.4 miles W of junction of Hwys 40 and 12 on Hwy 40	110.0	7	140.0
Forsythe, C.	H+7:45	12 miles W of junction of Hwys 40 and 12 on Hwy 40	180.0		Fall-out occurring
Williams, G.	H+27:15	12 miles W of junction of Hwys 40 and 12 on Hwy 40	28.0	7	135.0
Rossano	H+7:52	13 miles W of junction of Hwys 40 and 12 on Hwy 40	110.0		Fall-out occurring
Melton	H+9:10	13.4 miles W of junction of Hwys 40 and 12 on Hwy 40	200.0	7	275.0
Williams, G.	H+27:20	14.0 miles W of junction of Hwys 40 and 12 on Hwy 40	31.0	7	155.0
Melton	H+9:04	14.9 miles W of junction of Hwys 40 and 12 on Hwy 40	155.0	7	210.0
Williams, G.	H+27:23	14.5 miles W of junction of Hwys 40 and 12 on Hwy 40	38.0	7	180.0
Williams, G.	H+27:25	15 miles W of junction of Hwys 40 and 12 on Hwy 40	32.0	7	160.0
Rossano	H+8:01	15.5 miles W of junction of Hwys 40 and 12 on Hwy 40	40.0		Fall-out occurring
Melton	H+9:00	15.6 miles W of junction of Hwys 40 and 12 on Hwy 40	160.0	6	250.0
Forsythe, C.	H+7:55	16 miles W of junction of Hwys 40 and 12 on Hwy 40	110.0		Fall-out occurring

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Melton	H+8:58	16.6 miles W of junction of Hwys 40 and 12 on Hwy 40	100.0	6	160.0
Williams, G.	H+27:30	17 miles W of junction of Hwys 40 and 12 on Hwy 40	20.0	6	120.0
Melton	H+8:53	17.6 miles W of junction of Hwys 40 and 12 on Hwy 40	80.0	6	130.0
Williams, G.	H+27:35	18 miles W of junction of Hwys 40 and 12 on Hwy 40	14.0	6	83.0
Melton	H+8:48	18.6 miles W of junction of Hwys 40 and 12 on Hwy 40	60.0	6	97.0
Williams, G.	H+27:40	19 miles W of junction of Hwys 40 and 12 on Hwy 40	14.0	6	85.0
Forsythe, C.	H+8:15	20 miles W of junction of Hwys 40 and 12 on Hwy 40	32.0	6	47.0
Williams, G.	H+27:45	20 miles W of junction of Hwys 40 and 12 on Hwy 40	6.0	6	33.0
Melton	H+8:43	20.4 miles W of junction of Hwys 40 and 12 on Hwy 40	28.0	6	37.0
Rossano	H+18:13	20.5 miles W of junction of Hwys 40 and 12 on Hwy 40	22.0	6	82.0
Melton	H+8:40	21.4 miles W of junction of Hwys 40 and 12 on Hwy 40	60.0	6	94.0
Williams, G.	H+27:55	22 miles W of junction of Hwys 40 and 12 on Hwy 40	6.0	6	34.0
Melton	H+8:32	22.3 miles W of junction of Hwys 40 and 12 on Hwy 40	75.0	6	115
Melton	H+8:24	23.4 miles W of junction of Hwys 40 and 12 on Hwy 40	95.0	6	140
Melton	H+8:20	Junction of Hwys 40 and 91	180.0	6	265
Forsythe, C.	H+8:40	Junction of H'vys 40 and 91	100.0	6	150
Rossano	H+17:51	Junction of Hwys 40 and 91	15.0	6	56
Williams, G.	H+28:03	Junction of Hwys 40 and 91	35.0	6	200
Carter	H+1:05 to 1:22	Indian Springs	Background		
Carter	H+3:22	Indian Springs	0.28		Fall-out occurring

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H+6:29	Indian Springs	0.70	4	1.3
Carter	H+10:30	Indian Springs	0.1	4	0.31
Carter	H+1:20	Cactus Springs	Background		
Carter	H+3:22	Cactus Springs	0.28		Fall-out occurring
Carter	H+9:54	Cactus Springs	0.1	4	0.29
Carter	H+3:50	Junction of Hwy 95 and Mercury Road	0.1		Fall-out occurring
Carter	H+5:30	Junction of Hwy 95 and Mercury Road	0.5	2	1.7
Carter	H+9:25	Junction of Hwy 95 and Mercury Road	0.09	2	0.5
Carter	H+4:15	Mercury Lab.	0.5	2	1.2
Carter	H+9:37	5 miles SE of junction of Mercury Road and Hwy 95 on 95	0.1	3	0.40
Carter	H+9:47	10 miles SE of junction of Mercury Road and Hwy 95 on 95	0.1	3	0.42
Rowe	H+7:35	Junction of Hwy 95 and Caretaker Road to Desert Game Refuge	0.5	5	0.80
Rowe	H+7:43	2 miles N on Caretaker Road	0.6	5	0.95
Rowe	H+7:49	4 miles N on Caretaker Road	0.8	5	1.40
Rowe	H+7:55	6 miles N on Caretaker Road	1.0	5	1.70
Rowe	H+8:20	Junction of Hwys 95 and 39	0.5	5	0.90
Rowe	H+8:30	5 miles from junction on Hwy 39	0.4	5	0.75
Rowe	H+8:39	10 miles from junction on Hwy 39	0.3	5	0.55
Rowe	H+8:54	20 miles from junction on Hwy 39 (Charleston Lodge)	0.4	5	0.78
Rowe	H+5:27	5 miles NW of Las Vegas on Hwy 95	0.7	5	0.78
Rowe	H+5:43	15 miles NW of Las Vegas on Hwy 95	0.7	5	0.81
Carter	H+2:16	18 miles NW of Las Vegas on Hwy 95	Background		
Carter	H+2:32	23 miles NW of Las Vegas on Hwy 95	Background		
Rowe	H+6:02	25 miles NW of Las Vegas on Hwy 95	0.7	5	0.85
Carter	H+1:53	28 miles NW of Las Vegas on Hwy 95	Background		

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Carter	H+2:40	29 miles NW of Las Vegas on Hwy 95	0.15		Fall-out occurring
Carter	H+2:48	31 miles NW of Las Vegas on Hwy 95	0.55		Fall-out occurring
Carter	H+2:59	32 miles NW of Las Vegas on Hwy 95	0.90		Fall-out occurring
Carter	H+1:41	33 miles NW of Las Vegas on Hwy 95	Background		
Carter	H+3:04	34 miles NW of Las Vegas on Hwy 95	1.30		Fall-out occurring
Carter	H+3:07	35 miles NW of Las Vegas on Hwy 95	4.8		Fall-out occurring
Rowe	H+6:14	35 miles NW of Las Vegas on Hwy 95	2.2	5	2.7
Carter	H+3:16	40 miles NW of Las Vegas on Hwy 95	0.4		Fall-out occurring
Rowe	H+6:17	40 miles NW of Las Vegas on Hwy 95	0.5	5	0.65
Rowe	H+29:10	Hoover Dam	0.3	7	1.4
Rowe	H+29:32	10 miles SE of Hoover Dam on Arizona 93	0.2	7	1.2
Rowe	H+29:57	30 miles SE of Hoover Dam on Arizona 93	0.2	9	0.85
Rowe	H+30:20	50 miles SE of Hoover Dam on Arizona 93	0.15	13	0.42
Rowe	H+30:40	Junction of Hwys Arizona 93 and 68	0.04	13	0.11
Rowe	H+30:51	5 miles W on Hwy Arizona 68	0.10	13	.28
Rowe	H+31:16	20 miles W on Hwy Arizona 68	0.70	13	1.90
Rowe	H+31:26	27 miles W on Hwy Arizona 68	0.70	13	1.95
Rowe	H+32:15	Kingman	0.1	15	0.24
Rowe	H+32:48 to 33:46	From Kingman to 50 miles E on Hwy 66 (Arizona)	0.1	12	0.32
Rowe	H+34:01	60 miles E of Kingman on Hwy 66 (Arizona)	0.08	12	0.24
Rowe	H+34:13	70 miles E of Kingman on Hwy 66 (Arizona)	0.02	12	0.58
Rowe	H+34:43 to 35:43	From 80 miles E of Kingman to Williams (Arizona)	Background		
Rowe	H+35:55	Junction of U. S. Hwy 66 and Arizona Hwy 64	0.07		
Rowe	H+36:19	20 miles N of junction of Hwys 66 and 64 (Arizona)	0.1	10	0.48
Rowe	H+36:41	40 miles N of junction of Hwys 66 and 64 (Arizona)	0.8	10	3.8

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H+36:50	43 miles N of junction of Hwys 66 and 64 (Arizona)	2.5	10	12.0
Rowe	H+36:56	45 miles N of junction of Hwys 66 and 64 (Arizona)	2.3	10	11.0
Rowe	H+37:11	54 miles N of junction of Hwys 66 and 64 (Arizona)	3.0	10	14.0
Rowe	H+37:18	57 miles N of junction of Hwys 66 and 64 (Arizona)	3.5	10	19.0
Rowe	H+37:30	End of Hwy 64 at Grand Canyon	1.9	10	9.5
Weathersbee	H+26:55	Las Vegas	Background		
Weathersbee	H+27:30	Jean	Background		
Weathersbee	H+15:55	Lake Mead Resort	0.3	7	0.81
Weathersbee	H+15:10	Boulder City	0.15	7	0.38
Weathersbee	H+15:35	Whitney	1.2	6	3.5
Weathersbee	H+28:0 to 29:30	Las Vegas to Mercury	Background		
Platz	H+29:0	St. George	Background		
Platz	H+29:05	1 mile W of St. George on Hwy 91	0.10		
Platz	H+29:15	4 miles W of St. George on Hwy 91	0.1		
Platz	H+29:25	9 miles W of St. George on Hwy 91	0.1		
Platz	H+29:30	14 miles W of St. George on Hwy 91	0.1		
Platz	H+29:40	19 miles W of St. George on Hwy 91	Background		
Forsythe, C.	H+3:10 to 4:10	Mesquite to Glendale	Background		
Forsythe, C.	H+6:25 to 7:20	Glendale to Mesquite	Background		
Rossano	H+1:09 to 12:10	Overton	Background		
Forsythe, C.	H+6:20	2 miles N of junction of Hwys 40 and 12 on Hwy 12	0.3		Fall-out occurring
Forsythe, C.	H+6:15	4 miles N of junction of Hwys 40 and 12 on Hwy 12	0.15		Fall-out occurring
Melton	H+10:22	4.6 miles N of junction of Hwys 40 and 12 on Hwy 12	0.30	8	0.41
Forsythe, C.	H+6:10	5 miles N of junction of Hwys 40 and 12 on Hwy 12	0.10		Fall-out occurring
Williams, G.	H+25:25	Overton	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Melton	H+10:32	9.3 miles N of junction of Hwys 12 and 40 on Hwy 12	0.3	8	0.41
Melton	H+10:45	Logandale	0.3	8	0.42
Williams, G.	H+26:15	Logandale	Background		
Melton	H+10:55	Junction of Hwys 12 and 91	Background		
Barry	E+26:10 to 27:45	Beatty to Furnace Creek	Background		
Barry	H+28:10	Badwater	Background		
Barry	H+29:50 to 30:31	Death Valley Junction to Lathrop Wells	Background		
Barry	H+30:45	9 miles S of Lathrop Wells on Hwy 95	0.20		
Barry	H+30:48	10 miles S of Lathrop Wells on Hwy 95	0.12		
Barry	H+30:52	11 miles S of Lathrop Wells on Hwy 95	0.18		
Barry	H+30:54	12 miles S of Lathrop Wells on Hwy 95	0.20		
Barry	H+30:57	13 miles S of Lathrop Wells on Hwy 95	0.20		
Fetz	H+31:13	14 miles S of Lathrop Wells on Hwy 95	0.30		
Fetz	H+31:23	21 miles S of Lathrop Wells on Hwy 95	0.30		
Barry	H+1:0 to 24:0	Beatty	Background		
Platz	H+1:0 to 16:20	St. George	Background		
Platz	H+9:25 to 11:10	St. George to 60 miles E of St. George	Background		
Platz	H+15:15 to 16:20	Enterprise to St. George	Background		
Weathersbee	H+1:05 to 4:25	Las Vegas	Background		
Weathersbee	H+1:40 to 3:35	Nellis AFB	Background		
Weathersbee	H+5:10	Nellis AFB	1.2		Fall-out occurring
Weathersbee	H+8:45	Nellis AFB	0.75	5	1.5
Weathersbee	H+13:10	Nellis AFB	0.55	5	1.8
Weathersbee	H+18:25	Nellis AFB	0.3	5	1.4
Weathersbee	H+24:45	Nellis AFB	0.3	5	1.9
Jensen	H+0:30 to 12:55	Lincoln Mine	0.3		
Claborn	H+28:55 to 30:15	Lincoln Mine to Groom Mine	Background		
Williams, D.	H+2:55 to 3:40	Pioche to Caliente	Background		
Williams, D.	H+7:25 to 8:10	Pioche to 30 miles N on Hwy 93	Background		
Graber	H+4:10 to 5:10	Caliente to Crystal Springs	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Paganini	H+1:30 to 2:55	Alamo to 24 miles S of Alamo Hwy 93	Background		
Paganini	H+3:00	26 miles S of Alamo on Hwy 93	0.50		
Paganini	H+3:08	Junction of Hwy 93 and Butler Ranch Road	0.55		
Paganini	H+3:16	1 mile S of Butler Ranch Road on Hwy 93	0.35		
Paganini	H+7:40 to 8:35	Crystal Springs to Alamo	Background		
Paganini	H+6:55 to 7:20	Crystal Springs to Hiko	Background		
Paganini	H+29:15 to 31:40	Crystal Springs to Groom Lake	Background		
Shipman	H+6:05 to 7:10	Currant to Ely	Background		
Shipman	H+13:0 to 14:20	Currant to 60 miles W of Currant	Background		
Shipman	H+23:0 to 23:51	Ely to Currant	Background		
Shipman	H+28:15 to 29:0	Ely to 30 miles S of Ely	Background		
Shipman	H+29:05	54 miles S of Ely on Hwy 93	0.15		
Shipman	H+29:15 to 30:05	66 miles S of Ely to 106 miles S of Ely on Hwy 93	Background		
Fetz	H+1:0 to 35:0	Tonopah Airport	Background		
Fetz	H+3:0 to 3:35	Tonopah to Goldfield	Background		
Fetz	H+28:30 to 31:09	Tonopah to 10 miles S of Lathrop Wells on Hwy 95	Background		
Barry	H+2:14 to 2:50	Beatty to 27 miles S of Beatty on Hwy 95	Background		
Barry	H+3:17	28 miles S of Beatty on Hwy 95	0.12	2	0.19
Barry	H+2:56	29 miles S of Beatty on Hwy 95	0.20	2	0.32
Barry	H+3:10	Lathrop Wells	0.20	2	0.30

Inclosure 3

SPECIAL STUDY, SHOT BADGER

April 24, 1953

TO: William S. Johnson, Off-Site Operations Officer, N.P.G.

FROM: R. H. Fetz and A. L. Platz, Rad/Safe Off-Site Monitors, N.P.G.

SUBJECT: SPECIAL STUDY, POST SHOT VI

The purpose of this special study was to determine the presence of humans and livestock in the area of fall-out in the area bounded by U. S. Highway 91 and the Lake Mead shoreline. Radiation levels were determined wherever habitation was encountered, providing road conditions permitted vehicle travel to these locations. Normal survey instruments were employed.

The radiation levels were determined during the period of 1240 to 1740 on April 21, 1953. The interval between readings varied from one to five miles, depending on the intensity of radiation encountered. A summary of the pertinent readings obtained is presented in the attached table.

The first phase of the study was conducted in an easterly direction along U. S. Highway 91 from Las Vegas to the point of "double background" on the Glendale side of the fall-out. Proceeding from Las Vegas, background only was encountered up to a point 8.8 miles east of the city limits of North Las Vegas. At this point, a radiation level of 0.25 mr/hr was observed. Proceeding further eastward along U. S. Highway 91, a gradual increase in radiation was noted until the turn-off road to Garnet (0.42 mr/hr) was read. Investigation at the railroad housing settlement (Garnet) revealed that sixteen (16) persons normally lived in the vicinity, with no livestock. The radiation level was 0.35 mr/hr at Garnet.

Returning to U. S. Highway 91 and proceeding toward Glendale, a roadside residence was observed 0.7 miles east of the Garnet road (0.40 mr/hr). The next habitation was at Dry Lake on U. S. Highway 91. The gas station attendant here estimated that thirty-five (35) people lived in the vicinity of Dry Lake. Radiation level in the area was 1.2 mr/hr.

Proceeding further toward Glendale, the radiation level increased gradually to a point 1.3 miles west of Crystal where a level of 11.4 mr/hr was determined at 1347. The level at Crystal was found to be 7.25 mr/hr, and seven (7) persons were working in the vicinity on D-day. Two calves and twenty (20) assorted poultry were observed in a pen in the rear of the Crystal service station. The run was continued toward Glendale, and it was found that the radiation level dropped off rapidly until the point of "double background" was found 2.1 miles east of Crystal (0.30 mr/hr) on Highway U. S. 91.

The survey vehicle then returned to Crystal and proceeded out Highway 40, southeast, toward Lake Mead. Readings were made at short intervals along Nevada Highway 40 to the junction of the Bitter Springs road. (Map point 1.) At this junction, a level of 2.9 mr/hr was observed. The vehicle then proceeded along the Bitter Springs road to the Colorock Quarry road. (Map point 2.) At the junction of the Colorock Quarry road and the Bitter Springs road, a level of 4.1 mr/hr was noted. The vehicle then proceeded to the Colorock Quarry. (Map point 3.) Four (4) persons were found to be living at the quarry (level of 1.0 mr/hr). Inquiry here revealed that a man named Ciro operated a ranch in the vicinity which normally ran 1500 head of cattle, but that only 150 head were believed to be in the area at the time of fall-out. The vehicle then returned to the Bitter Springs road and proceeded toward Bitter Springs until the road became too rough for the vehicle. This point was 2 miles past the Colorock Quarry road and is designated as point 4 on the map. Here the level was noted at 1.45 mr/hr.

The survey team then returned .. Nevada Highway 40 and proceeded toward Lake Mead through the Valley of Fire State Park. An high was observed at a point 13.4 miles west of the junction of Nevada Highways 40 an 5 mr/hr).

Investigation in the vici o' erton Beach (the terminus of Nevada Highway 12) revealed only background. Accom ion. for approximately 150 to 200 persons were observed at Overton Beach. A water sample w , taken at the boat dock at Overton Beach. (Map point 5.)

Background only was encountered along Nevada Highway 12 to Glendale.

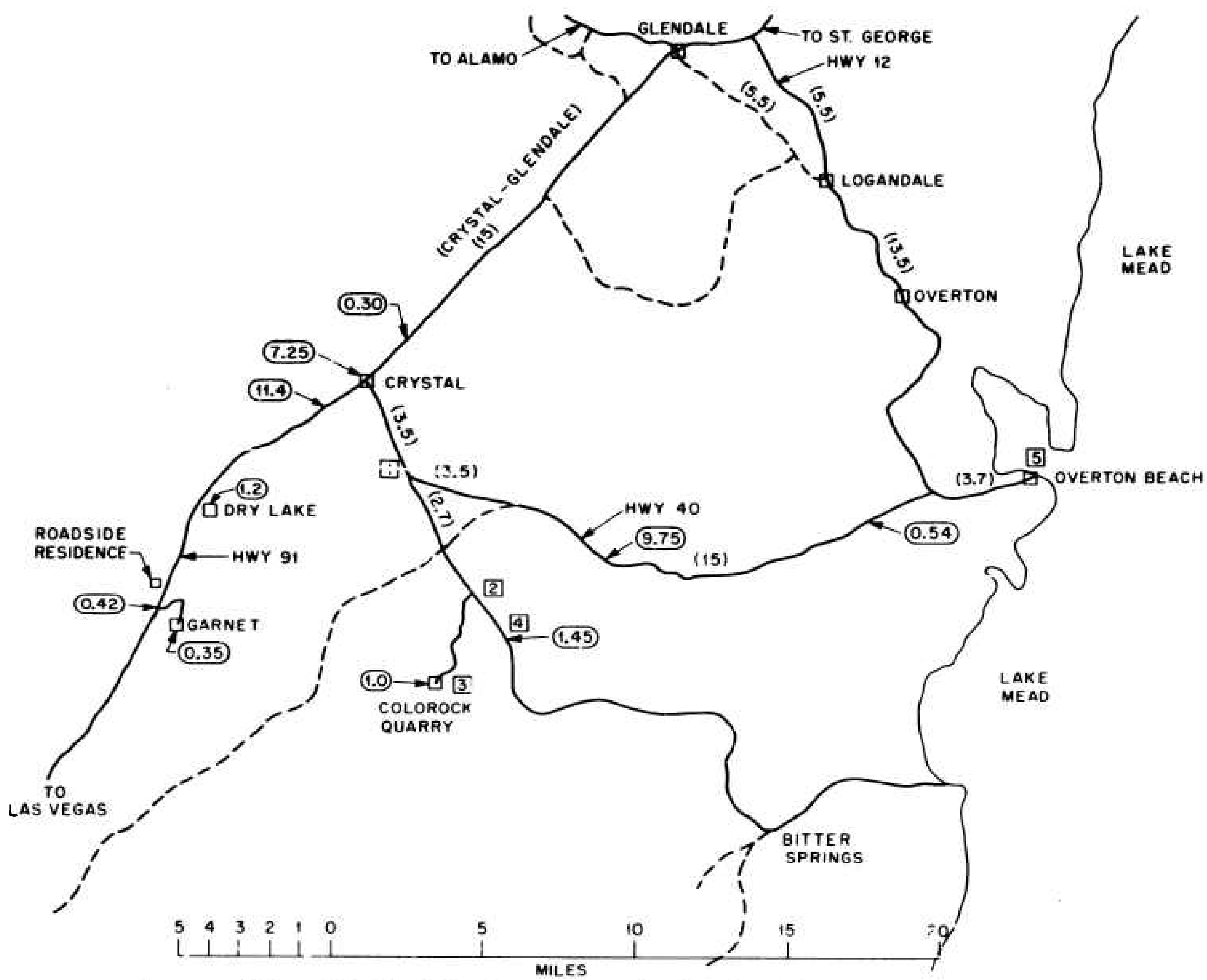
The team then returned along U. S. Highway 91 toward Las Vegas. On the return trip to Las Vegas, approximately ten (10) cows were observed along the highway in the vicinity of the Garnet road.

Richard H. Fetz
Albert L. Platz
Rad/Safe Off-Site Monitors
Nevada Proving Grounds

js

Table of Pertinent Ground Levels Obtained April 21, 1953, During the Special Study of Fall-out Area

Time	Location	Radiation level, mr/hr
1240	City limits of North Las Vegas	0.08
1246	Nellis AFB Entrance	0.10
1253	U. S. Hwy 91, 8.8 miles E of city limits of North Las Vegas	0.25
1316	Garnet community	0.35
1329	Dry Lake community	1.2
1347	U. S. Hwy 91, 26.9 miles E of city limits of North Las Vegas	11.4
1351	Crystal community	7.25
1403	U. S. Hwy 91, 30.3 miles E of city limits of North Las Vegas	0.30
1429	Junction of Nevada Hwy 40 and Bitter Springs road	2 9
1512	Colorock Quarry	1.0
1549	Point 4 (on map), six miles from junction of Nevada Hwy 40 with Bitter Springs road	1.45
1625	10.3 miles from Crystal on Nevada Hwy 40	9.75
1700	21.5 miles from Crystal on Nevada Hwy 40	0.54
1717	Overton Beach	0.13
1738	Overton community	0.13



Area covered in special study. Values in parentheses show the mileage between points. Circled values show the radiation level, mr/hr. Numbers in squares are identification points.

Inclosure 4

RADIATION DOSES FOR INFINITE TIME OF EXPOSURE

Location	Time of run	Ground level, mr/hr	Fall-out time, hr	Infinite dose, mr
17 miles SW of Glendale Junction on Hwy 91	31 – 39	38	H + 5	8000
Junction of Hwy U. S. 91 and Nevada 40	28 – 3	35	H + 6	7000
Nellis AFB	18 – 25	0.3	H + 5	35
Las Vegas	7 – 25	0.65	H + 5	23
14.5 miles W of junction on Nevada Hwys 12 and 40 on Hwy 40	27 – 23	38	H + 7	6000
Indian Springs	6 – 29	0.7	H + 4	24
Charleston Lodge	8 – 54	0.4	H + 5	18
57 miles N of junction of U. S. Hwys 64 and 66 on U. S. 64 toward Grand Canyon, Arizona	37 – 18	3.5	H + 10	800
Grand Canyon Rim	37 – 30	1.9	H + 10	480
Lake Mead Resort	15 – 55	0.3	H + 7	27
Boulder City	15 – 10	0.15	H + 7	10
Hoover Dam	29 – 10	0.3	H + 7	50
Kingman, Arizona	31 – 15	0.1	H + 12	17

Inclosure 5

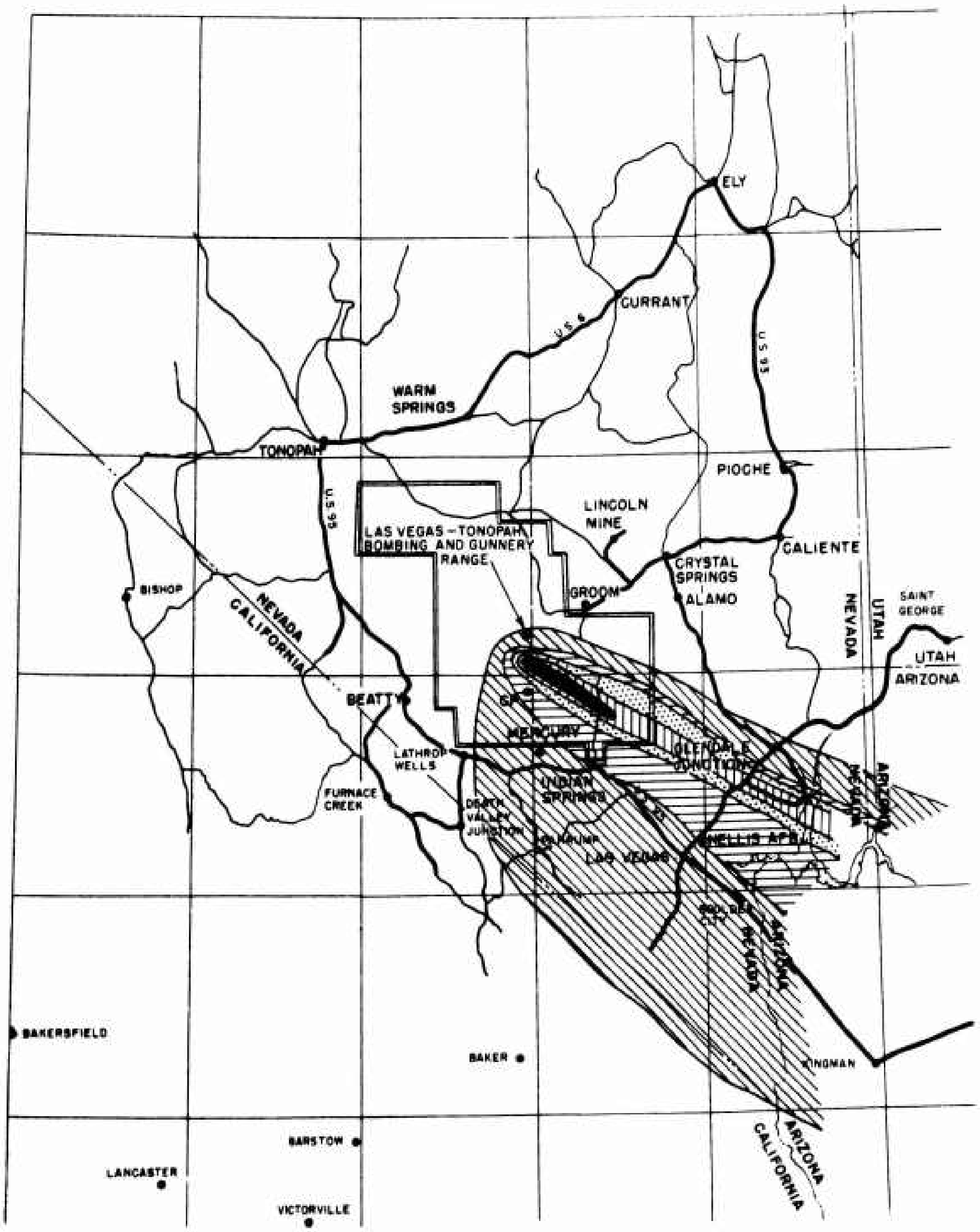
AIR SAMPLING RESULTS

Location	Time of sample	Result, $\mu c/M^3$
CP	0335–0535, 4/18/53	4.86×10^{-2}
	0535–0735, 4/18/53	1.2×10^{-2}
	0735–0935, 4/18/53	4.06×10^{-3}
	0935–1135, 4/18/53	7.3×10^{-4}
	1145–1335, 4/18/53	4.0×10^{-4}
	1335–1730, 4/18/53	2.3×10^{-4}
	1735–2140, 4/18/53	3.8×10^{-4}
	2145–0435, 4/18 to 4/19/53	1.8×10^{-4}
	Average concentration for sampling period	3.76×10^{-4}
	0535–0935, 4/18/53	MMD = 3.8μ
	1335–2140, 4/18/53	MMD = 4.65μ
Shot area (10 mr/hr line)	0517–0527, 4/18/53	1.13×10^{-2}
	0517–0527, 4/18/53	MMD = 2.13μ
Mercury	0140–0835, 4/18/53	3.24×10^{-1}
	0835–1245, 4/18/53	1.09×10^{-2}
	1250–1735, 4/18/53	2.07×10^{-3}
	1735–2205, 4/18/53	1.57×10^{-3}
	2205–0805, 4/18 to 4/19/53	1.69×10^{-3}
	Average concentration for sampling period	7.64×10^{-2}
	0835–1245, 4/18/53	MMD = 5.0μ
	1315–1735, 4/18/53	MMD = 4.0μ
	1805–2205, 4/18/53	MMD = 2.46μ
	2235–0805, 4/18 to 4/19/53	MMD = 1.31μ
Indian Springs	0105–0535, 4/18/53	1.22×10^{-4}
	0535–1435, 4/18/53	4.87×10^{-2}
	1440–2000, 4/18/53	1.87×10^{-3}
	2005–0920, 4/18 to 4/19/53	2.33×10^{-3}
	Average concentration for sampling period	1.37×10^{-2}
	0535–1435, 4/18/53	MMD = 4.1μ
	1455–2000, 4/18/53	MMD = 6.6μ
	2020–0920, 4/18 to 4/19/53	MMD = 2.6μ

Location	Time of sample	Result, $\mu c/M^3$
Las Vegas	0330–0530, 4/18/53	Background
	0530–0840, 4/18/53	Background
	0840–1140, 4/18/53	4.65×10^{-2}
	1140–1440, 4/18/53	1.24×10^{-2}
	1440–1755, 4/18/53	5.88×10^{-3}
	1755–2355, 4/18/53	5.33×10^{-3}
	2400–0435, 4/18 to 4/19/53	2.52×10^{-3}
	Average concentration for sampling period	9.45×10^{-3}
	0910–1210, 4/18/53	MMD = 3.4 μ
	1215–1815, 4/18/53	MMD = 1.94 μ
	1815–0015, 4/18 to 4/19/53	MMD = 2.8 μ
	0015–0435, 4/19/53	MMD = 1.5 μ
Nellis AFB	0405–0605, 4/18/53	Background
	0605–0805, 4/18/53	1.47×10^{-1}
	0805–1005, 4/18/53	1.08×10^{-2}
	1005–1305, 4/18/53	1.19×10^{-2}
	1305–1705, 4/18/53	4.91×10^{-3}
	1705–2245, 4/18/53	2.88×10^{-3}
	2245–0515, 4/18 to 4/19/53	4.8×10^{-4}
	Average concentration for sampling period	1.575×10^{-2}
	1315–1715, 4/18/53	MMD = 4.3 μ
	1715–2300, 4/18/53	MMD = 4.5 μ
	2300–0515, 4/18 to 4/19/53	MMD = 2.0 μ
Glendale Junction	0335–0535, 4/18/53	Background
	0535–0935, 4/18/53	4.4×10^{-3}
	0935–1235, 4/18/53	4.6×10^{-4}
	1235–1635, 4/18/53	5.72×10^{-4}
	1635–0500, 4/18 to 4/19/53	4.24×10^{-4}
	Average concentration for sampling period	1.06×10^{-2}
Overton	0441–0541, 4/18/53	Background
	0543–1025, 4/18/53	2.93×10^{-3}
	1335–1635, 4/18/53	1.1×10^{-3}
	Average concentration for sampling period	1.96×10^{-3}
St. George	0335–0435, 4/18 to 4/19/53	Background
Alamo	0405–0547, 4/18 to 4/19/53	Background
Crystal Springs	0340–2350, 4/18/53	Background
Caliente	0335–0705, 4/18 to 4/19/53	Background
Pioche	0335–0435, 4/18 to 4/19/53	Background
Ely	0340–0350, 4/18 to 4/19/53	Background
Currant	0350–2135, 4/18/53	Background
Warm Springs	0335–0435, 4/18 to 4/19/53	Background
Tonopah	0335–0540, 4/18 to 4/19/53	Background
Beatty	0335–0435, 4/18 to 4/19/53	Background
Groom Mine	0335–0435, 4/18 to 4/19/53	Background
Lincoln Mine	0330–0430, 4/18 to 4/19/53	Background

Inclosure 6

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT BADGER



Radiation intensity, Shot Badger, April 1953. ▬, 400 mr/hr or over. ▥, 200 to 400 mr/hr. ▒, 20 to 200 mr/hr. ☰, 2 to 20 mr/hr. ▧, 0.2 to 2 mr/hr. Heavy lines indicate the monitor run.

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Inclosure 7

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at collection time, μc/liter
4/18/53	1002	Lake Mead at end of Nevada Hwy 12	2.1×10^{-2}
4/18/53	1550	Lake Mead at end of Nevada Hwy 12	7.3×10^{-3}
4/21/53	1705	Lake Mead at end of Nevada Hwy 12	5.6×10^{-4}
4/19/53	0630	Pahranagat Lake (upper)	1.76×10^{-3}
4/19/53	0900	Crystal Springs	1.47×10^{-3}
4/19/53	0700	Pahranagat Lake (lower)	1.34×10^{-3}
4/19/53	0800	Groom Mine	1.64×10^{-3}
4/19/53	0950	Lincoln Mine	1.51×10^{-3}
4/18/53	1930	Lake Mead resort area (seaplane base)	6.3×10^{-3}
4/21/53	1605	Lake Mead resort area (seaplane base)	2.96×10^{-4}

Inclosure 8

DATA FOR CLOUD TRACKING AIRCRAFT B-29 AND B-25 AND CLOUD SAMPLER (SKULL CAP)

Position*	Time	Altitude	Direction of cloud	T1B meter readings, mr/hr	Remarks
			Cook Book 1 (B-29)		
D 44	0544	22,000	E	2600	
E 46	0606	22,000	Above aircraft and SE	400	Background 300
G 45	0617	22,000	S	340	Background 260
I 46	0624	22,000	SSE	360	Background 220
I 46	0644	22,000	SE	240	Background 180
L 48	0659	22,000	W	800	Background 160 Rosie is SW
K 47	0708	22,000	S	600	Background 145
M 49	0717	22,000	W	400	Rosie is south
N 49	0735	22,000	W	320	Background 130 Rosie S
O 49	0743		Above		
N 53	0749	22,000		300	Background 110
O 49	0802	22,000	NW	650	Background 110
O 46 to	0835				Cloud extends from
S 52	0851	22,000		120	Background 80 point to point
S 50	0901	22,000	W	240	Rosie covers large area.
T 50	0912	22,000		300	Background 50
R 49	0918	22,000		200	
U 47	0951	22,000		90	Background 80
X 50	1003	22,000		460	Background 80 Rosie S
X 54	1020	22,000		220	Background 90
X 51	1038	22,000		80	Background 80
			Cook Book 2 (B-29)		
D 44	0537	18,000	E and above	200	Rosie spread approximately 50 miles
E 45	0541	18,000	Above and NE	80	Reading believed due to fall-out
E 46	0544	18,000		8	Background count

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Position*	Time	Altitude	Direction of cloud	T1B meter readings, mr/hr	Remarks
G 46	0557	18,000	Above	34	
F 44	0615	18,000	E	90	
D 44	0622	18,000	E	5	Background count
E 45	0629	18,000	E and NE	80	
G 46	0645	18,000	SE	280	
I 44	0655	18,000	S and SE	18	Background count
L 48	0718	18,000	S	22	Above aircraft
N 49	0728	18,000	E	24	Rosie is dissipating
N 50	0743	18,000	E	10	Rosie above aircraft
K 50	0759	18,000	E	9	Background count
P 49	0810	18,000	SE	22	
T 51	0832	18,000	SE	10	
T 54	0845	18,000	NW	10	Background count
S 52	0907	18,000	NE and above	7	
T 49	0937	18,000	Unknown	8	
			Cook Book 3 (B-25)		
A 43	0455	12,000	NE	5	Background 0.03. Highest 2100.
A 43	0504	12,000	Overhead	4	Background 0.02. Highest 15.
B 43	0511	12,000	SE	4	Background 0.03. Highest 37.
D 44 C 43	0532	12,000	SE	8	Background 0.02. Highest 1000.
D 44	0546	12,000	SE	33	Background 28. Highest 60.
D 45	0607	12,000	SE	24	Background 18. Highest 50.
E 46	0623	12,000	SE	20	Background 14. Highest 33.
D 47	0642	12,000	E	16	Background 11. Highest 34.
F 47	0654	12,000	SE	16	Background 10. Highest 100.
G 47	0658	12,000	SE	17	Background 11. Highest 45.
H 45	0710	12,000	SE	16	Background 11. Highest 27.
J 43	0735	12,000	SE	14	Background 9. Highest 38.
I 45	0752	12,000	SE	16	Background 8. Highest 20.
H 49	0803	12,000	E	14	Background 7. Highest 32.
			Skull Cap		
I 47/48	0620	37,000			Cloud top 37,200. Cloud bottom 29,000.
M 47/48	0700	37,000			
T 53/54	0823	37,000			
Y 52	1007	37,000			
K 50	0739	37,000			

*The coordinates used are those shown in Incl. 9, Chap. 2.

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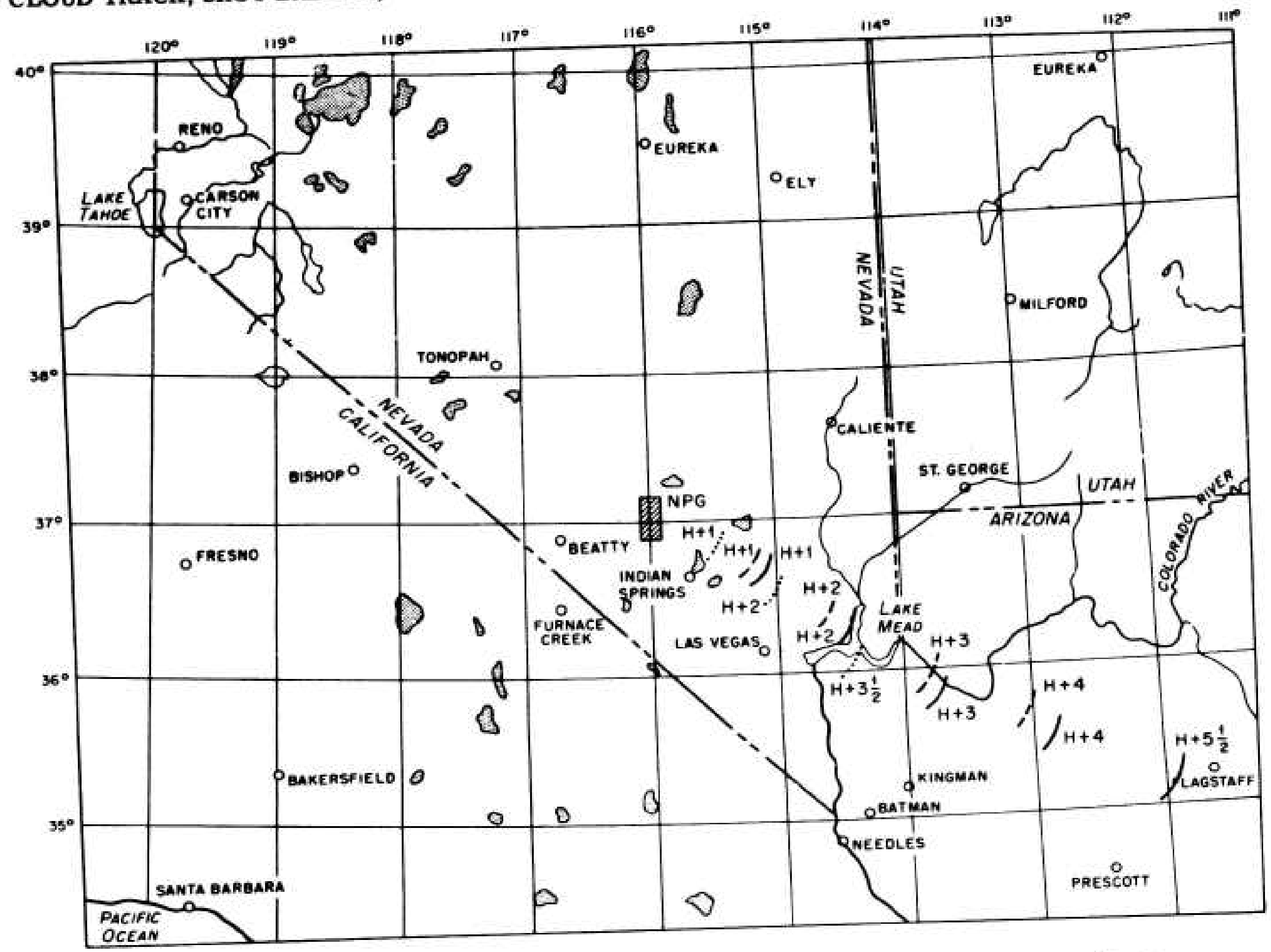
Inclosure 9

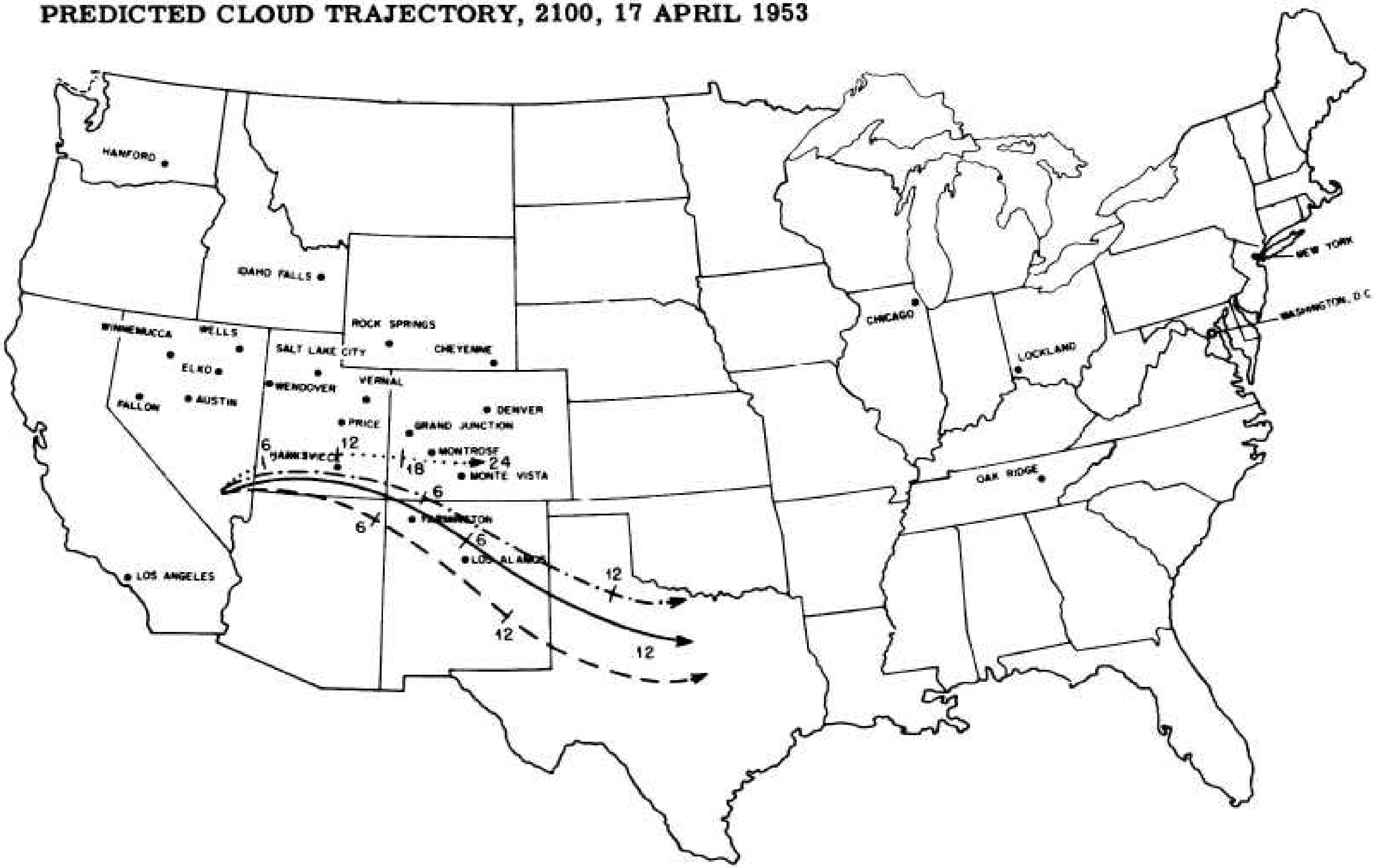
CLOUD TRACK, SHOT BADGER, 18 APRIL 1953



Cloud position: ...., 12,000 ft msl. ------, 18,000 to 22,000 ft msl. ———, 37,000 ft msl (top).

Inclosure 10

PREDICTED CLOUD TRAJECTORY, 2100, 17 APRIL 1953



· · · · · · · ·, 10,000 ft msl. - - - - - - - , 20,000 ft msl. — - — - —, 30,000 ft msl. ———— , 40,000 ft msl.

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Inclosure 11

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter readings, mr/hr
		Trip No. 1	
L 21	0447	50	2
L 20	0448	50	2
L 17	0501	50	2
L 16	0504	50	1.5
L 15	0505	50	1
L 14	0457	50	8.0
L 12	0500	50	1,000
L 12	0500	50	6,000
L 10	0504	50	10,000
K $^1/_2$9/10	0505	100	1,000
K 9	0505	50	10
Stake line 128	0507	50	5
Stake line 126	0508	30	10
Stake line 121	0510	30	20
Stake line 119	0511	30	40
Stake line 116	0512	30	100
Station 2.300	0513	30	800
Station 2.1000	0515	50	10,000
Stake line 200	0514	10	1,000
Stake line 211	0519	20	300
Stake line 113	0520	20	100
Stake line 513	0525	20	500
Stake line 508	0528	30	1,000
Stake line 311	0535	20	200
Stake line 313	0536	20	100
Station 2.300	0540	15	450
K 9	0540	30	10
K 10	0545	30	500
K$^1/_2$ L$^1/_2$	0550	30	2,000
L 15/16	0553	50	100

Position*	Time	Altitude above ground, ft	T1B meter readings, mr/hr
K 15	0555	30	20
N 15	0605	50	45
J 15	0557	50	10
	Trip No. 2		
Stake line 636	0738	30	2,000
Stake line 643	0741	30	2,000
Stake line 646	0742	30	2,500
Stake line 643	0742	30	3,500
Stake line 641	0743	30	4,000
Stake line 618	0743	30	3,000
Stake line 616	0745	30	2,000
Stake line 536	0748	30	250
Stake line 533	0748	30	400
Stake line 533	0749	30	500
Stake line 524	0750	30	600
Stake line 521	0751	30	300
Stake line 520	0752	30	200
Stake line 513	0752	30	300
Stake line 510	0754	30	300

* The coordinates are those listed in Incl. 19, Chap. 3.

Inclosure 12

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr		
			MX-5	T1B	"Scint"
A ½45/46	0658	500	0.01	0	0
ZA 44	0707	500	0.07	0.4	0.08
ZA 43	0712	500	0.06	0.8	0.08
ZA 42	0720	500	0.5	1.6	0.7
A ½41/42	0728	500	0.06	1.2	0.044
A 42	0732	500	0.05	0.4	0.13
A ½42/43	0735	500	20+	2000.	500.
A 43	0740	500	0.4	0.4	0.38
B 43	0743	500	18	36	13
B 42	0747	500	0.05	0.4	0.03
B 41	0752	500	0.06	0.2	0.024
C 41	0754	500	0.07	0.2	0.018
C 42	0758	500	0.05	0.4	0.01
C 43	0802	500	0.04	0.4	0.01
D 42	0813	500	0.05	0.2	0.01
D 41	0816	500	0.04	0.2	0.01
D 43	0807	500	0.06	0.6	0.010
E 41	0818	500	0.03	0.2	0.01
E 42	0823	500	0.03	0	0.01
E 43	0830	500	0.07	0.2	0.01
E 45	0840	500	0.1	1.8	0.03
E 44	0835	500	0.05	0.2	0.01

*The coordinates used are the same as in Incl. 9, Chap. 2.

Inclosure 13

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	C-1 air foil	Remarks
D 45	0729	1000	1.35	1.1	1.1		Background; MX-5, 0.03; T1B, 0.01; Scint, 0.01
E 45	0732	600	1.4	1 + 2 min 3 mr	0.24		
F 44	0740	800	0.25	0.2 – 3 min 8 mr	0.24		
F 43	0744	500	0.2	0.2	0.24		F, minus 2 min; MX-5, 13.0; T1B, 8.0; Scint, 7.4
F 42	0748	500	0.2	0.1	0.24	23	C-1 air foil No. 2, 3.0 background
G 42	0751	500	0.15	0.2	0.20		
G 43	0754	600	0.15	0.1	0.20		
G 44	0757	500	0.15	0.2	0.18		
G 45	0801	500	0.25	0.4	0.20		
G 46	0805	500	3.5	2			
G 47	0809	500	0.5	0.4	0.54		
H 47	0813	500	0.8	0.8	0.8		MX-5, 5.0; T1B, 8.0; Scint, 4.0; H 47 plus 30 sec
H 46	0822	500	0.35	0.6	0.6		H 46 minus 8 min; MX-5, 7.0; T1B, 6.9; Scint, 5.7; 2 min wide
H 45	0825	500	0.4	0.7	0.54		
H 44	0827	500	0.35	0.5	0.60	20	

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	C-1 air foil	Remarks
I 44	0830	500	0.35	0.6	0.54		C-1 air foil not operating
I 45	0832	500	0.4	0.6	0.54		
I 46	0835	500	0.45	0.6	0.54		
I 47	0839	500	0.95	1.6	1.1		I 47 minus 2 min; MX-5, 7; T1B, 6.0; Scint, 6.2
I 48	0843	500	0.45	0.7	0.60		
I 49	0847	500	0.4	0.8	0.60		
J 49	0849	500	0.42	0.7	0.54		
J 48	0852	500	0.55	0.8	0.60		
J 47	0857	500	7.5	8.0	4.5		
J 46	0901	500	0.5	0.9	0.8		
K 46	0903	500	0.45	1.0	0.8		
K 47	0906	500	10	12	5.4		MX-5, 16.5; Scint, 9.0; T1B, 18; K 47 plus ½ min
K 48	0909	500	1	1.5	1.0		
K 49	0914	500	0.65	1.4	0.94		
K 50	0918	500	1.0	1.0	0.94		
K 51	0922	500	0.55	1.0	0.94		
L 51	0925	500	0.5	0.8	0.80		
L 50	0929	500	0.65	0.9	0.86		
L 49	0933	500	0.55	1.0	0.88		
L 48	0937	500	0.5	1.0	0.94		
L 47	0942	500	1.15	1.5	1.8		
M 47	0946	700	2	2.4	1.8		
M 48	0950	800	0.55	1.2	0.86		
M 49	0954	800	0.6	1.3	0.80		
M 50	0958	700	0.5	1.1	0.80		
M 51	1002	700	0.5	1.0	0.80		60 head of cattle
M 52	1006	800	0.45	1.0	0.70		
N 52	1010	700	0.55	0.9	0.80		
N 51	1014	800	0.55	1.0	0.70		
N 50	1018	800	0.5	1.0	0.70		
N 49	1023	700	0.5	1.0	0.66		
N 48	1027	700	0.75	1.2	0.80		
N 47	1031	700	1.1	1.4	0.94		

* The coordinates used are those shown in Incl. 9, Chap. 2.

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Inclosure 14

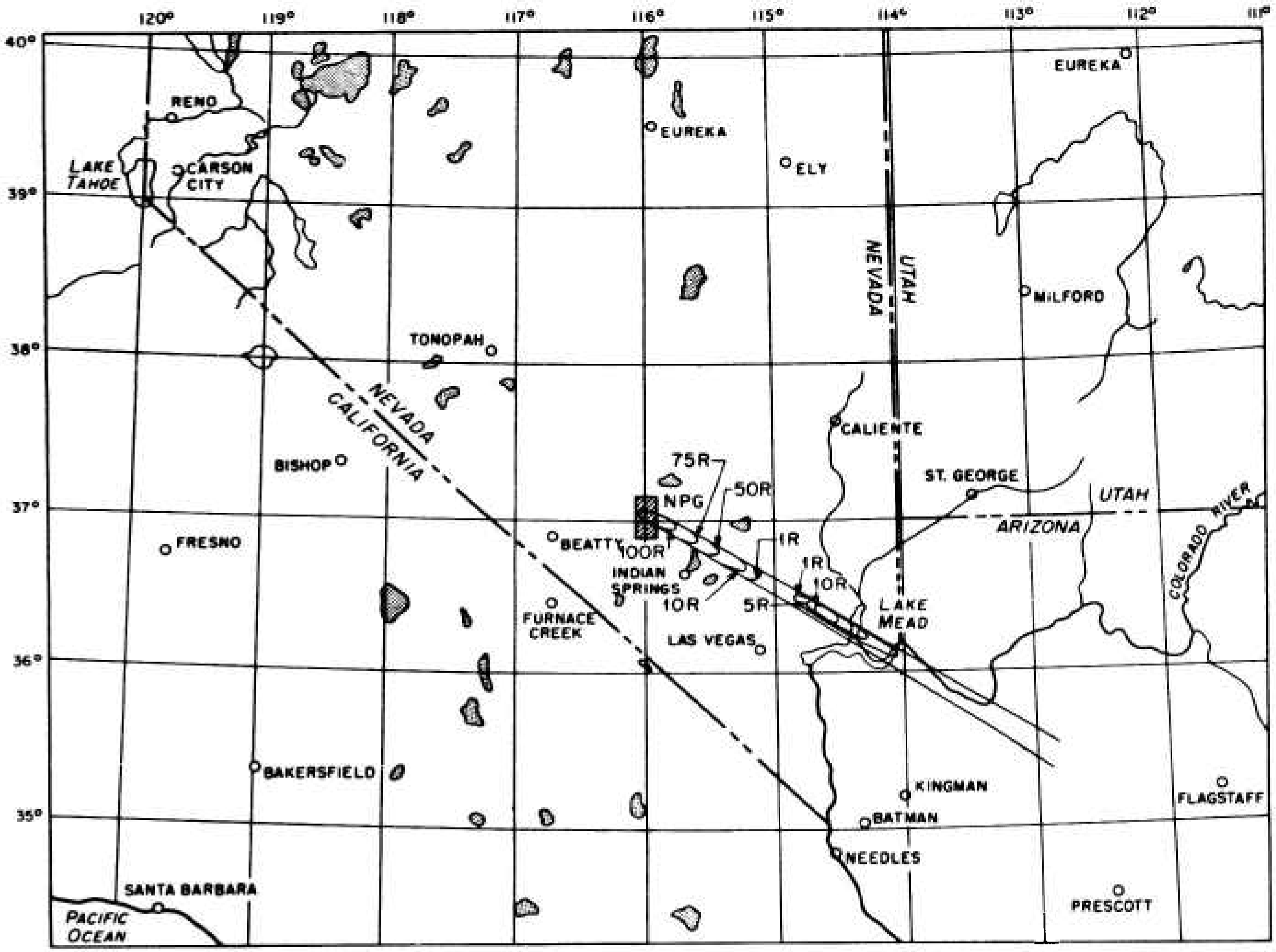
DATA FOR D+1 TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	T1B meter readings, mr/hr	Remarks
B $\frac{1}{2}$42/43	1100	800	30	
C $\frac{1}{2}$43/44	1105	2000	1.5	
D $\frac{1}{2}$43/44	1110	700	18	
F 44	1120	1500	0.5	
J $\frac{8}{10}$47/48	1130	600	1.2	8 head of cattle at K 48
K $\frac{1}{2}$47/48	1145	600	1.5	8 head of cattle at M 48
M $\frac{1}{2}$47/48	1200	500	1.2	
M $\frac{1}{2}$46/47	1210	500	0.8	10 mile wide strip
H 47	1245	400	2.6	30 head of cattle

*The coordinates used are those shown in Incl. 9, Chap. 2.

Inclosure 15

INFINITE DOSE FALL-OUT PATTERN, SHOT BADGER



Pattern based on combined air and ground survey data. 18 April 1953, Shot Badger.

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Chapter 8

SHOT SIMON*

8.1 INTRODUCTION

8.1.1 The seventh shot of the Upshot-Knothole series, Simon, was detonated on a 300 ft tower in Area 1 of Yucca Flat, NPG, at 0430, 25 April 1953. The 2100 hour forecast on 24 April 1953 indicated that the fall-out would be to the southeast and would miss all populated communities. The amount of fall-out was expected to be much larger than usual; however, due to the fact that no populated communities were expected to be in its path, the decision was made to fire on schedule.

8.1.2 The On-Site ground survey began at 0450 and was completed by 0715. Extensive fall-out on access roads slowed completion of the survey. R (general recovery) hour was not announced until H+8 hours or 1230. Prior to this time, however, the Test Director had released ten recovery parties into the contaminated area.

8.2 ON-SITE OPERATIONS

8.2.1 Two dry runs were completed and radio equipment checked by D−1. Communications were excellent for both dry runs and the initial survey on D-day. The officer in charge of the initial survey worked out an alternate entry plan to be used in case of a weather change. Three special survey teams were organized to obtain readings at specific stations in Area 1 and in Area 3. The initial survey party left the Rad-Safe building at 0435, and the survey was completed by 0715 on D-day. R Hour was declared at 1230 by the Test Director. Survey plots are shown in Incl. 1.

8.2.2 A check point was established on Mercury Highway on D-day near the 10 mr/hr line. Owing to traffic in the area this check point was maintained in continuous operation for the period of this report. All entry roads to contaminated areas were posted with warning signs.

8.2.3 Dosimetry and Records processed 1,880 film badges during this period. A total of 39 persons exceeded the 3.9 r permissible dosage on D-day and D+1 day. Eleven of these persons were in a B-29 working for Project 6.2. A comparison of film badge to pocket dosimeter readings showed that the film badge read generally twice as high as the pocket dosimeter for this period. On D+2 the pocket dosimeter and film badge readings compared normally. An investigation of these discrepancies in dosimeter and film badge readings is being made; however, no fault was found with the pocket dosimeter or film badge procedure.

8.2.4 A total of 789 persons in 262 parties were processed during the period. The vehicle decontamination section decontaminated one hundred two (102) vehicles, one electric generator, and two photo vans.

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*Period covered, 24 April to 2 May 1953.

8.3 OFF-SITE OPERATIONS

8.3.1 The changes in the anticipated fall-out pattern resulting from Shot Simon are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705).

8.3.2 The movement of mobile equipment and personnel to provide additional coverage in the anticipated path is described in Incl. 2. It is to be noted that a new experience in Off-Site operations was encountered from heavy fall-out on public highways resulting in contamination of vehicles traversing the fall-out path. This influenced the Test Director to order the establishment of roadblocks and decontamination stations at North Las Vegas, Alamo, and St. George. The pertinent information concerning these roadblocks is also included in Incl. 2. A detailed report of this experience has been prepared at the request of the Test Director, and reference should be made to this report where additional data are desired (Incl. 3).

8.3.3 Significant ground levels were detected along U. S. Highways 93 and 91 between Alamo and the approaches to St. George. A documentation of ground monitoring results is given in Incl. 4. Maximum fall-out occurred in the region from 15 to 20 miles north of Glendale Junction on Highway 93 and 10 to 20 miles east of Glendale Junction on Highway 91. A report of a special survey of this area for inhabitants, domestic animals, and other pertinent data has been compiled in Incl. 5. Infinite doses for localities of interest are given in Incl. 6. As noted on Shot Badger, the monitoring logs indicate a duration of fall-out considerably longer than previously encountered.

8.3.4 Air sampling results confirm the pattern of paragraph 8.3.3. In addition, the communities of St. George, Alamo, Caliente, Pioche, Mercury, CP, Crystal Springs, Ely, Groom Mine, and Beatty all showed significant air concentrations ($>10^{-4}$ $\mu c/M^3$ on a 24-hr average) to indicate that widespread airborne contamination resulted from this shot. A tabulation of air concentrations is given in Incl. 7. The inhabited areas in the above Inclosure were subjected to a later fall-out than was anticipated from available wind data.

8.3.5 The pictorial presentation of the pattern is shown in Incl. 8.

8.3.6 The results of water samples analyzed for fission product activity are presented in Incl. 9.

8.4 AIR PARTICIPATION

8.4.1 The high level winds were toward the northeast, whereas the lower level winds were toward the southeast. Recommendations were made to close the air space in the sector bounded by the 0° and 80° vectors from ground zero out to a distance of 100 miles at all altitudes from 0400 to 0730. In addition, the air space in the sector bounded by the 80° and 180° vectors from ground zero to the west boundary of Amber 2 airway was recommended closed at all altitudes from 0400 to 0730. The opening time was changed from 0730 to 0930 at H+2 hours. The sector bounded by the 180° and 360° vectors through west out for a radius of 50 miles was recommended closed from 0400 to 0530. A high altitude sector at 24,000 ft msl and up bounded by a line from Las Vegas to Winslow to Fort Bridger to Elko to Las Vegas was recommended closed from 2400 to 1200. A warning circle with a radius of 170 miles from Las Vegas was also recommended.

8.4.2 The two B-29 cloud trackers were off from Kirtland AFB on schedule, but one aborted the mission owing to mechanical failure. The remaining B-29 and the B-25 tracked the cloud at 22,000 and 12,000 ft msl, respectively. The data from these aircraft are attached as Incl. 10. These data are plotted and attached as Incl. 11. The predicted path is shown in Incl. 12. The top of the cloud was reported at 43,200 ft msl. Its position was reported by cloud sampling aircraft. The top of the cloud was last reported some 225 miles east southeast of ground zero.

8.4.3 The close-in aerial survey was performed by a helicopter which took off from the CP at H+10 min. The data from this flight are attached as Incl. 13.

8.4.4 The L-20 and C-47 performed the terrain survey. Although the C-47 did not take off until H+4 hr, it picked up some air contamination. The pattern and data from the L-20 are listed in Incl. 14 while those for the C-47 are given in Incl. 15. A D+1 day survey was made in the C-47. The data from this flight are listed as Incl. 16. A plot of the fall-out area made from these data and ground monitor's data is attached as Incl. 17.

8.5 LOGISTICS AND SUPPLY

8.5.1 For this period, the Supply Section issued 316 protective caps, 359 pairs of shoe covers, 308 pairs of coveralls, 283 respirators, 327 pairs of cotton gloves, 186 high intensity goggles, and 32 pairs of clear goggles. The laundry serviced 170 protective caps, 951 pairs of shoe covers, 702 pairs of coveralls, 252 respirators, 551 pairs of cotton gloves, and 158 towels. The laundry also serviced one (1) bag of contaminated clothing for Indian Springs and 84 pieces of personal contaminated clothing. The instrument repair section issued 124 survey instruments and repaired and calibrated 92 instruments. Weekly maintenance was performed on 31 vehicles. Three vehicles were deadlined during the period.

8.6 GENERAL

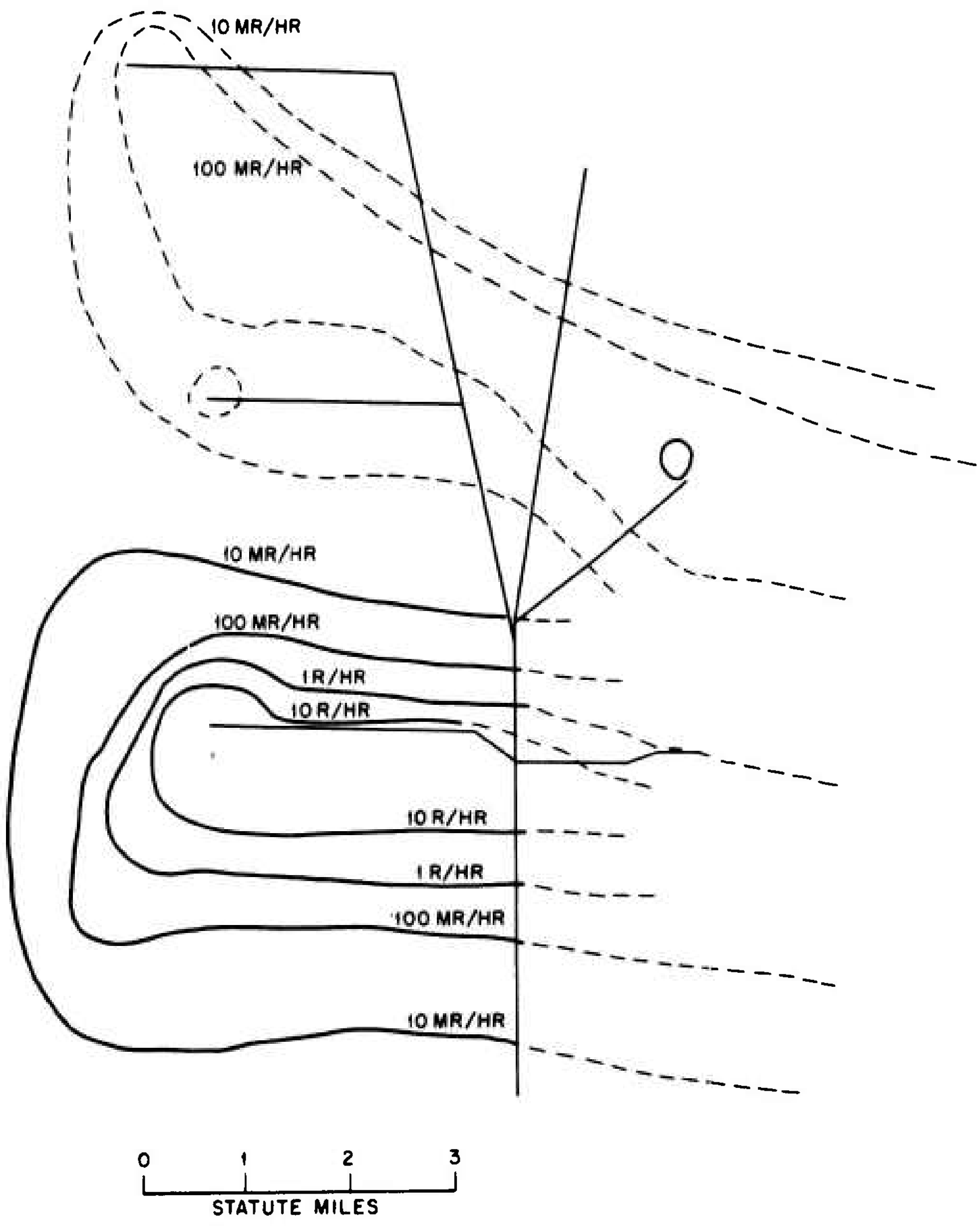
8.6.1 The general fall-out area for this shot was narrow, no greater than 20 miles wide at more than 200 miles from ground zero. The radiation intensity was very high even at the 250 mile limit. The infinity dose at this distance was 5 r. The only locations where fall-out hit populated areas were a service station west of Bunkerville, Bunkerville, and Mesquite, Nevada. The 25 r infinity iso-dose line extended for 60 miles from ground zero, and the 10 r infinity iso-dose line extended for 110 miles.

8.6.2 The fall-out was so great on the highways near Glendale that several vehicles were found highly contaminated. It was necessary to establish roadblocks and decontamination stations at Las Vegas, St. George, and Alamo. These stations were very effective in their decontamination processes.

8.6.3 A considerable number of monitor and project personnel were overexposed on this shot. The pocket dosimeter and T1B survey meters were used as a guide by the monitors to judge their stay in the contaminated area. The film badge readings, however, gave in some cases a value two to three times as large as the pocket dosimeter and the T1B survey meter indicated. Data from previous shots had indicated that the dosimeter readings were generally higher than the film badge readings. No suitable explanation can be made for this variation at this time.

Inclosure 1

YUCCA FLAT RADIOLOGICAL SITUATION, SHOT SIMON



Initial survey, 0730, 25 April, Shot Simon.

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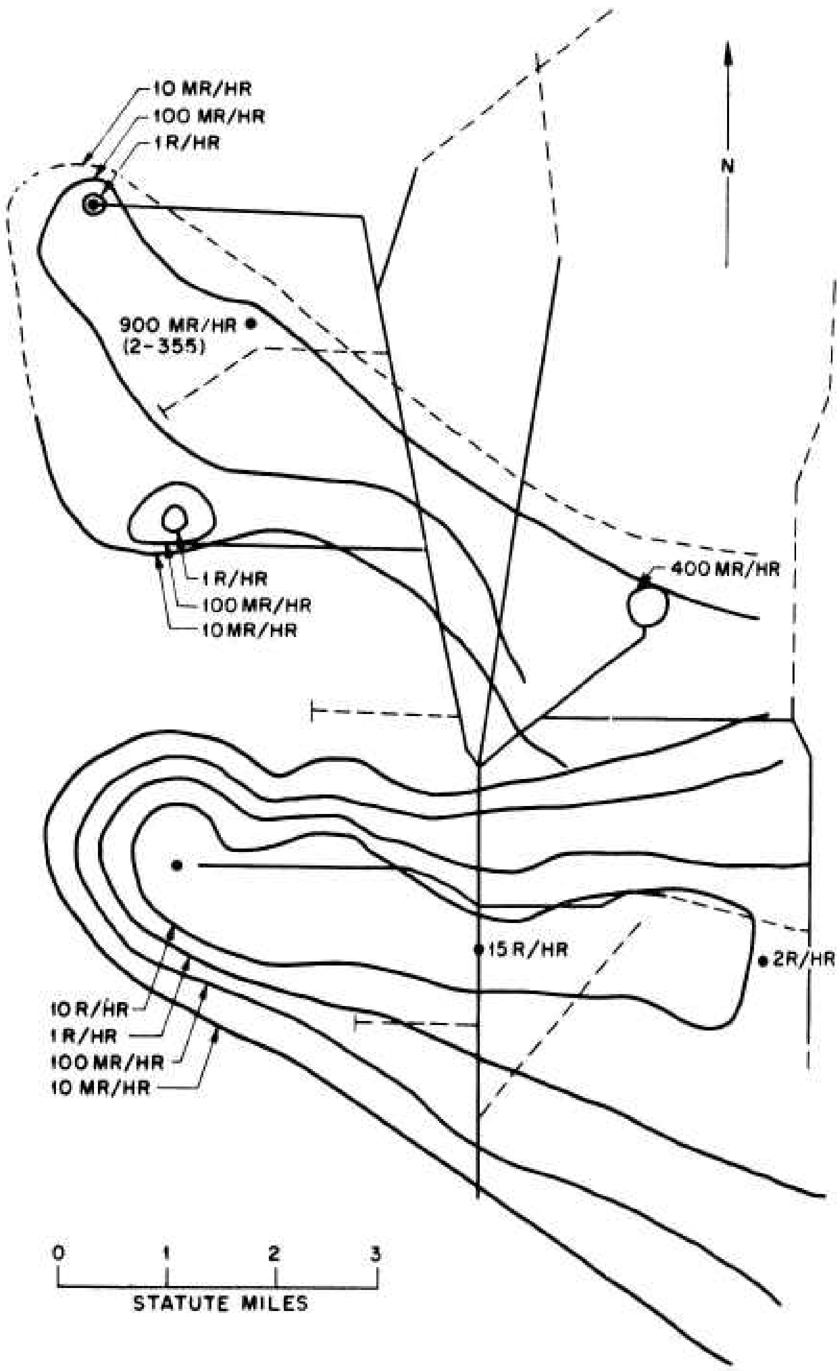

Resurvey, 1500, 25 April, Shot Simon. Resurvey, 1500, 25 April, Shot Badger, H-hour, 0435, 18 April.

Inclosure 2

OFF-SITE ACTIVITIES JOURNAL, SHOT SIMON

Time	Events
25 April 1953	
1000	All teams departed for their respective stations. Radio contact established at CP upon departure. Due to the latest weather forecast, it appeared advisable to have the four mobile units remain in the Mercury Area. Attempts were made to maintain radio control with the units as they proceeded toward their destination.
1530	Unable to transmit from CP control unit.
1535	Radio transmission at CP control unit restored.
1545	Off-Site Headquarters transferred to CP Building No. 1.
1650	Unable to transmit from CP Control unit.
1655	Received call from unit at Caliente reporting broken Geiger tube on background recorder. Arrangements made to replace same through any mobile unit which may operate in that area.
1700	Transmission restored on CP Building No. 1 radio.
1713	Unable to transmit from CP Control Unit.
1717	Transmission restored on CP Building No. 1 radio.
1850	All teams but one (Caliente) had reported arrival on station via radio as of this time. Caliente reported via telephone. Intermittent contact with Osage 1 and Apache established through their contacts with the mobile units was not too successful.
2000	Status report on distribution of personnel and equipment at this time prepared for Rad-Safe Operations Officer.
2110	On the basis of the 2100 briefing winds, all mobile units were dispatched to Glendale Junction to stand by for further movement orders.
2200	General forecast information broadcasted to all units in the field. Acknowledgments received from nine stations.
0200	Latest wind plot indicates no movement of mobile units advisable at this time.
0330	Latest wind plot indicates no movement of mobile units advisable at this time. All units so informed by telephone at Glendale Junction and advised to expect further instructions about H+1 hr.
0545	All mobile monitoring teams contacted via radio and instructed as follows: One Mobile Air Sampling unit to proceed to Mesquite and set up station. One Mobile Monitoring unit at Glendale to stand by at present location until further advised. One Mobile Monitoring unit instructed to proceed about 40 miles toward Alamo and stand by till H+2, then return to Glendale monitoring enroute. Monitor at Warm Springs Ranch and Moapa on return. One Mobile Air Sampling unit instructed to proceed to Overton and set up station.

0650	Mobile monitoring team standing by at Glendale Junction instructed to proceed to Mesquite. Monitor back to Glendale, leaving Mesquite at H + 3.5 and contact CP from Glendale. Inform Mobile Air Sampling unit at Mesquite to monitor 20 miles northeast of Mesquite at about H + 4 and return to Mesquite.
0655	Team at St. George instructed to monitor Highway 91 to 25 miles southwest of St. George, departing at H + 4, then return to St. George and contact CP.
0700	General radio report broadcasted to all Hickory stations; acknowledgements received from 6 teams.
0701	Beatty unit instructed to monitor to Lathrop Wells at about H + 5.
0735	Mobile Monitoring unit at 20 miles north of Glendale Junction proceeding toward Glendale Junction. Instructed to stand by present location for 30 min unless activity detected earlier, then proceed slowly according to previous instructions.
0758	Received first report of fall-out on Hwy. 93, 18 miles north of Glendale Junction.
0805	Radio at CP Control Unit went out while attempting to contact monitoring unit on Hwy. 93.
0806	Radio at CP Control unit restored.
0810	Radio at CP Control unit not transmitting.
0840	Unit at Glendale Junction contacted and instructed to stand by radio with meter — background at present.
0854	Instructed Mobile Monitoring unit 18 miles north of Glendale via radio, to determine extent of fall-out; then proceed to Glendale Junction and phone in readings. (It is questionable whether this message was acknowledged.)
0900	Unit at Glendale Junction contacted via radio and instructed to give following message to Mobile Monitoring team whose radio is out: Proceed to Moapa and stand by until 1000. Then render assistance to Overton-Logandale area as necessary.
0925	Received call from Glendale Junction. Repeated message to proceed to Moapa at 1000; then render assistance to Overton-Logandale area as necessary.
0925	Report received via VHF that several windows had been broken at Groom Mine. Team at Groom Mine instructed to find out extent of damage, dimensions, and number of windows broken and report.
0930	Radio at CP Control Unit restored.
1000	General situation report broadcasted to all Hickory stations. Acknowledgements received from 6 teams.
1030 to 1115	Attempts were made via phone to contact Mobile Air Sampling unit at Mesquite; upon contact, instructed one man to monitor to Glendale and call in to CP upon arrival. It was not possible to give more details or other instructions because of poor telephone communications.
1145	Received report from Mobile Monitoring unit at Glendale advising the passage of a contaminated private vehicle (truck) through service station at Glendale. Maximum reading reported was 500 mr/hr.
1150	Rad-Safe Officer advised of the 1145 entry. Further investigation of this instituted to determine necessary action.
1220	Truck report received from monitor at Glendale via phone. A second truck did not stop at Glendale. A third truck is now at Glendale reading a maximum of 400 mr/hr outside and 20 mr/hr in the cab.
1240	Nevada State Highway Patrol contacted in Las Vegas and requested to locate and hold three trucks, described to the patrolman, outside of north Las Vegas. Las Vegas monitor so advised and asked to assist.
1245	Report of fall-out in Mesquite received via phone.

1305 Monitor in St. George contacted by radio and instructed to proceed to Mesquite, checking contamination enroute and report results via phone if necessary from Mesquite.

1312 Monitoring run from Mesquite to Glendale reported via telephone. Monitor told to stand by on phone.

1320 Greyhound bus monitored at Glendale—250 mr/hr outside, 100 mr/hr inside. One monitor dispatched back to Mesquite with instructions to investigate all points of habitation in the fall-out area.

1330 As requested by Test Director and his staff, roadblocks were ordered at Las Vegas, Alamo, and St. George.

1335 Unable to establish radio contact with St. George monitors to give roadblock instructions and cancel monitoring assignment.

1340 Nevada State Highway Patrol requested to establish roadblock at Chevron truck stop between Nellis AFB and North Las Vegas.

1400 Contacted unit at Alamo and gave them roadblock instructions.

1415 Roadblock established at Alamo.

1435 Monitor from St. George reported from Mesquite via phone. Given roadblock instructions and told to return to St. George to set it up.

1610 Alamo crew reported no cars to this time required decontamination.

1612 Monitor from Alamo instructed to monitor Hwy. 93 south to Glendale.

1615 As only one vehicle required decontamination in the last 25 min at Las Vegas, the Test Director ordered roadblock removed.

1618 Alamo roadblock removed. Summary of Las Vegas and Alamo roadblocks:

Las Vegas	Vehicles monitored, 125
	Vehicles requiring decontamination, 15
	Vehicles still to be decontaminated, 2
Alamo	Vehicles monitored, 9
	Vehicles requiring decontamination, none

1700 First report received from St. George monitor on roadblock. It had been in operation since 1600. 125 vehicles checked with 25 needing decontamination which was in process.

1755 Second report received from St. George monitor. Rate of overcontaminated vehicles now down to 1 in 20. Instructed to call back in 20 min with another report.

1819 Third report received from St. George monitor. Since 1755, no vehicles have had to be detained for decontamination. Roadblock ordered to be removed. Roadblock summary:

Vehicles monitored, 250
Vehicles requiring decontamination, 25
Vehicles still to be decontaminated, 3 to 4

Instructed to send assistants back to original stations.

1830 One monitor at Las Vegas instructed to stand by there until all vehicles released from decontamination and other monitors return to Mercury.

1850 Monitors from Alamo arrived at Glendale with broken down vehicle (Jeep). Instructed to stay the night there and return to Mercury in the morning.

2400 Radio and telephone watch at Off-Site Headquarters secured with one man sleeping near phone.

0930 Additional report received from St. George monitor on one vehicle still not low enough to be released.

1130 Arrangements completed for handling one remaining St. George vehicle and transmitted to monitor.

1320	Units expecting to return to CP via Groom Pass received erroneous level report of 50 r from security inspector. To simplify the matter, all units were instructed to return by way of Glendale and Las Vegas.
1900	Roadblock crews which had returned were briefed on data desired from this mission and advised of a meeting at 1430, 4/27/53, with the Test Director.
2200	Last teams reported in from field stations. Majority of data collected held over till 4/27/53 for compilation and Off-Site Headquarters secured for the night.
4/27/53	All personnel working on compilation of data for shot report and special reports requested on the roadblock experience.
1000	Monitor arrived in Las Vegas to handle any vehicles requiring decontamination this date.
1430	Meeting of roadblock personnel with Test Director.
1500	Report received by Rad-Safe Operations Officer from Las Vegas monitor advising of the release of remaining vehicles at that station.

Inclosure 3

SPECIAL REPORT ON THE ROADBLOCK SYSTEM

OFFICE OF THE TEST DIRECTOR
NEVADA PROVING GROUNDS
P. O. BOX L
MERCURY, NEVADA

DATE: 29 April 1953

TO : The Test Director
FROM : William S. Johnson, Off-Site Rad-Safe Operations Officer, NPG
THRU : Rad-Safe Operations Officer, NPG
SUBJECT: LETTER OF TRANSMITTAL

The attached report relates the experiences of this organization in establishing a system of roadblocks on public highways as a result of fall-out from Shot Simon. The report presents under two broad headings (1) the operations in the Off-Site Rad-Safe Control Room and (2) the operations at the individual monitoring and decontamination stations.

WILLIAM S. JOHNSON
Off-Site Rad-Safe
Operations Officer

cc: Rad-Safe Operations Officer
NPG
File (3)

OFFICE OF THE TEST DIRECTOR
NEVADA PROVING GROUNDS
P. O. BOX L
MERCURY, NEVADA

TO : The Test Director **DATE: 29 April 1953**
FROM : Off-Site Rad-Safe Control Room Personnel, NPG
SUBJECT: SPECIAL REPORT ON THE SYSTEM OF ROADBLOCKS ESTABLISHED ON D-DAY, SHOT SIMON

The activities of the Off-Site Rad-Safe Control Room personnel are presented below relative to the problem of establishing a system of roadblocks on public highways to control motor vehicles contaminated by radioactive fall-out from Shot Simon. The report is presented in the following four sections:

I. Statement of the situation at 1130, 25 April 1953, covering location of Rad-Safe Off-Site Monitoring Teams and the location of fall-out known in the control room at that time.

II. Chronological Sequence of Events.

III. Comments.
IV. Recommendations.

SECTION I: STATEMENT OF THE SITUATION AT 1130, 25 APRIL 1953

A. Location of Off-Site Monitoring Teams in the area of interest, i.e., along U. S. Highways 91 and 93, and Nevada Highway 12, in a sector bounded by Mesquite, Overton, Las Vegas and Alamo.

1. Air Sampling Stations in Operation
   a. On U. S. Highway 91.
      Location
      (1) Las Vegas, Nellis AFB: One man (Butrico) serving both stations with sedan; radio call, Alpha-67.
      (2) Glendale Junction: Attended temporarily by mobile monitoring team 2.
      (3) Mesquite: One man (Larson). This was a mobile Air Monitoring Station which began operation at about 0630.
      (4) St. George, Utah: One man (Fetz) with a sedan; radio call, Alpha-68.
   b. On Nevada State Highway 12, south of Glendale Junction.
      (1) Overton: Mobile Air Monitoring Station, set up at 0625. Two men (Rossano and Forsythe) in a pick-up truck; radio call, Bravo-72.
   c. On U. S. Highway 93 north of Glendale.
      (1) Alamo, Crystal Springs: One man (Paganini) with a jeep; radio call, Coca-84 (serving both stations).
2. Mobile Monitoring Teams

Team 1: Rowe and Stevens, in sedan (radio call, Alpha-65) located at Glendale Junction and under instructions to stand by, having just returned from monitoring run from Moapa to Overton and return to Glendale. (Temporarily attending Glendale Station).

Team 2: Shipman and Claborn, in jeep (radio call, Coca-81) located at Glendale Junction and under last instructions to stand by. These men had already found and reported peak fall-out on Highway 93, and both were contaminated. Claborn's 1 r dosimeter off scale. Shipman's dosimeter read 0.75 r.

Team 3: Melton in pick-up truck (radio call, Bravo-72) following instructions to monitor from Mesquite to Glendale, and report.

Team 4: Smithson in sedan (radio call, Alpha-62) following instructions to monitor from Glendale north on U. S. 93 to determine the northern limit of the fall-out area.

B. Information on location of fall-out known at CP at 1130, 25 April 1953.

1. At this time it was known that fall-out had occurred on U. S. Highway 93 north of Glendale Junction. The fall-out was first reported to have been metered at a point 19 miles north of Glendale beginning at 0745 and increased progressively as follows (same location):

Time	Reading, mr/hr
0745	1.5
0805	200
0815	240
0820	300
0825	340
0900	460
0930	440

2. Fall-out was known to have occurred also on U. S. Highway 91 between Glendale Junction and Mesquite and had been reported and posted as follows:

Time	Reading, mr/hr	Location
0838	1.1	20 miles W of Mesquite
0855	220	26 miles W of Mesquite
0901	60	29 miles W of Mesquite

This area was being remonitored at the time, but radio contact could not be established.

3. Fall-out was known to be occurring at Mesquite. It was first noted at 0930 and climbed slowly and was reading 10.0 at last contact (1110).

4. Very light fall-out had been reported from Glendale as of 1130. Levels had increased from background at 0914 and maximum reading reported by 1100 was 3.0 mr/hr.

5. Although no fall-out had been reported at Overton, it was considered to be advisable to maintain the Mobile Air Sampling Station in operation there because of its location in the predicted fall-out pattern.

SECTION II: SEQUENCE OF EVENTS

There follows a chronological schedule of events which ultimately led to the establishment and operation of a system of roadblocks for investigation and decontamination of motor vehicles traveling through areas contaminated by radioactive fall-out.

Wherever appropriate, reasons will be stated for the event and the decisions which were made. In this presentation, sincere effort has been made to minimize hindsight.

Time	Event
1145	Report received from Mobile Monitoring Team No. 1, located at Glendale Junction, advising the passage of a contaminated truck through the Glendale Service Station. Maximum reading on the outside of the truck was 500.
1147	Rad-Safe Operations Officer advised of the 11:45 entry. Further investigation of this instituted to determine necessary action.
1156	Test Director advised that an attempt be made to locate and decontaminate the truck before it reached Las Vegas. Phone call placed to Glendale Service Station to obtain more identifying information on this truck. It was learned that the truck had already departed and that it would be necessary to encounter it at some other point toward Las Vegas. The Radiological Safety Staff Officer requested that if it should be necessary to decontaminate the truck, then such work should be accomplished outside of North Las Vegas.
1200	Mobile Unit proceeding from Mesquite to Glendale reported 420 at 1122, 9 miles west of Mesquite.
1205	Radio message sent to Las Vegas monitor to stand by present location for special instruction.
1220	Phone contact established with Glendale for further truck identification; a second truck (similar to the first one) did not stop at Glendale, but its passage was noted on the survey instrument. A third truck is now at Glendale reading a maximum of 400 outside and 20 in the cab. The first 2 trucks were described as being "flat-bed Pacific Intermountain Express carrying a cargo of rolled sheet steel."
1230	Message to monitor in Las Vegas instructing him "to attempt to flag down two PIE flat-bed trucks enroute to Las Vegas. They are in need of washing, so remonitor them and if reading more than 7 in the cab,

escort them to a truck washing station on the edge of North Las Vegas and have them washed. Use credit card for payment."

1240 Nevada State Highway patrol was contacted in Las Vegas and requested to locate and hold the three trucks, described to the patrolman, outside of North Las Vegas. Las Vegas monitor was advised of the above.

1241 Phone call from monitor in Mesquite reporting a maximum of 80 at that location at 1130. 1230 reading there was 70.

1300 In view of the readings at Mesquite, it was decided by the Rad-Safe Operations Officer that the extent of the fall-out east of Mesquite should be determined.

1305 Monitor in St. George was contacted by radio and instructed to proceed to Mesquite, checking contamination enroute and report results by phone if necessary from Mesquite.

1312 Monitor run from Mesquite to Glendale reported by telephone. Monitor told to stand by on the phone. Monitor stated that passing vehicles caused maximum deflection on his survey instrument (MX-5) during this monitoring run. He also reported that his dosimeter now read 0.7 r. The discussion continued among the Test Director's Staff concerning this matter of vehicle contamination, when at 1320, a westbound Greyhound bus stopped at Glendale Junction. It was immediately monitored, and a 250 reading was found outside and a 100 reading was found inside. The monitor who had just arrived from Mesquite was dispatched back to Mesquite with instructions to investigate all points of habitation in the fall-out area.

1330 As requested by the Test Director and Staff, roadblocks were ordered established in Las Vegas, Alamo, and St. George.

1332 Mobile Monitoring Team 1 instructed to proceed to Las Vegas bus station and remonitor bus and supervise its decontamination. Enroute, he was to drop off one monitor to assist at the North Las Vegas roadblock. Instructed to use available means to reduce inside contamination of vehicles to 7 mr per hour gamma before release. J-3 representative contacted the Las Vegas Union Bus Station at this time also advising them of the situation and learned that the bus was due to arrive in Las Vegas at 1420.

1335 Unable to establish radio contact with St. George monitor to give him roadblock instructions. At this time he was making the Mesquite monitoring run as instructed at 1305.

1340 Nevada State Highway Patrol was requested to establish roadblock at Chevron truck stop between Nellis AFB and North Las Vegas for all southbound cars.

1341 Las Vegas monitor radioed from the highway truck inspection station located on the south side of Las Vegas that he had stopped the three original trucks.

1347 Two remaining monitors at Glendale dispatched to North Las Vegas to render assistance at the roadblock.

1350 Monitors in Caliente and Pioche instructed by phone to proceed to St. George and assist at the roadblock there. They were given all necessary instructions concerning the operation of the roadblock in the event that they should arrive in St. George before the St. George monitor returned from his monitoring run to Mesquite.

1355 Monitors at Lincoln Mine instructed to proceed to Alamo and assist in the roadblock there.

1400 Contacted monitor at Alamo and gave him necessary instructions for the establishment of his roadblock.

1410 Las Vegas monitor reported on the contamination of the trucks. Outside reading 30; inside 17. He was advised of the establishment of a roadblock outside North Las Vegas and instructed to proceed to that point immediately.

1415 Report received from Alamo that roadblock had been established. At this same time the extra monitor at the roadblock was dispatched back to Glendale to cover the operation of his station, since fall-out there was anticipated.

1423 Ground level reading at Alamo reported to be 5.

1425 Las Vegas monitor reports that no cars nor State Patrolmen were at the Chevron stations where the roadblock was supposed to be. He was told that the patrolmen would probably be there shortly.

1430 Lincoln Mine monitor reported that he was on the way to Alamo as instructed.

1435 Monitor from St. George reported from Mesquite via telephone. He was given roadblock instructions and told to return to St. George to put them into effect.

1440 to 1452 Las Vegas monitor radioed a dramatic running account of the radiation levels as they were being measured on the first thirty-two vehicles going through his roadblock. Of these thirty-two vehicles monitored only one exceeded the 7 inside tolerance level.

1453 Las Vegas roadblock crew reinforced by arrival of Monitoring Team 2 from Glendale.

1500 J-3 representative received a call from State Highway Patrol inquiring if their patrolmen were on the job. They had lost radio contact. Answered in the affirmative.

1502 Las Vegas monitor instructed to ask State Patrolmen to screen out for monitoring only those vehicles arriving from north and east of Glendale Junction.

1515 Report received from Las Vegas on the condition of the bus. It had carried thirty people, none of whom were found to be significantly contaminated. All the luggage had been monitored, and it was also found to be uncontaminated. Maximum reading on the inside of the bus was found to be 160 near the back seat.

1527 Las Vegas roadblock reported having monitored 35 to 40 additional vehicles, and of this number eleven sedans and two trucks had been found to be sufficiently contaminated to require washing.

1545 Personnel at the Las Vegas roadblock reported that the press had arrived and was taking many pictures and asking many questions. Requested advice on how to handle the press situation. Instructed to refer all such inquiries to the Public Relations Office of the AEC in Las Vegas.

1546 A monitor at the Las Vegas decon station asked instructions on two points:

1. Who is to sign the clearance checks on decontaminated vehicles?
   Reply: "Reynolds Electric Company Expediter will be there shortly and if not use your credit card."
2. Is the highway open east of Mesquite?
   Reply: "Yes, but vehicles traveling in that direction are subject to monitor check at St. George, Utah."

1547 Lincoln Mine monitor arrived at roadblock at Alamo.

1556 Alamo roadblock reported seven autos had been monitored and none required decontamination. Background level at Alamo now 4.5 (MX-5); 1.8 (T1B).

1600 Las Vegas decon monitor requested to give location of decon stations. He reported all trucks and the one bus at 1000 S. Main — Mac and Bill's Service Station. All passenger cars are being processed at 1325 S. Main St. In this same conversation the decon monitor was asked to be responsible for the final check of vehicles before release from the decon station.

1604 Las Vegas roadblock crew reported in reply to a question from Dr. Dunning that they had not sent a car in for washing in the past fifteen minutes.

1605 Alamo monitor received a report from program 27 team that a reading of 700 had been found at a spot on highway 93 thirty miles south of Alamo.

1612 Alamo monitor instructed to send one of the Lincoln Mine men down highway 93 to check on the reported 700 reading.

1615 In reply to a question raised by the Test Director the Las Vegas roadblock reported only one sedan sent to decon since last call (i.e. 1604).

1616 Test Director advised that the roadblocks at Alamo and Las Vegas were to be removed. Las Vegas acknowledged at this time.

1618 Alamo crew acknowledged receipt of the message to remove the roadblock. At this time instructions were given for the Lincoln Mine monitors to return to their station after completion of their monitoring run south of Alamo.

1620 The Test Director advised the Field Manager in Las Vegas via the Off-Site radio that the Las Vegas roadblock was no longer necessary.

1625 Contacted by radio the monitors enroute from Caliente to St. George and requested that they obtain a statistical coverage of the St. George roadblock experience and call back on the telephone. They replied tnat they were still fifteen miles out of St. George. (At this time the above information could not be obtained directly from St. George monitor because of radio failure).

1637 Contacted Overton crew and instructed them to remain in that area until 2000 at which time they were to shut down their station, secure a water sample from Overton Beach, and then return to Mercury. They replied "Wilco" and that the reading at Overton was still background.

1638 Contacted AWX Station at St. George by radio and requested them to locate the roadblock monitor and have him transmit a statistical summary of his experiences as soon as convenient.

1645 Test Director requested that the Off-Site Operations Officer compile a special report dealing with all phases of the roadblock operation.

1650 Las Vegas decon monitor reported that the second PIE truck had been decontaminated to 7 in the cab but the rolls of steel on the flat bed of the truck still read 100 and a similar reading of 100 was still to be found in the back of the Greyhound bus. He requested advice for further decontamination procedures to be used on the rolls of steel. He also reported that the bus had been washed twice with soap and water and vacuumed once. He offered the suggestion that facilities were available for steam cleaning the engine of the bus.

1700 First report received from St. George roadblock. There had been 125 vehicles checked and of these 25 required washing. Levels inside ranged from 10 to 35. He reported further that assistance had not yet arrived from Caliente.

1715 Las Vegas monitor reported that after moving the truck away from the washing area the average reading on the rolls of steel was 40 and inside of the cab was 6.5. The truck had been released since the cab was below 7.

1716 Dr. Dunning requested that the Las Vegas monitor overtake the truck just released and return it to the decon station while the allowable level for sheet steel likely to enter instrument manufacture could be determined.

1730 Las Vegas monitor reports that he has stopped the steel truck and the shipment is consigned to the Rome Cable Corporation, 1739 213th St., Torrance, California. The cargo is rolled sheet steel in four packages having a total weight of 33,490 lbs.

1732 Alamo monitor reported more information on the 700 reading south of Alamo. The reading had been taken on the ground at the side of the road at about 1500.

1755 Second report received from St. George roadblock. Only about one in twenty of the vehicles now being checked require decontamination. Readings now are rarely over 20. He was requested to supply information on the service stations performing his decontamination work as well as further data on contaminated vehicles and report back in 20 minutes.

1810 Las Vegas decon station reports that one bus and one truck remain to be cleared. He was advised to send Monitoring Team 2 back to Mercury.

1819 Third report received from St. George roadblock. Within the past twenty minutes no vehicles had to be detained for decontamination. In response to request he reported that approximately four to five hundred cars had been checked and that between thirty and thirty-five had required washing. Upon the advice of Dr. Dunning the roadblock at St. George was ordered to be removed. Upon further questioning the monitor reported the names and addresses of the service stations involved in the washing operations, as follows:

1. Dixie Service, UTOCO Stn. No. 771, St. George, Utah
2. UTOCO Service No. 403 St. George, Utah
3. Pioneer Texaco Service Stn. St. George, Utah

The monitor was advised that the AEC would pay the bill and he was to bring in an estimate of the total on the following day. He was further instructed to advise the monitors from Caliente to return to their stations.

1830 Las Vegas decon monitor reported that the truck and its cargo of rolled steel has been washed and the level is now down to 22 and will be released upon the advice of the Field Manager who is on the spot. Latest readings on the bus are 130 on the engine and 110 on the back seat. He was advised that the bus could not be released until the inside level reached 7. He was further advised that Mobile Monitoring Team 1 could be released to return to Mercury.

1850 Lincoln Mine monitors reported arrival at Glendale after completing the monitoring run from Alamo. Their jeep was broken down and they stated that they would spend the night at Glendale.

2330 Telephone call received from the Las Vegas decon monitor advising that maximum outside reading on the bus was now 20 and the maximum inside was 15, and the rest of the bus inside was averaging 8. As a result of these readings and with the concurrence of the Field Manager, the bus was released to the Greyhound Company.

2400	Radio and telephone watch at Off-Site Headquarters secured with one man sleeping near the telephone.

April 25, 1953

0930	Additional report received by telephone from the St. George monitor. One vehicle still reads 25 at the driver's seat. This vehicle is a 1949 Pontiac 4-door sedan owned by Mr. Jack Prisbery of Boulder City, carries Nevada license plates 47-101. The monitor was told to call again within two hours while arrangements could be made to handle this problem.
1130	After conferring with Dr. Dunning and the Field Manager, instructions were issued to the St. George monitor to have Mr. Prisbery drive his vehicle to Mac and Bill's Garage, 1000 S. Main St., Las Vegas, on Monday morning, on his return to Boulder City, and the vehicle would be monitored and processed there.
1200	On-Site Operations Office contacted and asked to supply a monitor to handle the Prisbery vehicle at the designated garage in Las Vegas. The officer in charge advised that he would report on this later in the day.
1210	Las Vegas monitor reported latest bus readings to be 12 outside and 9 at one spot located on the left rear seat. The remainder of the bus inside read less than seven. Ground reading at Mac and Bill's Garage was 10. Ground reading at the Minute Man Wash station located at 1325 S. Main St. was 0.5.
1900	Roadblock crews which had returned to Mercury were briefed on the data desired from their missions and advised of a meeting to be held at 1430, April 27, at Building 101 with the Test Director and his Staff.
2200	Officer in charge on On-Site Operations reported that his organization will supply necessary monitor in Las Vegas on April 27 as previously requested.

April 27, 1953

0900 to 1400	Roadblock monitoring crews worked on compilation of data for preparation of a special report.
1430 to 1600	Meeting of roadblock monitoring crews with the Test Director and his Staff.
1930	On-Site monitor reported verbally on his experiences with decontamination of vehicles in Las Vegas. He was requested to submit a written report covering this subject and indicated that he would comply.

SECTION III: COMMENTS

At this time it appears to be appropriate to make two general comments concerning the participation of the Rad-Safe Off-Site group in the Operation just described.

1. The task of setting up roadblocks, monitoring, and decontamination of privately owned vehicles on the public highways had not been anticipated as a function of the Off-Site Group and no advance preparations had been made. Nevertheless, it is felt that the organization was sufficiently flexible to handle this particular emergency situation without greatly reducing the effectiveness of its assigned program, which is the determination of the radiological hazard in inhabited communities within 200 miles of the Nevada Proving Grounds.

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2. The writers believe that the mature and sound judgment exercised by the field personnel and especially their unquestioning response to directions gave maximum speed and efficiency to the implementation of the decisions of the Test Director, the Rad-Safe Officer, and the Off-Site Control Room personnel.

SECTION IV: RECOMMENDATIONS

A number of practical recommendations for the operation of future roadblocks under similar circumstances are contained in the individual reports submitted by the monitors located at Las Vegas, Alamo, and St. George. The Control Room personnel wish to add or emphasize the following:

1. A definite need exists for a clear cut statement of policy designating the responsible agency or agencies who are to assume control when the decision is made that an emergency situation exists involving traffic on public highways.

2. Investigation should be made by competent authority which will lead to establishment of safe tolerance levels applicable to situations resulting from heavy radioactive fall-out on public highways.

3. It is suggested that serious consideration be given to the development of a plan for the control of surface transportation in advance over an area likely to receive heavy fall-out. Such a plan which should cover rail as well as motor vehicular traffic might serve as a starting point for planning surface transportation control.

Control Room Personnel

W. S. JOHNSON
Off-Site Rad-Safe Operations Officer

POPE A. LAWRENCE
Senior Public Health Service Officer

CLARENCE P. SKILLERN
Radio Operator

MARGARET JANE SMITH
Clerical Assistant

TO: William S. Johnson, Off-Site Rad-Safe Operations Officer, NPG
FROM: Frank A. Butrico, Monitor-in-Charge, Las Vegas, Nevada
SUBJECT: REPORT COVERING VEHICLE DECONTAMINATION PROCEEDINGS AT LAS VEGAS, NEVADA, 25 APRIL 1953

This report covers the events leading to and following the establishment of a roadblock on Highway 91 five miles north of Las Vegas for the purpose of detecting those vehicles contaminated by the fall-out from Shot 7 which was detonated at 0430 on 25 April. The following is the disposition of the participating personnel prior to the establishment of the roadblock.

(1) At 1345 Coca-81 manned by Claborn and Shipman was standing by at Glendale Junction when they were informed by Chief Rowe to proceed to the Chevron Gas Station near Nellis Air Force Base to assist in establishing a roadblock. They departed at 1355 and arrived at the roadblock site at 1455.

(2) At 1145 Alpha-65 manned by Rowe and Stevens had returned to Glendale Junction after completing a monitoring run from Moapa to Overton. While Rowe was calling CP by telephone (radio contact could not be made) Stevens decided to monitor some of the vehicles coming from Mesquite enroute to Las Vegas. His training with the Rad-Safe Vehicle Decontamination Unit prompted this because he knew that with the high monitoring readings being obtained some vehicles would no doubt be contaminated. In monitoring an open type tractor trailer an average reading of 450 was obtained on the outside and a reading of 25 on the inside of the cab. This prompted Stevens to have Rowe report the readings to CP while he was still in telephone contact. The monitoring procedure was repeated on several parked cars and these were also found to be contaminated. At 1155 the team was instructed to repeat a monitoring run to Moapa. Upon returning to Glendale at 1215 they received a message from Coca 81 to report to CP all vehicles reading over 200 and to get the occupant's name, car license number, and to make a note of the readings. A truck was the first to be monitored (Truck No. 12 Chicago Bridge and Iron Co., Torrance, Calif., driven by Leo Miller) and readings of 400 on the outside and 22 on the inside of the cab were obtained. The driver's name was taken and he was instructed to stop at the Chevron Station outside Las Vegas to be decontaminated.

At 1315 a Greyhound bus arrived at Glendale Junction with thirty (30) passengers enroute to Las Vegas and points beyond. The maximum reading obtained outside the bus was 250 near the motor compartment and an inside reading of 140 on the rear seat. Melton who was also at Glendale Junction and in telephone contact with CP was instructed to call in these readings (the name of the driver and bus number are included in Table 1). The monitoring group was instructed to let the bus proceed to Las Vegas where it would be monitored and decontaminated. The Alpha 65 team was also instructed to remain at Glendale Junction and monitor vehicles passing through with all contaminated vehicles to be directed to the Chevron Gas Station outside Las Vegas. In doing the monitoring at Glendale Junction Rowe covered the Junction of Highways 91 and 93 and Stevens remained at Glendale. At 1330 the station at Glendale called Stevens to answer a telephone call from CP. The team was then instructed to stop the monitoring at Glendale and proceed to the Chevron Station outside of Las Vegas. They were to contact a State Trooper and Alpha 67 and set up the roadblock. In addition they were to locate Coca 81 and request their assistance at the roadblock. At 1428 the Alpha 65 team arrived at the Chevron Station.

(3) At 1205 Alpha 67 manned by the writer was instructed to stand by at the present location for a special assignment that would be forthcoming in about 30 min. At the time the message was received my location was near the gate to Nellis Air Force Base in North Las Vegas. While waiting for the message an open trailer truck carrying rolled sheet steel passed and caused the needle of the MX-5 instrument to go off the 20 scale. The truck was followed for a few miles to be sure it was the cause for the high reading. This fact was established when a reading of 35 (on the T1B) was obtained alongside the truck while in motion. It was decided not to stop the truck but to report the incident to CP when radio contact was made for the special assignment message. It later turned out that the special assignment message involved this same truck.

At 1245 (about 10 min after the truck passed) the message came through via the radio to be on the lookout for an open trailer truck with a cargo of rolled sheet steel. This truck had come through the fall-out area and was contaminated. CP also indicated that a second truck meeting the same description was also on the way to Las Vegas and that an effort should be made to intercept it before getting into the city. It was suggested that the Chevron Station or the Richfield Truck station on South Main Street be used as decontamination stations. After quickly explaining that truck No. 1 had already passed, I proceeded towards Las Vegas to locate it and possibly get a lead on truck No. 2. In proceeding through town there was no sign of the trucks. I went out as far as the weighing station located near the airport. There the attendant told me that no truck meeting the description had passed. He informed me that he had received a telephone call from Camp Mercury to the effect that a roadblock was to be set up in North Las Vegas at the Chevron Station and that cars would be decontaminated at 1325

South Main Street. After waiting five minutes the first of the open trailer trucks arrived. Another reading was taken to be sure it was the right one. When asked about the second truck meeting the same description the driver informed me that he was not too far behind. I waited for him and then instructed them both to proceed to the Richfield Station for decontamination. I went on ahead to negotiate for the work at the station. Upon arrival I was told this station had no facilities for washing trucks. After another unsuccessful try at the Associated Station I came upon the Mobilgas Gas Station at 1000 South Main Street where it was noted that facilities were available for washing trucks. The problem was explained to the owner, and he immediately agreed to take on the work. No difficulty was encountered when it was indicated that Reynolds Electric Co. would be billed for the work. This was probably due to the fact that the company is located in Las Vegas. It then became necessary to be on the lookout for the returning trucks to inform them of the change in decontamination points. This was accomplished, and the first washing was started at about 1415.

CP then informed me by radio of the proposed roadblock and asked me to proceed to the Chevron Station to set it up with a trooper who was already enroute, and that Coca 81 and Alpha 85 were also enroute to assist me. At 1430 I arrived at the Chevron Station only to be informed that the trooper had already been there and had proceeded North on Highway 91 towards Glendale. I waited about 5 to 10 min when the trooper and Alpha 65 arrived. In 60 sec the trooper had his "STOP" sign out and the roadblock was established (1440). Rowe immediately informed me of the contaminated bus and went on ahead to Las Vegas to take care of the decontamination.

Stevens and I both monitored the cars, using the MX-5 and T1B instruments. Readings were taken around the car and inside by opening the door and taking a reading near the floor. In selecting cars for decontamination we used a figure of 7 as a maximum allowable concentration for the inside of the vehicle. Those exceeding this figure were sent to the decontamination station. The name of the driver, license number, and the inside and outside readings were recorded. These are included in Table 1. During the operation some inside and outside readings were relayed to CP via the car radio in order that they would have some idea of the levels being encountered.

At about 1455 Coca 81 arrived. Shipman and Claborn informed me they were contaminated and so were the instruments they had. In view of this it was decided that Stevens and I would continue the monitoring while Shipman and Claborn kept notes and radio contact with CP. At this point the operating procedure was changed in order to get traffic moving a little faster. Claborn started up the line of cars asking the drivers whether they came through Glendale Junction from the North. Those that did not were allowed to proceed while the others remained to be monitored. This got the traffic moving faster, although even with the other procedure of stopping all cars we did not have over 15 cars waiting at any one time. With the situation under control at this point it was decided to proceed to the truck decontamination station. Upon arrival at the decontamination station it was found that the first truck had been cleaned and was ready for monitoring. These figures are included in Table 1. Since the readings were below the tolerance figure previously established (7 inside the cab), the truck was released. Work was then started on the bus. In the meantime Rowe was instructed to proceed to the car decontamination station to monitor the cars leaving. I was later informed that four cars had departed without being monitored. He monitored the other seven, and the results are included in Table 1.

The decontamination of the bus continued. After the first cleaning on the outside the inside readings were reduced to 10 except on the back seat where a reading of 160 was still being recorded. The bus was then vacuumed, but apparently this did no good because the readings remained the same. The next decision was to steam clean the motor located at the rear of the bus. Since this would take some time it was decided to proceed with the decontamination of the two remaining trucks. At this time Coca 81 arrived at the decontamination station and informed me that the roadblock at the Chevron Station was removed at 1618 on radio instructions from CP. About 5 min later Mr. Woodruff also appeared on the scene. One of the trucks was released after the first washing reduced the activity in the cab below the 7 figure. The truck with the rolled sheet steel gave us some trouble. After the first washing the reading in the cab had been reduced to 7 but the cargo still read 40. From CP we were instructed by radio to continue the washing until the steel got down to 20. This was done and after the second washing a reading of 20 was obtained. Before releasing the truck, Mr. Woodruff, who was then on the scene, gave the driver a letter addressed to the consignee indicating the slight degree of contamination and suggested that they not use the material for instruments (if this was the ultimate use) for at least 10 days.

Work was again started on the bus. After steam cleaning the motor, readings were taken and again the left rear portion gave us readings of over 150. The only remaining portion of the bus not thoroughly cleaned was the radiator. It was decided to steam it and see if the readings would come down. Before proceeding with that operation, contact was made with the Greyhound mechanic to ascertain whether steam cleaning might injure the radiator. After discussing the situation with him at the scene it was decided to remove the radiator and clean it separately. The bus was moved to the Greyhound bus garage and the work was started immediately. By removing the radiator the readings dropped to 80. He next steam cleaned the radiator and the area in which it was housed. After this was finished the maximum reading obtained on the outside of the bus was 20 and the one spot on the rear seat was reduced to 15. The radiator unit after cleaning gave a reading of 18. This was considered satisfactory and the decontamination operation was stopped. The next morning, 26 April, it was decided to monitor the decontamination stations and the bus. The figures obtained are included in Tables 1 and 2. It will be noted that a reduced reading was obtained on the bus.

PUBLIC RELATIONS

By and large the whole operation was accepted rather favorably by the public. When stopped at the roadblock most people were of course curious to know why. When they were told it was a precautionary measure to detect radioactive contamination, they seemed to accept it as sufficient reason for being delayed. Those requiring decontamination also were not too disturbed about the situation. Indicative of this is the fact that all eleven cars requiring decontamination arrived at the decontamination station even though the roadblock and the stations were located ten miles apart. The most often asked question was whether the amount of radiation to which they had been exposed was injurious. In each case full explanations were given to the effect that in dealing with radiation we were striving to avoid as much exposure as possible. It was also explained that the amount to which most of them had been exposed was well within the tolerance figures established by health officials. One reaction worth mentioning was that remark from one gentleman who expressed a feeling of satisfaction to know that such precautionary measures were being taken to safeguard the general public.

RELATIONS WITH THE PRESS

At approximately 1530 two newspaper men came out to the roadblock at the Chevron Station. The station was then being manned by Stevens, Claborn, and Shipman. The photographer requested permission to take pictures. He was given the permission and as best determined he took about 5 or 6 shots. The other reporter started asking Shipman questions as to how many vehicles had been found to be contaminated and where the fall-out occurred. His questions were not answered, but instead Shipman radioed CP for instructions. He was told to refer the press to Mr. Elliott at the AEC, Las Vegas, office. After asking the questions again and getting no answer the newspaper men left.

About 20 minutes later some gentlemen from AEC arrived at the roadblock and informed Shipman and the State Trooper that we had received a complaint from the press about not being allowed to take pictures. The AEC person was informed of what had happened and that no one was denied the right to take pictures. During the conversation another newspaper photographer arrived and started taking pictures and, of course, was not stopped from doing so.

RECOMMENDATIONS

My first suggestion would be to stop all traffic from entering the fall-out area during the period of maximum fall-out. A lower limit should be established, and, when monitoring units start to get readings above this, the roads should be closed. From a public relations standpoint, if an individual wants to proceed he should be allowed to do so except that he should be pre-warned that it may be necessary to decontaminate when arriving on the other end of the fall-out area. If it is decided that stopping traffic is not feasible, it may be well to consider using decontaminating equipment and personnel at selected highway areas where the fall-out is expected. These units could operate much like our mobile monitoring units by being dispatched to the fringe of maximum interest points for decontamination operations as soon as these areas are known. This will avoid negotiating with private garages and more important it will permit performing the decontamination operation close to the check points and in areas where water is not readily available.

Table 1 — MONITORING DATA ON MOTOR VEHICLES

Vehicle	Name of driver	License or truck No.	Where decontaminated	Readings, mr/hr: Before decontamination, Inside	Before decontamination, Outside	After decontamination, Inside	After decontamination, Outside
Passenger car	A. Slack	Utah J/M 233	Washmobile, 1325 S. Main St.	12	32	*	*
Passenger car	Lorin L. Bird	Utah CB 575	Washmobile, 1325 S. Main St.	9	35	5	12
Passenger car	E. Loegering	Calif. N72617	Washmobile, 1325 S. Main St.	10	15	*	*
Passenger car	J. Duns	Calif. 2J5513	Washmobile, 1325 S. Main St.	15	15	3	5
Passenger car	B. Sessions	Calif 1W29275	Washmobile, 1325 S. Main St.	12	28	4	6
Passenger car	J. Eichen	Calif. R80727	Washmobile, 1325 S. Main St.	29	29	*	*
Passenger car	V. Thurston	Nev. 30-499	Washmobile, 1325 S. Main St.	10	12	*	*
Passenger car	W. Fullerton	Nev. 44-165	Washmobile, 1325 S. Main St.	10	20	3	6
Passenger car	Thelma Abbott	Utah J/M 311	Washmobile, 1325 S. Main St.	15	20	6	10
Passenger car	Eugene Miller	Utah D/P 702	Washmobile, 1325 S. Main St.	15	10	5	8
Passenger car	A. Williams	Mont. 27201	Mac & Bill, 1000 S. Main St.	15	10	5	8
Truck	Kent Lisk	Truck No. 3082 Pacific Intermountain Express, Cedar City, Utah	Mac & Bill, 1000 S. Main St.	17	30	5	18
Truck	Bob Barkin	Truck No. 1046 Pacific Inter-mountain Express, Cedar City, Utah	Mac & Bill, 1000 S. Main St.	15	28; average 160; rolled steel cargo	7	25
Truck	C. A. Mills and L. L. Largent	Truck No. 1614 Garrett Freight Line, Pocatello, Idaho	Mac & Bill, 1000 S. Main St.	12	30	7	20
Bus	S. K. Fullerton	Bus No. 1154 Greyhound Bus Line, Las Vegas, Nevada	Mac & Bill, 1000 S. Main St.	Average 100 mr over radiator; 160 mr on rear seat	250	15 mr (4/25); 9 mr (4/26); max. on rear seat	20 mr (4/25); 15 mr max. near radiator (4/26)

*These vehicles left the decontamination station before they could be monitored.

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Table 2 — MONITORING OF DECONTAMINATION STATION

Date	Station	Reading, mr/hr
26 April	Washmobile	0.5
26 April	Mac & Bill	10
26 April	Greyhound Garage	0.3

SUMMARY

The roadblock operation in the Las Vegas area involved the monitoring of approximately 150 vehicles at the Chevron Gas Station check point located 5 miles north of the city. Of these, eleven passenger cars, three trucks and one bus had inside readings above 7 and required decontamination. Two decontamination stations were set up, one at 1325 South Main St. to take care of passenger cars, and the other at 1000 South Main St. for handling trucks. The Washmobile Station (1325 So. Main St.) decontaminated 10 passenger cars while Mac & Bill (1000 So. Main Street) handled one passenger car, three trucks, and one bus.

The one truck (Chicago Bridge and Iron Co., Torrance, Calif.) which was monitored by Stevens at Glendale Junction was not decontaminated, although the driver did take the truck to the Chevron Station as instructed. When he arrived and the truck was remonitored the highest reading in the cab was 7 and about 18 on the outside. In view of these figures it did not seem necessary to detain him. Where he lost most of the activity cannot be explained. It will be noted that at Glendale the readings were 22 in the cab and 400 on the outside.

REVIEWED:

Robert A. Stevens, ENC, USN

John G. Rowe, ADC, USN

Eldred S. Claborn, ADC, USN

Harold D. Shipman, T/Sgt, USAF

FRANK A. BUTRICO
Off-Site Monitor-in-Charge
Las Vegas, Nevada

TO : William S. Johnson, Off-Site Rad-Safe Operations Officer, NPG
FROM : Richard H. Fetz, Monitor-in-charge, St. George Roadblock
SUBJECT: SUMMARY OF EVENTS AT ST. GEORGE ROADBLOCK

At approximately 1300 on 25 April 1953, the Off-Site monitor (Rad-Safe) at St. George was notified by radio to make a monitoring run from St. George, Utah, to Mesquite, Nevada. Departure from St. George was accomplished at 1318 and arrival time at Mesquite was 1421.

During the course of this monitoring run several significant happenings took place. The first of these was the discovery of a contaminated weighing scale manned by the Utah Highway Department at Santa Clara. When the location was passed it was noted that the survey meter registered contamination even from a rapidly moving vehicle. Noting this the Off-Site monitor stopped, turned around, and checked the weighing station for activity. This was readily evident in the area of the scales. With this information the Off-Site monitor suggested that the State Police at the station inform each of the trucks proceeding eastward to get their trucks washed inside and out at their earliest convenience, provided they had previously come over the route U. S. 91 from Las Vegas.

The second item of interest noted on this monitoring run was the fact that almost all vehicles passing the monitor's vehicle caused the survey meter to register off-scale when the vehicles passed each other on the highway. Upon arrival in Mesquite, Nevada, a telephone call was placed to Mr. W. Johnson at CP 1 and he was informed of this information, including the monitoring results. The time of this message was approximately 1430. During the course of this conversation the Off-Site monitor was instructed to set up a roadblock in west St. George on U. S. Highway 91. He was further instructed to solicit the assistance of the local authorities in St. George.

The Off-Site monitor left immediately for St. George, the time being 1440. At 1550 the monitor arrived again at the Santa Clara weighing station. This time he informed the State Troopers present that he had been instructed to set up a roadblock in St. George. The overall situation as far as contamination was concerned was explained to them. In a very short time one of the troopers quit his post and proceeded in the monitor's car to St. George. It was understood at this time that another Utah Trooper would follow us in about 5 min to a point just west of the city of St. George. Upon arrival there the three people split up, the monitor proceeding to the center of town to enlist the cooperation of local filling station operators in the decontamination work, and the State Troopers calling for aid from the city police and another trooper who was off duty at his home in St. George. The Off-Site monitor found that the Utoco Service Station No. 403 at 5 West First North, Col. Cottam, Manager, was willing to cooperate in the program. It was explained to the person in charge of the station at this time that the monitor could not reimburse the filling station for their services, but that the AEC or its contractor would do so. Attempts to enlist the aid of other stations failed either because they did not do car washing or because the personnel who usually did that type of work were off at the time.

On the way back to the roadblock site that had been chosen the monitor stopped by a 5 and 10 cent store and bought some 3 × 5 in. filing cards for keeping data.

At approximately 1620 the roadblock was established on a stretch of U. S. 91 about three blocks west of First Street North. The location chosen was ideal in that the road was sufficiently wide at the point to allow 10 to 20 cars to pull off the highway at any one time.

It was decided before the actual roadblock was established that two of the State Troopers should do vehicle monitoring and one of the Troopers would do the paper work necessary to record the required data. The city policeman would be assigned the task of stopping traffic on the highway, and the Off-Site monitor would do the public relations work of explaining to the drivers and occupants of vehicles what the stopping of traffic was all about. This arrangement worked rather smoothly as long as cars did not appear at the check point at too fast a pace in a time sense. The operating procedure was simple. The driver was stopped off the highway and asked whether he had driven from the vicinity of Las Vegas or Mesquite. If the answer was affirmative he was informed that he had driven through an area that had been slightly contaminated from the radioactive dust of the explosion that morning. All individuals were requested to step out of the car so that it could be checked for activity. The two troopers, who had been given a brief lesson in monitoring by the Off-Site monitor, scanned the vehicles. If the vehicle was found to be contaminated, the driver was informed of this fact and further informed that it would be to his best interests to have the radioactive material removed from his vehicle. He or she was informed that there was no question of a health hazard involved, but that it would be better to get the car cleaned. It was explained that the contaminated vehicle could be taken to the designated filling station and that this service would be done at no charge to the vehicle operator.

It was decided before the roadblock was actually set up that compliance with the request for decontamination would probably be close to perfect, but as a check it was decided to reliev each vehicle operator of his driver's license prior to departure from the decontamination station. This was done to assure that our work would be 100 per cent effective. It was explained to owners of contaminated vehicles that they would retrieve their driver's license upon their return, provided the contamination had been removed. This procedure worked perfectly. Only when cars approached the check point in too great numbers did the organiz.tion experience difficulties.

The following persons made the roadblock force:

Utah State Trooper L. A. Porter, St. George, Utah
Utah State Trooper R. J. Brown, Hurricane, Utah
Utah State Trooper Elroy Mason, St. George, Utah
St. George City Policeman L. Glen Leavitt, St. George, Utah
Off-Site monitor R. H. Fetz, Mercury, Nevada

It became evident shortly after the roadblock was established that one filling station was not sufficient for the volume of work encountered. A state trooper was dispatched to St. George to enlist the aid of more filling stations. This was accomplished. As a result the following stations assisted in the program:

(1) Utah Oil Service (Utoco)
5 West First North
St. George, Utah
(2) Dixie Service No. 771 (Utoco)
St. George, Utah
(3) Pioneer Service Station (Texaco)
St. George, Utah

Monitoring, as has been mentioned before, was done by hastily instructed State Troopers. Instruments used were MX-5's and AN/PDR 39's. The original instructions to the Off-Site monitor directed that a level of 7 mr/hr within a vehicle was indicative of contamination. This val pointed out to the trooper monitors on their instruments and the same level was use ghout the roadblock program.

drivers of contaminated vehicles were instructed to proceed to the assigned decon sta s where the decontamination would take place. The decon operators were instructed to cle e inside of the cars as best they could—no filling stations had vacuum cleaners—and wa e outside of the car if so instructed. The filling station operators were requested to keep a list of all vehicles processed, recording the following information:

1. Vehicle tag number with state designation.
2. Operator's name.
3. Operator's address.
4. Make of car and year.

At the roadblock a similar list was kept on 3 × 5 filing cards. The above information was supplemented by recording the milliroentgen level before and after decontamination on the cards.

After a vehicle had been decontaminated, the driver returned to the roadblock for inspection and evaluation. If the inside of the car level was below 7 mr/hr, his driver's license was returned to him and he was thanked for his cooperation. Our apologies for his delay were extended also. It should be pointed out that no money exchanges occurred between the Off-Site monitor and any of the filling stations involved.

After approximately 45 to 60 min of operation of the roadblock the previously mentioned team comprising the roadblock was supplemented by Off-Site monitors Ralph Graber and George Williams from the stations at Caliente and Pioche. Their assistance was very instrumental in relieving the work load and pressure on the roadblock team.

At approximately 1800 Off-Site monitor Fetz was called to the radio by CP 1 and requested to provide statistical information on the percentage of contaminated vehicles in the traffic then checking past the roadblock. This was done. At approximately 1855 the roadblock team was informed by radio to cease operations. The troopers and the St. George policeman were thanked for their assistance, and the program was over except for one item, a contaminated vehicle that the decon stations were unable to clean upon repeated efforts.

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The driver of the vehicle, Jack Prisbey, had passed through the contaminated area in the morning. He had gone to St. George to visit his parents and had been caught at the roadblock after he had visited friends in the suburbs of St. George that afternoon. Prisbey's vehicle was so contaminated that he was instructed to drive it to the home of his parents in St. George and leave it, where it could be remonitored the next morning. The next morning the vehicle was again monitored and found to be contaminated, the decay being insufficient to get below tolerance. These facts were telephoned to Mr. Pope Lawrence at CP. After conferring with his supervisors, Mr. Lawrence directed that on Monday morning the Prisbey vehicle should be taken to Las Vegas to a certain garage where further decontamination procedures would be instituted.

A list is attached showing identifying data on the contaminated vehicles along with the mr/hr readings before and after decontamination—designated B and A. There are twenty-five vehicles on the list. This represents 10 to 15 percent of the vehicles passing the roadblock during its existence, since a total of 250 to 300 vehicles were processed at the St. George station.

In general, the reaction of the public was most cooperative. No one questioned our authority for our actions, and only one individual, a radiologist from California, was sufficiently well-informed to understand the reasons for the action taken. He cooperated splendidly after we informed him that his delay, if any, would be brief, since he had expressed some concern about making his assigned schedule for this trip.

When drivers were informed that they were riding in contaminated vehicles, they appeared to be not overly concerned when informed that there was no danger of any great magnitude. They merely wanted to know what to do and how to go about it. Once this was explained, everything flowed very smoothly. As far as the Off-Site monitor is aware, no one from the press visited the roadblock. However, there appeared in the Salt Lake City paper a story about the St. George roadblock and where the information came from is not known. One of the troopers did ask what should be done if the press did appear, and the Off-Site monitor informed him that any statements would have to come from the AEC in Las Vegas or the office of the Test Director at the Nevada Proving Grounds.

Recommendations for further operations of this type:

(1) Prior to any test it should be ascertained where fall-out will probably occur. The highways in the area should be closed during the hours fall-out is expected. Monitors or guards should be stationed at each end of these highways at check points. When vehicles are once again permitted to travel the contaminated highways, the driver and occupants of the conveyance should be instructed to remain in the vehicle until the next check point is reached, where the vehicle would be monitored for activity. It is this individual's opinion that there would be very little contamination of the interior of a vehicle if the vehicle were not allowed in the actual fall-out and if the occupants of the vehicle remained in the car or truck upon passage through the fall-out area after fall-out had occurred.

(2) Some system of record keeping should be developed before it is decided to conduct another test involving the possibility of road contamination.

(3) A survey should be made of any possible roadblock locations to see if facilities are available for car washing and vacuuming. If these are not available, then portable decon stations should be provided for this purpose.

(4) The program of vehicle inspection should be delegated to some other Off-Site group if the present Rad-Safe Off-Site group is to continue to carry on the functions it has been doing in the past prior to this test. It is impossible to carry on a roadblock program and Off-Site station operations at the same time.

Reviewed:

Ralph C. Graber

George M. Williams

Richard H. Fetz
Off-Site Monitor

List of Vehicles Requiring Decontamination at St. George, Utah

Identification	Readings before and after decon, mr/hr
(1) Calif. 1T-59076	B 9
Richard Jameson	A 5
741 Pinehurst Ave.	
La Habra, Calif.	
52 Chev.	
(2) Nev. 33-381	B 14
Fred Scharf	A 5
Hotel El Rancho Vegas	
Las Vegas, Nev.	
51 Buick	
(3) Calif. 3Y5771	B 9
B. J. Caldwell	A 4
560 W. Orange Grove	
Pomona, Calif.	
51 Ford S. Wagon	
(4) Wis. C 8269	B 20+
Clarence Reed	A 4
Gleason, Wisc.	
52 Plymouth	
(5) Calif. 1N62936	B 20
D. I. Dawson	A 3
608 So. A. St.	
Oakaloosa, Iowa	
52 Pont.	
(6) Calif. 1U52393	B 20
Paul Ferguson	A 3
Box 203	
Gunnison, Colo.	
40 Dodge	
(7) Nev. 42792	B 17
H. B. Bean	A 2
Richfield, Utah	
38 De Soto	
(8) Minn. 723184	B 15
Alvin F. Johnson	A 5
1347 Payne St.	
St. Paul, Minn.	
48 Pont.	
(9) Utah LC871	B 9
Leonard Jacobsen	A 2
612 8th St.	
Salt Lake City	
49 Ford	
(10) Calif. 2P10052	B 12
O. T. Ellis	A 2
550 Havana Ave.	
Long Beach, Calif.	
49 Cad.	

(11)	Nev. 47-101	B 37
	Jack Prisbey	A 20+
	660 Ave. M.	(will check again in AM)
	Boulder City, Nev.	
	49 Pont.	
(12)	Nev.	B 17
	John Brown	A 2
	Henderson, Nev.	
	52 Plymouth	
(13)	Nev. 44717	B 19
	M. Hardy	A 6
	Mesquite, Nev.	
	52 Olds	
(14)	Idaho 2/T5878	B 10
	Lester Allen	A 6
(15)	Nev. T9813	B 14
	Doyle Lee	A 5
	Ivins, Utah	
	52 Studebaker pickup	
(16)	Calif. 1R85707	B 9
	Richard Cobum	A 3
	San Diego, Calif.	
(17)	Quebec MC 2140	B 20
	P. Cartier	A 6
	Thetford Mines, Quebec	
	Chev 1952	
(18)	Fla. 8-15087	B 17
	W. N. Beck	A 7
	65 N 2nd E.	
	Provo, Utah	
	51 Dodge	
(19)	Iowa E 4 422	B 13
	W. H. Martell	A 2
	Rt. 1	
	Springville, Utah	
	49 Ford	
(20)	Va. 199-626	B 9
	John Willis	A 4
(21)	Calif. IE94225	B 8
	J. Hildebrand	A 2
(22)	Wyo. 9-1830	B 15
	R. Cutter	A 6
(23)	Utah CH 415	B 9
	H. E. Carlson	A 6
	Bacchus, Utah	
	49 Chev.	
(24)	Iowa 744303	B 12
	Elmer Frink	A 4
	Nellis AFB, Las Vegas	
	50 Packard	
(25)	Utah 7-77931	B 20
	140 W 400 S	A 8

Rorby Nt. Produce Co.
Wash truck himself
Will set aside until tomorrow

April 28, 1953

TO : William S. Johnson, Off-Site Rad-Safe Operations Officer, N. P. G.
FROM : Otto Paganini, Off-Site Monitor, Crystal Springs-Alamo Stations, Nevada
SUBJECT: Roadblock Experience Report, Hwy. 93, Alamo, Nevada, 4/25/53

Time notified: 1420 hr, 4/25/53.
Notified by: H. K. Smithson, Off-Site Monitor, Glendale Junction, Nevada.
Location when notified: Alamo, Nevada, station.

Roadblock was set up by Mr. Smithson, Off-Site Monitor, Glendale Junction, Nevada, Station, around 1400, with the assistance of Mr. Ansley Sharp, Deputy Sheriff and Mr. Larry Davis, Deputy Sheriff, Lincoln County, Nevada. Both of these men live at Alamo, Nevada.

The monitoring was done with an MX-5 No. 17439 and Thyac No. 289 GM instruments.

As instructed verbally through Mr. Smithson, by orders from CP No. 1, cars that had readings inside of the car of 7 mr or less were permitted to continue on their journey. This figure was that obtained after the local background of 1 mr was subtracted from the reading obtained inside the vehicle. The reading was taken by inserting probe in window of car from the driver's side.

The name, address, make of car, and license number were obtained from the driver of the car. The driver when stopped, was informed that a check was desired of the car and occupants to insure their safety as a precautionary measure against radiation. It was emphasized that concentrations were not high, but to insure their safety a check was being made. All persons stopped were most cooperative, when stopped. In the bed of one cattle truck, a reading of 12 mr was noted. One milk truck was monitored. A reading of 8.0 mr was noted in the cab. Instructions were given by Mr. Smithson to thoroughly wash the truck and cans before re-use. The cattle truck was not given any instructions.

No established car-washing facilities were available in the area; however, Mrs. A. Sharp, Alamo, offered the services of water and a hose at the post office. This could have been used for decontamination of vehicles; however, it may have proved inadequate.

The roadblock was removed around 1620 hr.

Data:

Vehicles processed, 9.

All persons were cooperative, inquisitive—yes, but not alarmed. Reason for monitoring was given with as little information other than previously reported so as not to alarm the occupants.

Press was not present.

Cars Stopped:

Time	Data
1420	Garibaldi Bros., Los Angeles, Calif. Tr. No. 76, Lic. Nev. P/B-72; bed of truck; 12 mr, Smithson Thyac GM 289; cab of truck; 4 mr, Smithson Thyac GM 289
1420	Garibaldi Bros., Los Angeles, Calif. Tr._____ Lic._____; bed of truck: 7 mr, Smithson Thyac GM 289; cab of truck: 3 mr, Smithson, Thyac GM 289
1420	Eldon Lee, Alamo, Nev. Lic. T 598 J; milk cans: 5 to 6 mr, Smithson Thyac GM 289; cab: 8 mr, Smithson Thyac GM 289

All above unloading in Alamo. Instructions given to Mr. Lee to wash cans and cab thoroughly.

1420 J. L. Crookston, no address, Utah P/B 857; 4 mr, Smithson Thyac 289

1420 A. Fedrico, Route 3, Las Vegas, Nev., Dodge Tr.; 3 mr, Paganini MX-5.

1430 Harry De Paoli, 299 Chestnut St., Reno, Nev., Lic. 8-274 Nev.; 6 mr, MX-5 Paganini

1440 Gene Bullough, Pioche, Nev., Stud., PF981 Utah; 6 mr, MX-5 Paganini

1445 W. A. Jones, Overton, Nev., Ford Truck, PX654 Nev.; 2 mr, MX-5 Paganini

1450 Bill Ligom, 1419 Gordon, Reno, Nevada, Chrysler, 1-419 Nev.; 2 mr, MX-5 Paganini

1520 George A. Ruid, Ely, Nev., DeSoto, 49-404 Nev.; 1.5 mr, MX-5 Paganini

Remarks:

1. Public officials who assisted in the roadblock should be sent a letter of gratitude for their services rendered. Also the persons stopped should be thanked for their cooperation in the matter, perhaps with some information on same. This may include why they were stopped, levels found were not hazardous, etc.

2. Where fall-out is anticipated in heavily trafficked areas and since adequate decontamination facilities are not available, mobile decontamination teams should be located in such areas beforehand to handle the situation. Roadblocks and vehicle monitoring stations should be part of the shot project.

3. Roadblock signs should be part of the mobile units, along with forms to record such items as background count, date, names, addresses, make of car, license number, before and after mr readings.

4. Cars should be vacuum cleaned and not blown out with compressed air when decontaminating the vehicles. This would minimize contamination of the local area and station and protect the worker decontaminating the vehicle. Personnel protective equipment as may be required should be available to the decontamination workers.

5. Clothing and other personal effects in vehicles may present a problem when decontamination is recommended and how to handle this needs further study and consideration.

Otto Paganini, Off-Site Monitor

Reviewed: H. K. Smithson

Inclosure 4

GROUND MONITORING DATA, SHOT SIMON

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Smithson	H + 1:30 to 4:30	Glendale Junction	Background		
Smithson	H + 4:45	Glendale Junction	0.5		
Smithson	H + 7:00	Glendale Junction	0.4	H + 4:30	0.7
Smithson	H + 7:15	Glendale Junction	0.5	H + 4:30	0.95
Jensen	H + 14:40	Glendale Junction	0.5	H + 4:30	1.9
Smithson	H + 12:07	Glendale Junction	0.5	H + 4:30	1.7
Claborn	H + 6:05	2 miles NW of Glendale Junction on Hwy 93	3.0	H + 4:30	4.5
Smithson	H + 12:00	4 miles NW of Glendale Junction on Hwy 93	0.4	H + 4:30	1.4
Claborn	H + 5:45	4 miles NW of Glendale Junction on Hwy 93	3.5	H + 4:30	5.5
Claborn	H + 5:40	5 miles NW of Glendale Junction on Hwy 93	3.5	H + 4:30	5.5
Claborn	H + 5:30	6 miles NW of Glendale Junction on Hwy 93	4.0	H + 4:30	5.3
Graber	H + 36:36	6 miles NW of Glendale Junction on Hwy 93	Background	H + 4:30	
Jensen	H + 14:30	5.9 miles NW of Glendale Junction on Hwy 93	0.5	H + 4:30	1.9
Claborn	H + 5:27	7 miles NW of Glendale Junction on Hwy 93	5.0	H + 4:30	6.0
Claborn	H + 5:25	8 miles NW of Glendale Junction on Hwy 93	5.0	H + 4:30	5.9
Graber	H + 36:30	8 miles NW of Glendale Junction on Hwy 93	Background		
Graber	H + 36:29	9 miles NW of Glendale Junction on Hwy 93	0.15	H + 4:30	1.8
Claborn	H + 5:20	9 miles NW of Glendale Junction on Hwy 93	6.0	H + 4:30	7.2
Claborn	H + 5:18	10 miles NW of Glendale Junction on Hwy 93	8.0	H + 4:30	9.5
Graber	H + 36:28	10 miles NW of Glendale Junction on Hwy 93	0.4	H + 4:30	3.9
Larsen	H + 28:38	10 miles NW of Glendale Junction on Hwy 93	0.45	H + 4:30	4.2
Graber	H + 35:26	11 miles NW of Glendale Junction on Hwy 93	2.5	H + 4:30	29.0

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Jensen	H + 13:25	11.3 miles NW of Glendale Junction on Hwy 93	2.0	H + 4:30	7.2
Claborn	H + 5:15	12 miles NW of Glendale Junction on Hwy 93	50.0	H + 4:30	59.0
Smithson	H + 7:35	12 miles NW of Glendale Junction on Hwy 93	0.80	H + 4:30	1.5
Graber	H + 35:22	12 miles NW of Glendale Junction on Hwy 93	8.0	H + 4:30	95.0
Graber	H + 35:21	13 miles NW of Glendale Junction on Hwy 93	10.0	H + 4:30	120.0
Claborn	H + 5:14	13 miles NW of Glendale Junction on Hwy 93	100.0	H + 4:30	120.0
Smithson	H + 11:50	13 miles NW of Glendale Junction on Hwy 93	9.0	H + 4:30	38.0
Larsen	H + 28:43	13 miles NW of Glendale Junction on Hwy 93	10.0	H + 4:30	92.0
Claborn	H + 5:13	14 miles NW of Glendale Junction on Hwy 93	152.0	H + 4:30	180.0
Smithson	H + 7:37	14 miles NW of Glendale Junction on Hwy 93	1.5	H + 4:30	2.7
Larsen	H + 28:47	14 miles NW of Glendale Junction on Hwy 93	13.5	H + 4:30	120.0
Graber	H + 35:18	14 miles NW of Glendale Junction on Hwy 93	10.0	H + 4:30	120.0
Claborn	H + 3:15	15 miles NW of Glendale Junction on Hwy 93	1.5		Fall-out occurring
Claborn	H + 3:25	15 miles NW of Glendale Junction on Hwy 93	5.5		Fall-out occurring
Claborn	H + 5:10	15 miles NW of Glendale Junction on Hwy 93	260.0	H + 4:30	310
Smithson	H + 7:41	15 miles NW of Glendale Junction on Hwy 93	90.0	H + 4:30	160

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Jensen	H + 13:18	15.6 miles NW of Glendale Junction on Hwy 93	40.0	H + 4:30	150
Claborn	H + 3:30	16 miles NW of Glendale Junction on Hwy 93	23.0		Fall-out occurring
Claborn	H + 5:05	16 miles NW of Glendale Junction on Hwy 93	260.0	H + 4:30	300
Smithson	H + 11:45	16 miles NW of Glendale Junction on Hwy 93	100.0	H + 4:30	310
Larsen	H + 28:50	16 miles NW of Glendale Junction on Hwy 93	30.0	H + 4:30	280
Claborn	H + 5:00	17 miles NW of Glendale Junction on Hwy 93	415.0	H + 4:30	480
Smithson	H + 7:48	17 miles NW of Glendale Junction on Hwy 93	160.0	H + 4:30	300
Larsen	H + 28:51	17 miles NW of Glendale Junction on Hwy 93	35.0	H + 4:30	240
Claborn	H + 3:40	18 miles NW of Glendale Junction on Hwy 93	150.0		Fall-out occurring
Claborn	H + 4:05	18 miles NW of Glendale Junction on Hwy 93	380.0	H + 4:30	Fall-out occurring
Claborn	H + 4:35	18 miles NW of Glendale Junction on Hwy 93	460.0		
Claborn	H + 4:50	18 miles NW of Glendale Junction on Hwy 93	440.0		
Larsen	H + 28:56	18 miles NW of Glendale Junction on Hwy 93	60.0	H + 4:30	580
Jensen	H + 13:15	18.2 miles NW of Glendale Junction on Hwy 93	80.0	H + 4:30	290
Smithson	H + 7:51	19 miles NW of Glendale Junction on Hwy 93	240.0	H + 4:30	500
Smithson	H + 11:36	19 miles NW of Glendale Junction on Hwy 93	200.0	H + 4:30	620

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Claborn	H + 2:50	20 miles NW of Glendale Junction on Hwy 93	Background		Fall-out occurring
Jensen	H + 13:12	20 miles NW of Glendale Junction on Hwy 93	60.0	H + 4:30	220
Larsen	H + 28:57	20 miles NW of Glendale Junction on Hwy 93	80.0	H + 4:30	760
Smithson	H + 7:56	21 miles NW of Glendale Junction on Hwy 93	320.0	H + 4:30	630
Larsen	H + 28:59	21 miles NW of Glendale Junction on Hwy 93	75.0	H + 4:30	700
Graber	H + 35:02	21 miles NW of Glendale Junction on Hwy 93	40.0	H + 4:30	460
Graber	H + 35:01	22 miles NW of Glendale Junction on Hwy 93	15.0	H + 4:30	175
Smithson	H + 11:29	23 miles NW of Glendale Junction on Hwy 93	100.0	H + 4:30	305
Graber	H + 35:00	23 miles NW of Glendale Junction on Hwy 93	15.0	H + 4:30	175
Larsen	H + 29:03	23 miles NW of Glendale Junction on Hwy 93	38.0	H + 4:30	360
Larsen	H + 29:05	24 miles NW of Glendale Junction on Hwy 93	45.0	H + 4:30	420
Graber	H + 34:59	24 miles NW of Glendale Junction on Hwy 93	20.0	H + 4:30	230
Claborn	H + 2:45	25 miles NW of Glendale Junction on Hwy 93	0.2		Fall-out occurring
Smithson	H + 8:05	25 miles NW of Glendale Junction on Hwy 93	180.0	H + 4:30	370
Graber	H + 34:57	25 miles NW of Glendale Junction on Hwy 93	14.0	H + 4:30	160
Smithson	H + 11:25	26 miles NW of Glendale Junction on Hwy 93	9.0	H + 4:30	28

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Larsen	H + 29:07	26 miles NW of Glendale Junction on Hwy 93	22.0	H + 4:30	205
Graber	H + 34:50	27 miles NW of Glendale Junction on Hwy 93	5.0	H + 4:30	57
Larsen	H + 29:10	28 miles NW of Glendale Junction on Hwy 93	4.0	H + 4:30	38
Larsen	H + 29:14	29 miles NW of Glendale Junction on Hwy 93	3.0	H + 4:30	28
Smithson	H + 8:06	29.5 miles NW of Glendale Junction on Hwy 93	10.0	H + 4:30	20
Claborn	H + 2:35	30 miles NW of Glendale Junction on Hwy 93	0.1		Fall-out occurring
Larsen	H + 29:17	31 miles NW of Glendale Junction on Hwy 93	3.0	H + 4:30	28
Smithson	H + 8:20	32 miles NW of Glendale Junction on Hwy 93	8.5	H + 4:30	18
Claborn	H + 2:25	35 miles NW of Glendale Junction on Hwy 93	0.35		Fall-out occurring
Smithson	H + 11:16	35 miles NW of Glendale Junction on Hwy 93	7.0	H + 4:30	21
Larsen	H + 29:23	35 miles NW of Glendale Junction on Hwy 93	3.2	H + 4:30	27
Graber	H + 34:40	35 miles NW of Glendale Junction on Hwy 93	1.0	H + 4:30	12
Larsen	H + 29:28	38 miles NW of Glendale Junction on Hwy 93	3.5	H + 4:30	32
Claborn	H + 2:10	40 miles NW of Glendale Junction on Hwy 93	Background		
Smithson	H + 8:34	42 miles NW of Glendale Junction on Hwy 93	8.0	H + 4:30	17
Larsen	H + 29:35	43 miles NW of Glendale Junction on Hwy 93	2.0	H + 4:30	19

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Graber	H+34:30	43 miles NW of Glendale Junction on Hwy 93	0.6	H+4:30	7
Smithson	H+11:05	45 miles NW of Glendale Junction on Hwy 93	3.1	H+4:30	9
Smithson	H+8:45	47 miles NW of Glendale Junction on Hwy 93	5.0	H+4:30	11
Larsen	H+29:41	48 miles NW of Glendale Junction on Hwy 93	1.0	H+4:30	9.5
Graber	H+34:20	52 miles NW of Glendale Junction on Hwy 93	0.2	H+4:30	2.3
Larsen	H+29:50	54 miles NW of Glendale Junction on Hwy 93	1.0	H+4:30	9.5
Smithson	H+9:06	57 miles NW of Glendale Junction on Hwy 93	0.5	H+4:30	1.2
Larsen	H+29:55	59 miles NW of Glendale Junction on Hwy 93	1.0	H+4:30	9.7
Paganini	H+1:50 to 7:50	Alamo	Background		
Paganini	H+8:37	Alamo	2.4		
Paganini	H+10:05	Alamo	5.0		
Smithson	H+10:40	Alamo	1.8		
Paganini	H+11:00	Alamo	2.0		
Paganini	H+12:20	Alamo	1.0		
Larsen	H+30:10	Alamo	0.7		
Graber	H+34:00	Alamo	0.06		
Larsen	H+1:00 to 4:30	Mesquite	Background		
Rowe	H+3:30	Mesquite	Background		
Larsen	H+5:00	Mesquite	0.10		Fall-out occurring
Larsen	H+5:25	Mesquite	5.0		Fall-out occurring
Larsen	H+6:15	Mesquite	11.0		Fall-out occurring

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Larsen	H+6:45	Mesquite	49		Fall-out occurring
Larsen	H+7:00	Mesquite	80		Fall-out occurring
Larsen	H+7:30	Mesquite	80	H+7:00	86
Larsen	H+8:00	Mesquite	70	H+7:00	82
Fetz	H+9:51	Mesquite	30	H+7:00	45
Larsen	H+11:00	Mesquite	39	H+7:00	66
Larsen	H+12:45	Mesquite	30	H+7:00	62
Larsen	H+26:51	Mesquite	11.5	H+7:00	59
Fetz	H+33:25	Mesquite	8.0	H+7:00	50
Rowe	H+3:30 to 4:01	Mesquite to 15 miles W on Hwy 91	Background		
Larsen	H+34:05	3 miles W of Mesquite on Hwy 91	12.0	H+7:00	79
Melton	H+6:30	3 miles W of Mesquite on Hwy 91	100.0		Fall-out occurring
Melton	H+10:21	Bunkerville	100	H+7:00	160
Melton	H+10:25	Bunkerville School	120	H+7:00	185
Melton	H+6:37	Bunkerville	290.0		Fall-out occurring
Larsen	H+27:00	Bunkerville	42	H+7:00	210
Fetz	H+34:10	Bunkerville	20	H+7:00	140
Larsen	H+12:04	8 miles W of Mesquite on Hwy 91	210	H+7:00	400
Melton	H+6:52	9 miles W of Mesquite on Hwy 91	420.0		Fall-out occurring
Larsen	H+27:07	9 miles W of Mesquite on Hwy 91	100	H+7:00	510
Fetz	H+34:18	9 miles W of Mesquite on Hwy 91	42	H+7:00	270
Larsen	H+12:42	Riverside Cabins	210	H+7:00	440
Melton	H+7:02	Riverside Cabins	400		Fall-out occurring
Melton	H+10:05	Riverside Cabins	300	H+7:00	480
Larsen	H+15:25	Riverside Cabins	170	H+7:00	420

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Larsen	H+27:13	Riverside Cabins	100	H+7:00	510
Melton	H+7:12	15 miles W of Mesquite on Hwy 91	160.0	H+7:00	170
Larsen	H+12:53	15 miles W of Mesquite on Hwy 91	70	H+7:00	150
Fetz	H+34:32	16 miles W of Mesquite on Hwy 91	9.0	H+6:00	72
Melton	H+7:20	17 miles W of Mesquite on Hwy 91	46.0	H+6:00	55
Larsen	H+13:00	17 miles W of Mesquite on Hwy 91	31.0	H+6:00	78
Larsen	H+27:20	17 miles W of Mesquite on Hwy 91	16	H+6:00	100
Melton	H+7:36	20 miles W of Mesquite on Hwy 91	100.0	H+6:00	135
Rowe	H+4:08	20 miles W of Mesquite on Hwy 91	1.0		Fall-out occurring
Larsen	H+13:06	21 miles W of Mesquite on Hwy 91	90	H+6:00	230
Larsen	H+27:25	21 miles W of Mesquite on Hwy 91	24	H+6:00	150
Fetz	H+34:37	21 miles W of Mesquite on Hwy 91	14	H+6:00	110
Rowe	H+4:14	22 miles W of Mesquite on Hwy 91	20		Fall-out occurring
Melton	H+7:42	22 miles W of Mesquite on Hwy 91	200.0	H+6:00	260
Larsen	H+13:10	22 miles W of Mesquite on Hwy 91	160.0	H+6:00	400
Rowe	H+4:17	23 miles W of Mesquite on Hwy 91	80		Fall-out occurring
Melton	H+7:45	23 miles W of Mesquite on Hwy 91	400.0	H+6:00	520
Larsen	H+13:13	23 miles W of Mesquite on Hwy 91	220.0	H+6:00	550
Rowe	H+4:20	24 miles W of Mesquite on Hwy 91	140		Fall-out occurring
Larsen	H+13:15	24 miles W of Mesquite on Hwy 91	240	H+6:00	600
Melton	H+7:48	24 miles W of Mesquite on Hwy 91	420.0	H+6:00	580
Larsen	H+27:30	24 miles W of Mesquite on Hwy 91	110.0	H+6:00	670
Rowe	H+4:23	25 miles W of Mesquite on Hwy 91	180		Fall-out occurring
Rowe	H+4:25	26 miles W of Mesquite on Hwy 91	220		Fall-out occurring
Melton	H+7:54	26 miles W of Mesquite on Hwy 91	300	H+6:00	420

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Larsen	H + 13:19	26 miles W of Mesquite on Hwy 91	180	H + 6:00	460
Fetz	H + 34:45	26 miles W of Mesquite on Hwy 91	36	H + 6:00	290
Rowe	H + 4:28	27 miles W of Mesquite on Hwy 91	180		Fall-out occurring
Larsen	H + 13:22	27 miles W of Mesquite on Hwy 91	80	H + 6:00	200
Melton	H + 8:02	28 miles W of Mesquite on Hwy 91	160.0	H + 6:00	230
Larsen	H + 27:34	28 miles W of Mesquite on Hwy 91	60.0	H + 6:00	360
Rowe	H + 4:31	29 miles W of Mesquite on Hwy 91	60.		Fall-out occurring
Melton	H + 8:04	29 miles W of Mesquite on Hwy 91	24.0	H + 6:00	33
Larsen	H + 13:26	29 miles W of Mesquite on Hwy 91	8.0	H + 6:00	20
Fetz	H + 34:53	30 miles W of Mesquite on Hwy 91	0.40	H + 6:00	3.1
Rowe	H + 4:35	31 miles W of Mesquite on Hwy 91	2.0		Fall-out occurring
Melton	H + 8:13	32 miles W of Mesquite on Hwy 91	2.0	H + 5:00	3.7
Larsen	H + 27:39	32 miles W of Mesquite on Hwy 91	2.0	H + 5:00	16.0
Fetz	H + 34:57	32 miles W of Mesquite on Hwy 91	0.2	H + 5:00	1.8
Larsen	H + 13:36	33 miles W of Mesquite on Hwy 91	5.0	(Instrument probably contaminated)	
Rowe	H + 4:44	Glendale Junction	0.5		
Larsen	H + 13:42	Glendale Junction	6.5	(Instrument probably contaminated)	
Larsen	H + 28:15	Glendale Junction	3.5	(Instrument probably contaminated)	
Fetz	H + 35:02	Glendale Junction	0.2	H + 5:00	1.9
Stafford	H + 1:00 to 7:40	Groom Mine	Background		
Stafford	H + 8:00	Groom Mine	0.09		
Stafford	H + 8:30	Groom Mine	0.25		
Stafford	H + 13:00	Groom Mine	0.20		
Stafford	H + 14:00	Groom Mine	0.12		
Stafford	H + 24:00	Groom Mine	Background		
Harrison	H + 2:00 to 24:00	Currant	Background		
Weathersbee	H + 1:10 to 24:00	Ely	Background		
Harrison	H + 10:00 to 11:00	Ely to 35 miles SE on Hwy 93	Background		

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Harrison	H+27:00 to 30:00	Ely to Tonopah	Background		
Barry	H+2:00 to 24:00	Beatty	Background		
Barry	H+5:20 to 6:17	Beatty to Lathrop Wells on Hwy 95	Background		
Barry	H+6:23	2 miles NW of Lathrop Wells on Hwy 95	0.7		
Barry	H+6:27	4 miles NW of Lathrop Wells on Hwy 95	0.1		
Barry	H+6:38	8 miles NW of Lathrop Wells on Hwy 95	0.25		
Barry	H+6:42 to 6:55	10 miles to 16 miles NW of Lathrop Wells on Hwy 95	0.10		
Barry	H+6:59 to 7:17	18 miles NW of Lathrop Wells on Hwy 95 to Beatty	Background		
Barry	H+26:41 to 30:33	Beatty to Furnace Creek to Death Valley Junction to Lathrop Wells to Mercury	Background		
Platz	H+1:10 to 28:20	Tonopah	Background		
Williams	H+2:00 to 24:00	Warm Springs	Background		
Platz	H+28:20 to 30:00	Tonopah to Beatty	Background		
Butrico	H+2:00 to 24:00	Las Vegas	Background		
Butrico	H+2:00 to 24:00	Nellis AFB	Background		
Butrico	H+29:00 to 29:45	Las Vegas to Boulder City	Background		
Butrico	H+32:00 to 33:15	Las Vegas to Mercury	Background		
Paganini	H+7:50 to 8:25	Alamo to Crystal Springs	Background		
Paganini	H+13:00	Crystal Springs	0.3		
Paganini	H+16:05	Crystal Springs	0.35		
Paganini	H+16:17	Hiko	0.15		
Paganini	H+28:00 to 29:17	Crystal Springs to Groom Lake	0.20		
Graber	H+6:30 to 7:20	Pioche to 39 miles N of Hwy 93	Background		
Graber	H+9:30 to 9:55	Pioche to Caliente	Background		
Graber	H+10:30 to 11:30	Panaca to Enterprise, Utah	Background		
Graber	H+12:00	Vejo, Utah	0.20		
Graber	H+12:15	St. George, Utah	0.50		
Graber	H+12:30	Santa Clara, Utah	0.50		
Graber	H+18:50	Pioche	0.20		
Graber	H+19:25	Caliente	0.30		

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Graber	H + 26:50	Caliente	0.20		
Graber	H + 27:14	18 miles W of Caliente on Hwy 93	0.10		
Graber	H + 27:19	22 miles W of Caliente on Hwy 93	Background		
Graber	H + 27:40	44 miles W of Caliente on Hwy 93	Background		
Carter	H + 1:00 to 2:20	Mercury	Background		
Carter	H + 2:55 to 5:00	Mercury	0.60		
Carter	H + 8:45	Mercury	0.11		
Carter	H + 5:35	Mercury Road and Hwy 95	0.16		
Carter	H + 1:25 to 10:20	Indian Springs	Background		
Rossano	H + 2:30 to 12:45	Overton	Background		
Rowe	H + 5:41 to 6:00	Junction Hwys 12 and 91 to Overton	0.5		
Fetz	H + 1:00 to 7:30	St. George, Utah, Airport	Background		
Fetz	H + 1:00 to 6:40	St. George, Utah, Dixie College	Background		
Fetz	H + 8:48	St. George, Utah, to 27 miles SE on Hwy 91	Background		
Fetz	H + 9:25	28 miles SW of St. George on Hwy 91	0.13		
Fetz	H + 9:30	33 miles SW of St. George on Hwy 91	0.40		
Fetz	H + 9:37	38 miles SW of St. George on Hwy 91	1.7		
Fetz	H + 9:38	38 miles SW of St. George on Hwy 91	2.2	H + 7:00	3.1
Fetz	H + 9:45	43 miles SW of St. George on Hwy 91	15	H + 7:00	19.0
Fetz	H + 32:00	Santa Clara	5.0		
Fetz	H + 32:34	Junction of Utah 18 and U. S. 91	0.40		
Fetz	H + 32:52	Castle Cliff	0.45		
Fetz	H + 33:03	Littlefield, Arizona, Beaver Dam Lodge	0.70		
Larsen	H + 11:25	Nevada-Arizona state line	30	H + 7:00	51
Larsen	H + 11:28	1 mile E of state line	21	H + 7:00	37

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Inclosure 5

SPECIAL STUDY POST SHOT SIMON

April 29, 1953

TO: William S. Johnson. Off-Site Operations Officer, N. P. G.
FROM: R. E. Stafford and E. J. Weathersbee, Rad-Safe Off-Site Monitors
SUBJECT: SPECIAL STUDY POST SHOT VII

This is a report of a special study made on D + 3 day to determine residual radiation levels and the numbers and distribution of people and livestock in the area of significant fall-out resulting from Shot VII. Water samples from the various surface streams and from community water supplies were also collected for later analysis.

The areas of interest were that portion of Highway 93 extending from 12 to 28 miles north of Glendale Junction, and Highway 91 from 6 to 48 miles east of Glendale with special emphasis on heavily populated Virgin River Valley, including the communities of Riverside, Bunkerville, and Mesquite.

Radiation levels were determined on Highways 93 and 91 at varying intervals depending on the intensities of radiation encountered, and at all population centers, during the period from 0950 to 1545, April 28, 1953. Corrected radiation levels are presented in the attached table.

The first phase of the study was conducted in a northerly direction from Glendale Junction on Highway 93. A maximum level of 21 mr/hr was obtained 20 miles north of Glendale. No people or livestock were observed along the highway in the area of significant fall-out.

Proceeding eastward from Glendale Junction on Highway 91 the heavy fall-out pattern was observed to cross the highway at a point 13 miles east of Glendale where a maximum level of 13.2 mr/hr was obtained. From this point the level on Highway 91 gradually fell off to 3.1 mr/hr at a point 18 miles east of Glendale Junction. The highway then turned back into the path of the main fall-out at Riverside where the level was 15.6 mr/hr. Fourteen people were reported to reside permanently at Riverside. No livestock was observed. Approximately 25 people reside on five farms in the Virgin River Valley southwest of Riverside within a distance of 3 miles from Highway 91. Drinking water is hauled from Mesquite, and water for other domestic uses is obtained from a shallow well under the bridge crossing the Virgin River.

Approximately six miles up the valley from Riverside and one mile west of the farming community of Bunkerville, a level of 16.2 mr/hr was recorded. At Bunkerville the level was found to be 10.9 mr/hr. The population of Bunkerville was reported by the staff of the Virgin Valley High School to be "200 Latter Day Saints and 2 others." The population of that part of the Valley served by the Union High School and extending from Riverside, Nevada, to Littlefield, Arizona, was estimated to be 1000 people. It was learned from the agriculture instructor at the school that the dairy cattle in Bunkerville numbered 235, with 280 at Mesquite, and a total for the valley of 550. The number of range cattle in the area was unknown. The source

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of domestic water supply is an open spring located in the mountains 15 miles due south of Bunkerville.

In Mesquite, 5 miles east of Bunkerville, a level of 3.5 mr/hr was obtained. Population of Mesquite was reported to be very close to 600 people. Domestic water is obtained from two deep wells located near the Virgin River.

The survey extended 11 miles further east to Littlefield, Arizona (population, 50 people), where the level was determined to be 0.2 mr/hr. Drinking water is obtained on an individual family basis from various sources.

Water samples were collected from the Muddy River near Glendale Junction on Highway 93, from both the domestic and irrigation supply at Bunkerville, the domestic supply at Mesquite, and from Lake Mead at Overton Beach.

Vicinity map attached.

R. E. Stafford
E. J. Weathersbee
Rad-Safe Off-Site Monitors
Nevada Proving Grounds

vme

Table of Pertinent Ground Levels Obtained April 28, 1953,
During the Special Study of Fall-out Area

Time	Location	Radiation level
77-53	12 miles N of Glendale Junction on U. S. Hwy 93	1.1
77-55	14 miles N of Glendale Junction on U. S. Hwy 93	4.3
78-01	16 miles N of Glendale Junction on U. S. Hwy 93	8.7
78-06	18 miles N of Glendale Junction on U. S. Hwy 93	15.6
78-11	20 miles N of Glendale Junction on U. S. Hwy 93	20.7
78-15	22 miles N of Glendale Junction on U. S. Hwy 93	15.0
78-20	24 miles N of Glendale Junction on U. S. Hwy 93	11.5
78-25	26 miles N of Glendale Junction on U. S. Hwy 93	4.1
78-30	28 miles N of Glendale Junction on U. S. Hwy 93	1.2
79-52	Glendale Junction	0.03
80-01	6.2 miles E of Glendale Junction on U. S. Hwy 91	0.8
80-05	8 miles E of Glendale Junction on U. S. Hwy 91	5.2
80-12	13 miles E of Glendale Junction on U. S. Hwy 91	13.2
80-20	18 miles E of Glendale Junction on U. S. Hwy 91	3.1
80-27	23 miles E of Glendale Junction on U. S. Hwy 91	15.6
80-32	Riverside, 24.2 miles E of Glendale Junction on U. S. Hwy 91	15.6
80-45	Riverside, 30 miles E of Glendale Junction on U. S. Hwy 91	16.2
80-54	Bunkerville (L. D. S. Church), 31.5 miles E of Glendale Junction on U. S. Hwy 91	10.9
81-40	Mesquite (paved area) 36.3 miles E of Glendale Junction on U. S. Hwy 91	2.3
81-42	Mesquite (gravel area), 36.4 miles E of Glendale Junction on U. S. Hwy 91	3.5
81-48	41 miles E of Glendale Junction on U. S. Hwy 91	1.0
82-00	Littlefield School, 48 miles E of Glendale Junction on U. S. Hwy 91	0.2
83-10	At U. S. Hwy 91 and Nevada Hwy 55	8.7
83-15	2 miles N of U. S. Hwy 91 and Nevada Hwy 55 on Nevada Hwy 55	2.7

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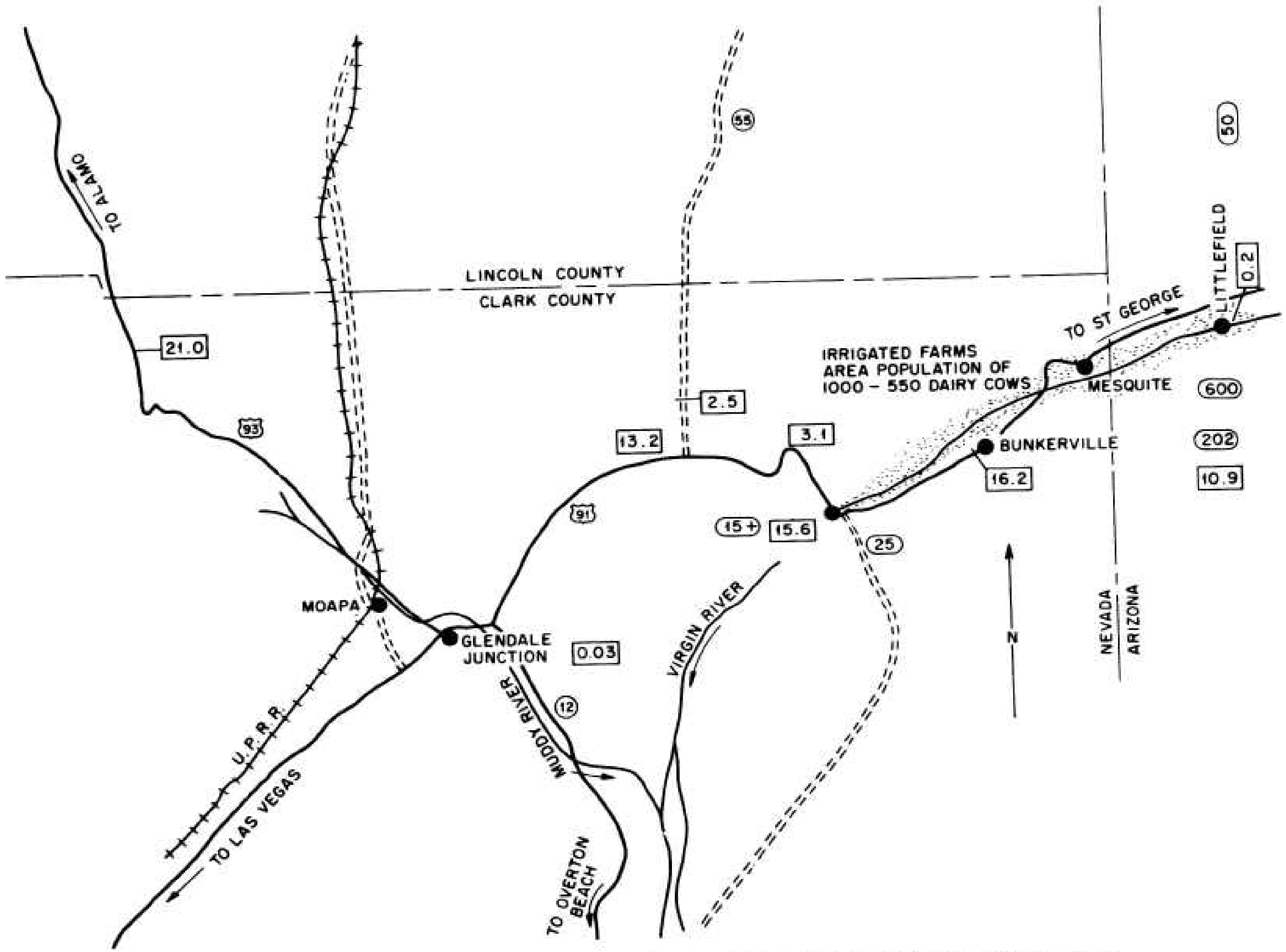

Map of fall-out area, 25 April 1953, Shot Simon. Numbers in boxes are the radiation levels. Numbers in circles give population.

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Inclosure 6

RADIATION DOSAGE FOR INFINITE TIME OF EXPOSURE

Location	Time of run	Ground level, mr/hr	Fall-out time, H + hours	Infinite dose, mr
Glendale Junction	7:15	0.5	4.5	19
20 miles N of Glendale Junction on U. S. Hwy 93	28:57	80	4.5	12,500
Alamo	10:40	1.8	10.12	100
24 miles W of Mesquite on U. S. Hwy 91	27:30	110	6.0	12,000
Mesquite	9:51	30	7.0	1,500
Bunkerville	10:21	100	7.0	5,000
	34:10	20	7.0	4,800
Riverside Cabins	12:42	210	7.0	14,000
	10:05	300	7.0	15,000
	15:25	170	7.0	15,000
Groom Mine	13:0	0.20	8.5	12.5

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Inclosure 7

AIR SAMPLING RESULTS

Location	Time of sample	Results, $\mu c/M^3$
CP, Shot area (10 mr line)	0500 to 0510, 4/25/53	6.6
CP, Station	0330 to 0535, 4/25/53	1.21×10^{-2}
	0535 to 0730, 4/25/53	7.78×10^{-2}
	0730 to 0930, 4/25/53	4.69×10^{-2}
	0930 to 1130, 4/25/53	5.6×10^{-2}
	1130 to 1330, 4/25/53	3.49×10^{-3}
	1330 to 1730, 4/25/53	3.44×10^{-4}
	1730 to 2130, 4/25/53	1.10×10^{-4}
	2130 to 0430, 4/25 to 4/26/53	1.12×10^{-4}
	Average concentration for sampling period	1.592×10^{-2}
counted H+5	0530 to 0935, 4/25/53	MMD = 2.7 μ
counted H+6	0530 to 0935, 4/25/53	MMD = 3.2 μ
counted H+12	0530 to 0935, 4/25/53	MMD = 3.6 μ
counted H+36	0530 to 0935, 4/25/53	MMD = 3.7 μ
	0935 to 1335, 4/25/53	MMD = 5.4 μ
Mercury	0315 to 0630, 4/25/53	Background
	0630 to 0830, 4/25/53	2.39×10^{-1}
	0835 to 1130, 4/25/53	6.83×10^{-2}
	1130 to 1330, 4/25/53	3.60×10^{-3}
	1330 to 1530, 4/25/53	1.95×10^{-3}
	1530 to 2030, 4/25/53	5.24×10^{-4}
	2030 to 0630, 4/25 to 4/26/53	5.28×10^{-5}
	Average concentration for sampling period	2.5×10^{-2}
	0630 to 1130	MMD = 2.9 μ
	1145 to 1530	MMD = 3.4 μ
	1545 to 2030	MMD = 2.84 μ
Indian Springs	0530 to 1230, 4/25 to 4/26/53	Background
Las Vegas	0340 to 0834, 4/25 to 4/26/53	Background
Nellis AFB	0310 to 0800, 4/25 to 4/26/53	Background
Glendale Junction	0327 to 0527, 4/25/53	2.46×10^{-5}
	0530 to 0835, 4/25/53	1.53×10^{-5}

Location	Time of sample	Results, $\mu c/M^3$
Glendale Junction	0837 to 0920, 4/25/53	Background
	0923 to 1123, 4/25/53	6.03×10^{-4}
	1125 to 1645, 4/25/53	1.01×10^{-3}
	1715 to 2125, 4/25/53	6.81×10^{-4}
	2145 to 0430, 4/25 to 4/26/53	1.86×10^{-4}
	Average concentration for sampling period	4.1×10^{-4}
Overton	0625 to 0825, 4/25/53	Background
	0825 to 1025, 4/25/53	3.66×10^{-5}
	1025 to 1325, 4/25/53	1.53×10^{-5}
	1325 to 1725, 4/25/53	1.42×10^{-5}
	1725 to 1925, 4/25/53	8.35×10^{-5}
	Average concentration for sampling period	2.64×10^{-5}
Mesquite	0655 to 0830, 4/25/53	2.5×10^{-5}
	0830 to 0930, 4/25/53	7.4×10^{-5}
	0930 to 0945, 4/25/53	4.4×10^{-3}
	0945 to 1000, 4/25/53	1.38×10^{-2}
	1000 to 1015, 4/25/53	8.51×10^{-2}
	1015 to 1030, 4/25/53	8.65×10^{-2}
	1030 to 1045, 4/25/53	4.21×10^{-1}
	1045 to 1115, 4/25/53	2.86
	1115 to 1130, 4/25/53	2.03
	1130 to 1145, 4/25/53	1.74
	1145 to 1200, 4/25/53	1.22
	1200 to 1230, 4/25/53	6.91×10^{-1}
	1230 to 1530, 4/25/53	1.51×10^{-1}
	1530 to 2100, 4/25/53	7.04×10^{-2}
	2100 to 0430, 4/25/53	1.33×10^{-2}
	Average concentration for sampling period	1.89×10^{-1}
St. George	0330 to 0520, 4/25/53	4.52×10^{-6}
	0530 to 0830, 4/25/53	Background
	0830 to 1038, 4/25/53	Background
	1040 to 2120, 4/25/53	2.16×10^{-2}
	2125 to 0740, 4/25/53	1.88×10^{-3}
	Average concentration for sampling period	8.43×10^{-3}
	1052 to 2125, 4/25/53	6.9 μ
Alamo	0340 to 0610, 4/25/53	Background
	0610 to 0825, 4/25/53	Background
	0825 to 1200, 4/25/53	9.7×10^{-5}
	1200 to 1410, 4/25/53	1.34×10^{-2}
	1410 to 1820, 4/25/53	9.68×10^{-3}
	1430 to 2200, 4/25/53	1.16×10^{-2}
	2200 to 0515, 4/25 to 4/26/53	4.18×10^{-4}
	Average concentration for sampling period	4.74×10^{-3}
	1210 to 1410, 4/25 to 4/26/53	MMD = 3 μ
	1420 to 2200, 4/25 to 4/26/53	MMD = 7.1 μ

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Location	Time of sample	Results, $\mu c/M^3$
Crystal Springs	0305 to 0515, 4/25/53	Background
	0515 to 0905, 4/25/53	Background
	0915 to 1115, 4/25/53	Background
	1115 to 1325, 4/25/53	1.26×10^{-4}
	1325 to 1735, 4/25/53	6.63×10^{-5}
	1735 to 2105, 4/25/53	3.42×10^{-3}
	2105 to 0400, 4/25 to 4/26/53	1.91×10^{-3}
	Average concentration for sampling period	1.18×10^{-3}
	1330 to 2100, 4/25/53	MMD = 3.9 μ
Caliente	0330 to 0530, 4/25/53	Background
	0530 to 0830, 4/25/53	Background
	0830 to 1030, 4/25/53	Background
	1030 to 1330, 4/25/53	6.75×10^{-3}
	1330 to 2400, 4/25/53	1.1×10^{-2}
	2400 to 0610, 4/25 to 4/26/53	1.16×10^{-2}
	Average concentration for sampling period	5.57×10^{-3}
Pioche	0340 to 0530, 4/25/53	Background
	0540 to 0830, 4/25/53	Background
	0835 to 1034, 4/25/53	Background
	1040 to 1330, 4/25/53	Background
	1340 to 2300, 4/25/53	5.5×10^{-2}
	2312 to 0603, 4/25 to 4/26/53	5.64×10^{-4}
	Average concentration for sampling period	1.83×10^{-2}
Ely	0330 to 1730, 4/25/53	Background
	1730 to 2100, 4/25/53	5.7×10^{-5}
	2100 to 0430, 4/25/53	3.39×10^{-4}
	Average concentration for sampling period	1.24×10^{-4}
	2100 to 0430, 4/25 to 4/26/53	MMD = 3.1 μ
Currant	0530 to 0730, 4/25 to 4/26/53	Background
Warm Springs	0330 to 0430, 4/25 to 4/26/53	Background
Tonapah	0330 to 0430, 4/25 to 4/26/53	Background
Beatty	0330 to 0530, 4/25/53	Background
	0530 to 0730, 4/25/53	7.7×10^{-5}
	0730 to 0930, 4/25/53	7.29×10^{-5}
	0930 to 1145, 4/25/53	3.24×10^{-3}
	1145 to 1330, 4/25/53	2.21×10^{-5}
	1330 to 1730, 4/25/53	1.21×10^{-4}
	1730 to 2130, 4/25/53	2.38×10^{-5}
	2130 to 0430, 4/25/53	3.19×10^{-5}
	Average concentration for sampling period	3.33×10^{-4}
	0930 to 1330, 4/25/53	MMD = 2.72 μ
Groom Mine	0330 to 0930, 4/25/53	Background
	0930 to 1130, 4/25/53	6.75×10^{-4}

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Location	Time of sample	Results, $\mu c/M^3$
Groom Mine	1130 to 1330, 4/25/53	2.99×10^{-2}
	1330 to 1530, 4/25/53	7.49×10^{-3}
	1530 to 1930, 4/25/53	8.96×10^{-4}
	1930 to 2330, 4/25/53	2.59×10^{-5}
	2330 to 0430, 4/25 to 4/26/53	1.22×10^{-5}
	Average concentration for sampling period	3.13×10^{-3}
	1930 to 0430, 4/25 to 4/26/53	MMD = 3.4 μ
Lincoln Mine	0330 to 1400, 4/25/53	Background

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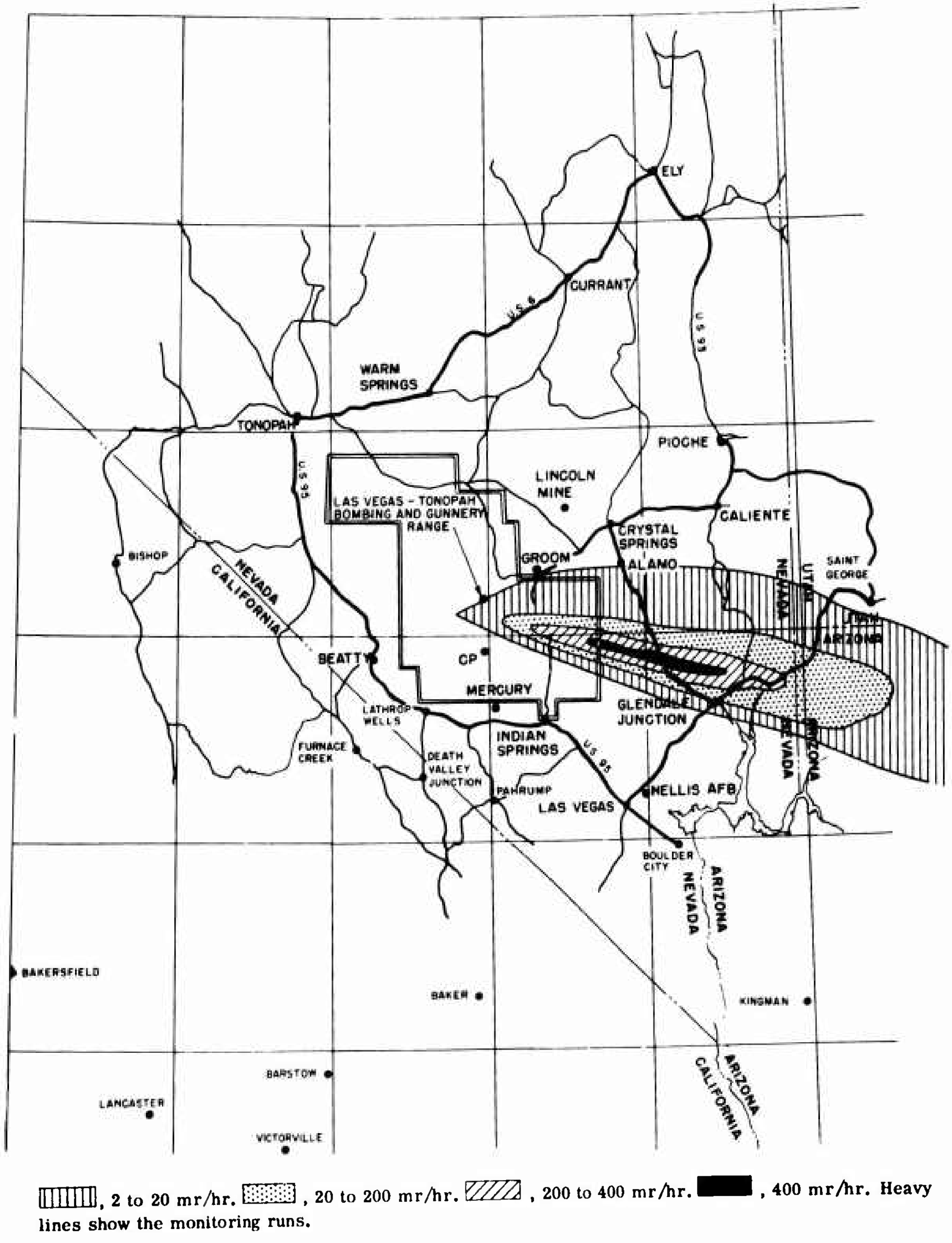
Inclosure 8

RADIATION INTENSITY AT TIME OF FALL-OUT



, 2 to 20 mr/hr. , 20 to 200 mr/hr. , 200 to 400 mr/hr. , 400 mr/hr. Heavy lines show the monitoring runs.

Inclosure 9

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at collection time, μc/liter
4/26/53	0800	Groom Mine water tap	3.09×10^{-4}
4/25/53	1705	Lake Mead at Overton Beach	1.18×10^{-3}
4/26/53	1130	Lincoln Mine water tap	Background
4/26/53	0555	Pahranagat Lake (upper)	1.47×10^{-3}
4/26/53	0615	Pahranagat Lake (lower)	1.1×10^{-2}
4/26/53	0740	Crystal Springs	3.26×10^{-3}
4/26/53	0730	Virgin River irrigation canal	2.9×10^{-1}
4/26/53	1000	Lake Mead at Lake Mead Resort near Boulder	Background
4/28/53	1630	Lake Mead at Overton Beach	1.12×10^{-4}
4/28/53	1145	Muddy River near Glendale Junction	6.6×10^{-5}
4/28/53	1400	Irrigation canal at Bunkerville	9.75×10^{-4}
4/28/53	1350	Bunkerville School tap water supply from a spring 15 miles SSE (closed system)	1.01×10^{-3}
4/28/53	1500	Mesquite (deep well)	3.09×10^{-4}

Inclosure 10

DATA FOR CLOUD TRACKING AIRCRAFT B-29 AND B-25 AND CLOUD SAMPLER SKULL CAP

Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
			Cook Book 2 (B-29)			
ZA 43	0502	22,000	SE	20	80	
A 43	0520	22,000	E	20	180	
C 45	0535	22,000	N	0	0	Background
B 44	0540	22,000	N	5	6	
E 44	0551	22,000	Above	20	60	Rosie above aircraft
C 45	0557	22,000	N	20	140	
A 44	0602	22,000	E	18	20	
E 44	0622	22,000	S	7	10	
H 41	0632	22,000	S	2	8	Background
G 45	0644	22,000	SW	20	1000	
D 44	0656	22,000	ESE	20	42	Westernmost edge of Rosie at 22,000 altitude
B 46	0702	22,000	NE	20	33	Background
F 46	0710	22,000	N	20	80	South boundary at this altitude
K 45	0732	22,000	Above	20	34	Rosie above and extending E and W. Eastern boundary at this altitude
G 45	0748	22,000	SE	20	32	
J 47	0756	22,000	Above	20	60	
G 48	0808	22,000		11	24	Background
H 47	0813	22,000	NE	20	240	
M 44	0828	22,000	E and W	9	24	Higher part of Rosie extends to SE from position M 44. Rosie is in two different parts, higher part being farther north
I 46	0846	22,000	E	18	36	
H 46	0911	22,000	E	12	28	
K 48	0919	22,000	Above and N	20	120	
U 46	0931	22,000	N and above	20	100	
K 49	0945	22,000	Above	20	80	Rosie is widely scattered

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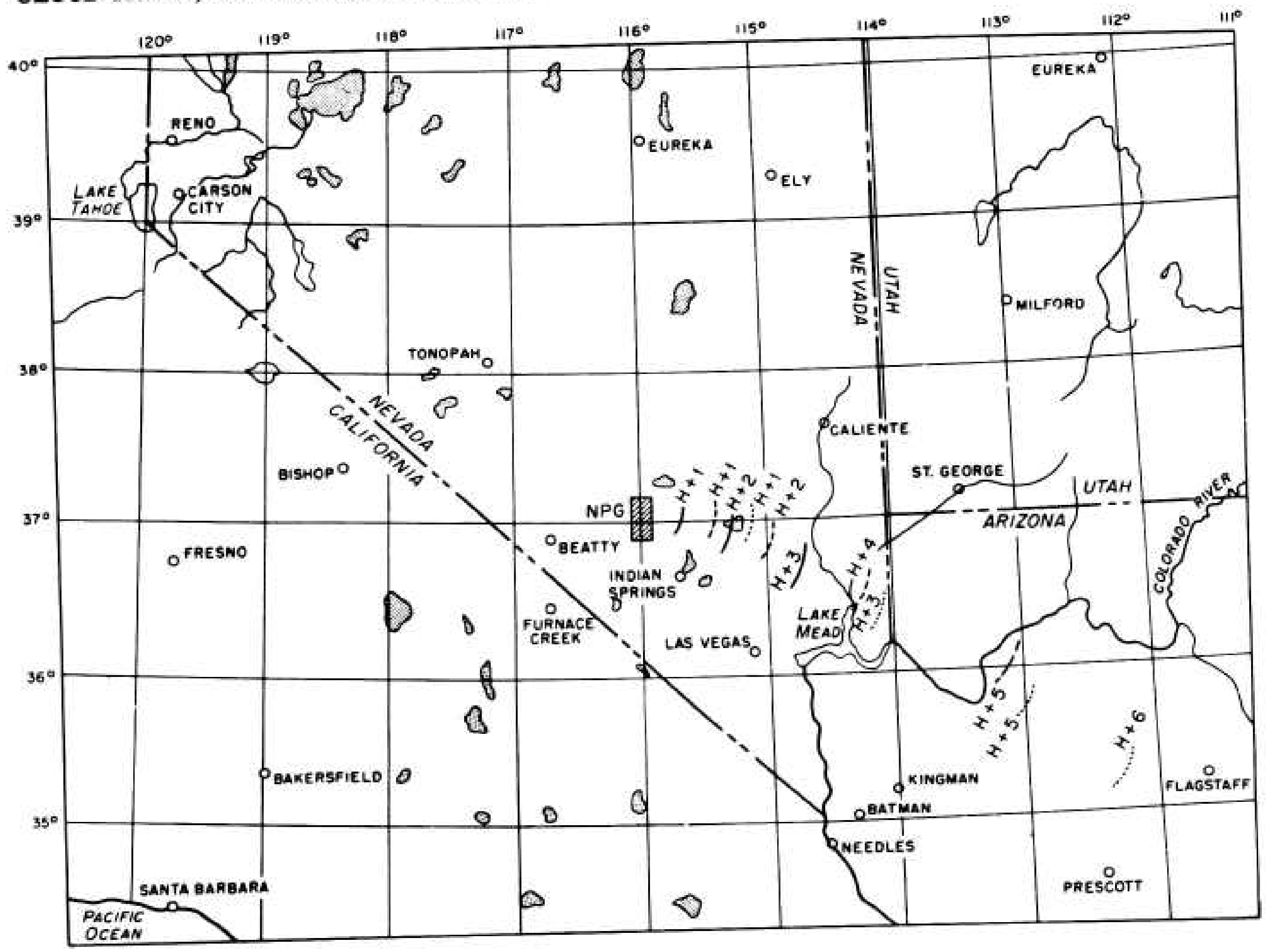
Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
O 47	0954	22,000	SE and SW	11	20	Background
K 48	1004	22,000	E	20	50	
			Cook Book 3 (B-25)			
A 42	0502	12,000	0°		8	T1B. Background 0; highest 42
B 43	0507	12,000	360°		7	T1B. Background 0; highest 2100
A 43	0513	12,000	180°		29	T1B. Background 23; highest 80
B 43	0527	12,000	180°		22	T1B. Background 18; highest 1800
B 43	0541	12,000	360°		33	T1B. Background 28; highest 205
D 43	0551	12,000	270°		29	T1B. Background 24; highest 280
B 43	0605	12,000	180°		27	T1B. Background 22; highest 70
C 43	0618	12,000	270°		26	T1B. Background 20; highest 415
C 43	0622	12,000	360°		28	T1B. Background 23; highest 465
E 43	0634	12,000	Above 90°		34	T1B. Background 29; highest 140
F 43	0640	12,000	Above 180°		36	T1B. Background 28; highest 215
E 43	0650	12,000	Above		38	T1B. Background 33; highest 160 This layer at 14,000
C 43	0703	12,000	SE and SW		35	T1B. Background 31; highest 75
D 43	0717	12,000	NE and NW		34	T1B. Background 29; highest 305
F 43	0725	12,000	W		34	T1B. Background 29; highest 80
D 43	0742	12,000	W		33	T1B. Background 28; highest 95
F 43	0800	12,000	W		30	T1B. Background 24; highest 90
I 44	0812	12,000	Above and W		30	T1B. Background 24; highest 100
F 43	0831	12,000	W		28	T1B. Background 22; highest 80
E 43	0838	12,000	SE and SW		28	T1B. Background 22; highest 44
F 43	0845	12,000	W		27	T1B. Background 21; highest 53
J 45	0856	12,000	W		27	T1B. Background 21; highest 32
G 43	0905	12,000	W		26	T1B. Background 20; highest 30
F 43	0915	12,000	W and E		26	T1B. Background 19; highest 29
			Skull Cap			
A 43	0445	43,000				Cloud top 43,200; cloud bottom 36,500
F 42.3	0524	43,000				
G 42	0545	43,000				
N 45	0740	43,000				
X 50	1015	43,000				

*The coordinates are those listed in Incl. 9, Chap. 2.

Inclosure 11

CLOUD TRACK, SHOT SIMON, 25 APRIL 1953



———, 12,000 ft msl. - - - - - -, 22,000 ft msl. . . . ., 40,000 ft msl.

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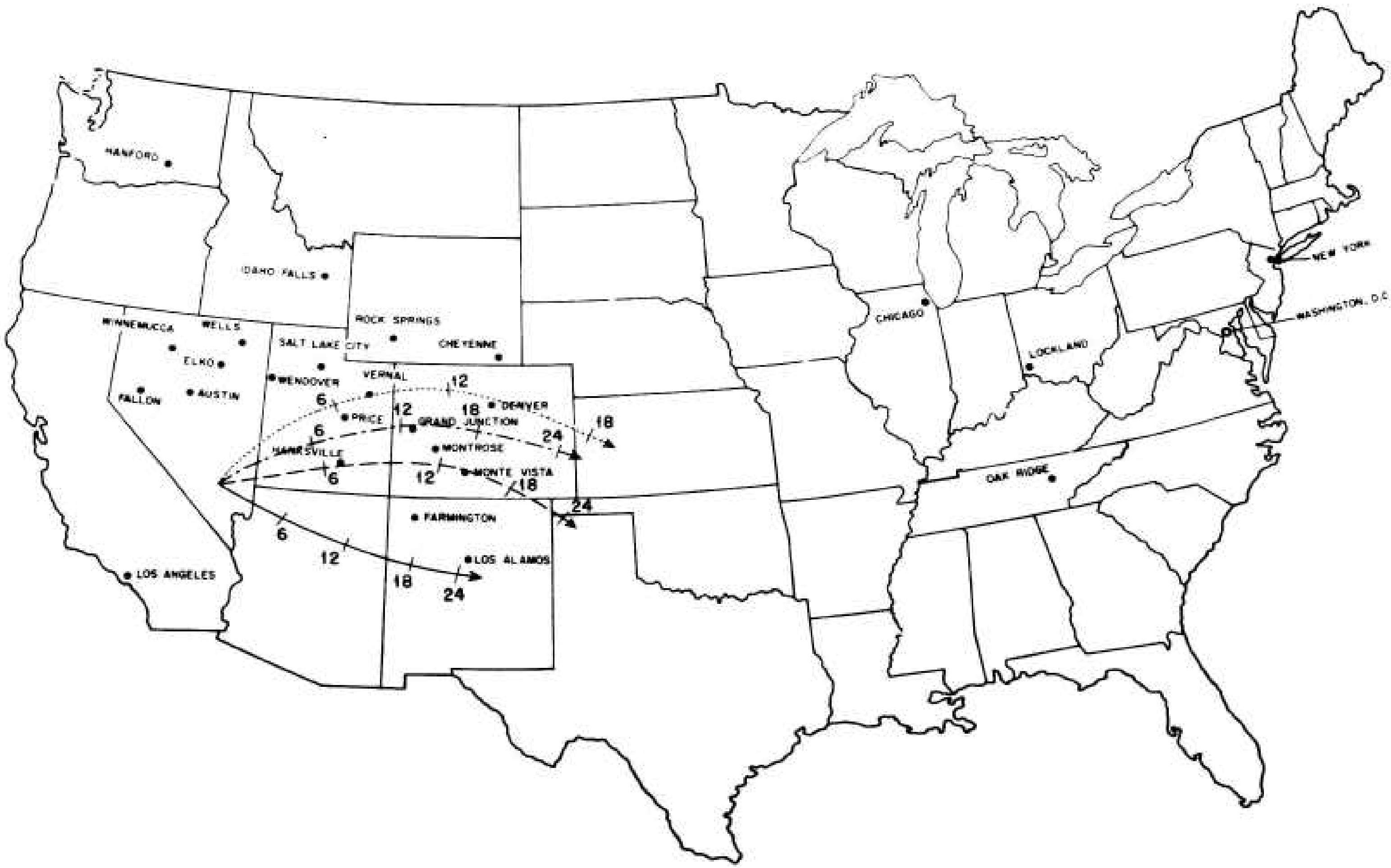
Inclosure 12

PREDICTED CLOUD TRAJECTORY, 2100, 24 APRIL 1953



———, 10,000 ft msl. - - - - - - -, 20,000 ft msl. · · · · · · · ·, 30,000 ft msl. —·—·—·—, 40,000 ft msl.

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Inclosure 13

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter, mr/hr	Remarks
L 21		40		
M $17+\frac{1}{4}$	0441	30	1	
M $17\frac{1}{2}$	0441	30	10	
M $17\frac{5}{8}$	0441	30	1,000	
M $17\frac{3}{4}$	0441	30	10,000	
M 18	0500	30	1	
M $18+\frac{1}{2}$	0500	30	10	
M 17	0501	30	1,000	
M $17\frac{1}{4}$	0501	30	10,000	Background 7
N $18\frac{1}{2}$	0513	30	1	
N 17	0514	30	10	
N $17\frac{1}{2}$	0515	30	1,000	Background 10
N $17\frac{3}{4}$	0516	30	10,000	
I $18\frac{3}{4}$	0530	30	1	
I $17\frac{1}{2}$	0531	30	10	
I $17\frac{3}{4}$	0531	30	1,000	
I $16\frac{1}{4}$	0532	30	10,000	Background 8
H 13	0550	30	1	
$\frac{1}{2}$H-I 14	0551	30	10	
$\frac{1}{2}$H-I $14\frac{1}{4}$	0551	30	1,000	
$\frac{1}{2}$H-I $14\frac{1}{2}$	0551	30	10,000	Background 6
Stake line 623	0723		4	Background
Station 413	0731	25	3,000	
M 14	0740	30	10	
M$\frac{1}{2}$ $14\frac{1}{2}$	0741	30	100	
M$\frac{1}{2}$ 15	0741	30	1,000	

*The coordinates are those listed in Incl. 19, Chap. 3.

Inclosure 14

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr			Infinite dose, mr
			MX-5	T1B	"Scint"	
A½ 45/46	0741	500	0.09	0	0.01	0
A 45	0743	500	0.1	0	0.042	0
A 44	0748	500	1	1.2	1.58	250
A 43	0754	500	0.5	0.4	0.76	100
A 42/43	0758	500	20	800	540	200
A 42	0801	500	0.4	0.2	0.2	0
A 41	0807	500	0.3	0.2	0.2	0
½AD 41	0809	500	0.3	0.2	0.16	0
½AD 42	0813	500	0.2	0	0.145	0
½AD 3/4 42/43	0820	500	20	280	185	70 r
½AD 43	0822	500	1.0	0.8	0.14	200
½AD 44	0826	500	7	0.6	0.90	100
B 44	0828	500	0.4	0.2	0.45	0
B 43	0833	500	0.7	0.6	1	100
B 42/43	0835	500	20	300	130	60 r
½DC 42	0839	500	1	1.2	1.4	300
½BC 41	0846	500	0.5	0.4	0.3	0
C 41	0847	500	0.4	0.2	0.27	0
C 42	0852	500	0.5	0.4	0.27	0
C 43/44	0901	500	20+	120	46	28 r
C 44	0909	500	0.6	0.4	0.37	0
D 44	0916	500	1	1	1.2	200
D 43	0920	500	19	26	12	6 r
D 42	0931	500	0.8	0.8	0.54	0
D 41	0934	500	0.9	0.8	0.54	0
½DE 40	0936	500	0.9	0.8	0.5	0
½DE 41	0942	500	0.7	0.6	0.45	0
½DE 42	0946	500	0.7	0.6	0.5	0
½DE 43	0949	500	3	3.6	2.2	800
½DE 44	0955	500	0.7	0.6	0.54	0
D 45	1000	500	0.8	0.8	0.64	0

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 15

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr			Infinite dose, r	Remarks
			MX-5	T1B	"Scint"		
D 45/46	0851	1300	0.04	0	0.01	0	
E 45/46	0853	1000	0.02	0	0.01	0	
E 45	0855	800	0.03	0	0.01	0	
E 44	0859	600	0.05	0	0.01	0	
E 43	0904	2100	16	36	24	100	
E 42	0908	1700	0.6	0	0.40	0	
½DE 41	0912	1200	0.1	0.1	0.40	0	Calculated ground intensity, 30 mv
½EF 41	0917	700	0.5	0	0.35	0	
½EF 42	0921	800	0.5	0	0.35	0	
½EF 43	0926	1200	0.5	20	3.25	25	Contaminated
½EF 44	0931	800	1.0	0.2	1.0	0	
½EF 45	0934	100	0.8	0.1	0.76	0	
F 44	0941	900	0.9	0.4	1.25	0	
F 43	0946	400	0.2	0.7	2.1	14 r−70 mr, F 43/44	
F 42	0950	500	0.9	0.1	0.26	0	
F 41	0954	400	0.16	0.2	0.32	0	
½FG 41/42	1001	500	0.1	0.0	26	0	
G 42	1003	700	0.16	0.1	0.21	0	
G 43	1006	700	0.15	0.2	0.26	0	
G 44	1010	700	14	18	11	8	
G 45	1014	900	0.4	0.6	0.76	0	
G 46	1018	1200	0.3	0	26	0	
½GH 46	1021	1100	0.2	0.2	21	0	
½GH 45	1024	1100	0.2	0.2	0.40	0	
½GH 44	1028	1900	5	6	60	25	
½GH 43	1031	1800	0.3	0.2	0.32	0	
½GH 42	1035	1200	0.2	0.2	0.26	0	
½GH 41	1038	1500	0.25	0.2	0.26	0	
H 41	1041	1300	0.3	0.2	0.23	0	
H 42	1045	1300	0.2	0.1	0.21	0	

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Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	Infinite dose, r	Remarks
H 43	1050	900	0.8	1.2	3.0	600 mr	
H 44	1052	1300	3.5	3.2	5.5	6	C-1 air foil, 3.3
H 45	1055	1000	0.3	0.2	3.5	0	
H 46	1100	1000	0.2	0.2	0.32	0	
I 46	1104	1000	0.1	0.1	0.23	0	
I 45	1107	400	0.2	0.2	0.23	0	
I 44	1112	600	4	3.2	4.1	1	
I 43	1116	800	0.2	0.2	0.26	0	
I 42	1119	600	0.2	0.1	0.21	0	
I 41	1121	1300	0.2	0.2	0.21	0	
J 41	1125	1300	0.1	0.1	0.21	0	
J 42	1128	500	0.1	0.1	0.21	0	
J 42/43	1132	500	0.2	0.2	0.21	0	
½IJ 43	1134	400	0.2	0.2	0.21	0	
½IJ 44	1138	500	4	4	3.5	1.4	
½IJ 45	1143	1200	0.2	0.1	0.21	0	
½IJ 46	1146	700	0.15	0.1	0.21	0	
I ¼ 46/47	1148	700	0.2	0.1	0.21	0	
H 47		500	0.2	0.1	0.21	0	
G 47/48	1156	500	0.2	0.1	0.21	0	
E 48	1204	500	0.2	0.1	0.21	0	

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 16

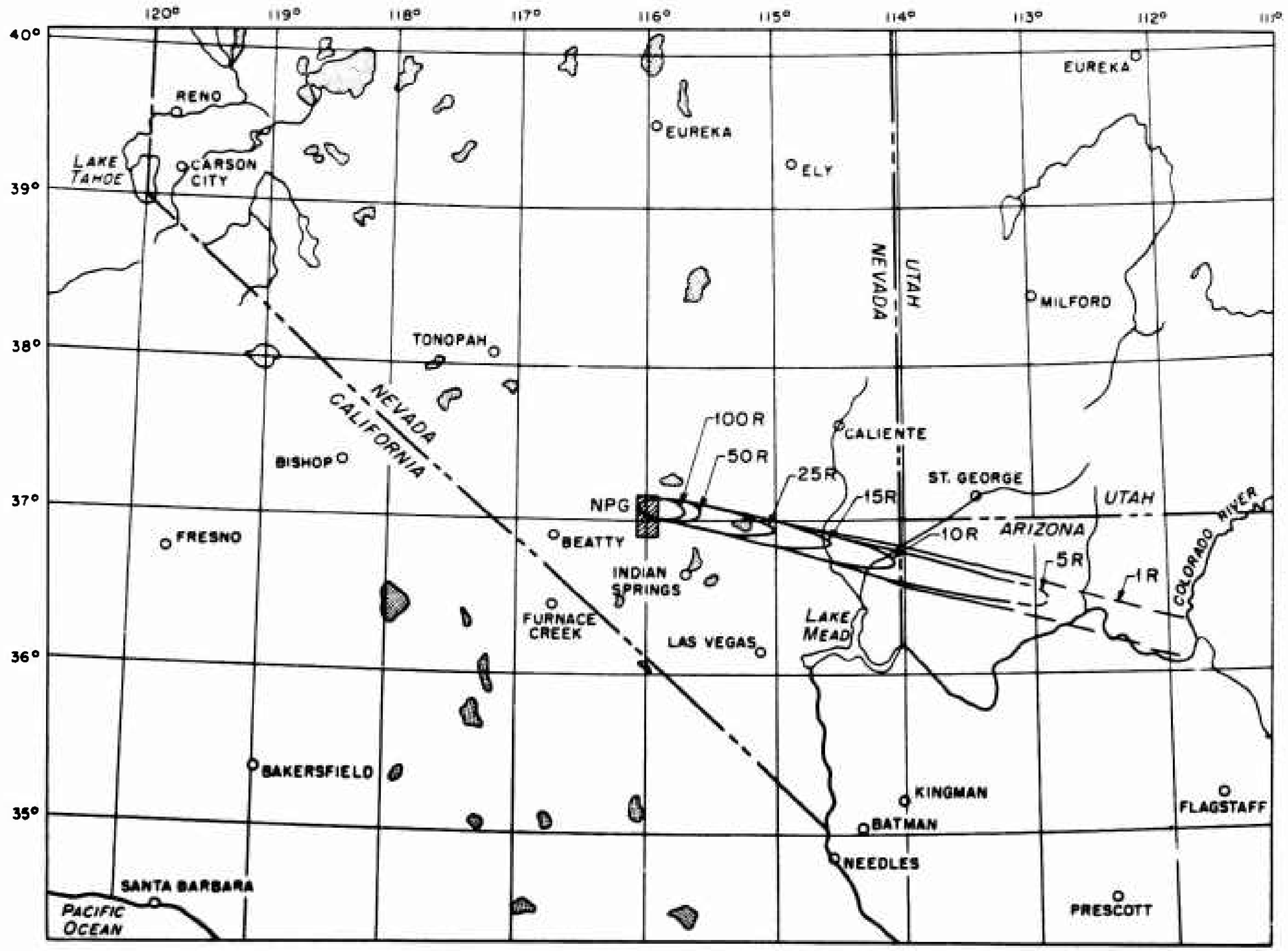
DATA FOR D+1 TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	T1B meter reading, mr/hr	Calculated ground intensity	Infinite dose, r	Remarks
A 43	1015	400	110	800	300	
B 43	1020	500	80	680	200	
½B/C 43	1023	500	55	500	125	
C 43	1038	500	22	200	50	10 miles wide
D 43/44	1053	400	24	170	40	
F 43/44	1110	800	8	130	30	
H 44	1130	500	9	80	20	
I 44	1144	500	8	70	16	
½J/K-½ 44/45	1157	400	10	65	14	
½K/L 45	1205	300	10	50	10	
Bunkerville	1210	200	7	25	5	Extends to 3 miles N of Mesquite
Q 47	1245	500	4.6	30	5	20 miles wide. 50 cattle here

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 17

INFINITY DOSE FALL-OUT PLOT, SHOT SIMON



Plot based on combined air and ground survey data, 25 April 1953, Shot Simon.

Chapter 9

SHOT ENCORE*

9.1 INTRODUCTION

9.1.1 The eighth shot of the Upshot-Knothole series, Encore, was an air drop at about 2400 ft over the Frenchman Flat area, NPG, at 0830 PDT, 8 May 1953. The decision to drop was made after a 24 hr delay caused by unfavorable weather conditions. The prevailing winds were to the northeast.

9.1.2 The initial On-Site ground survey started at 0857 and was completed at 0928. Only light contamination was encountered during the survey. R (general recovery) hour was announced at 0919. Prior to this time, one party was released into the area by previous arrangement with the Test Director. Mercury Highway was declared open to all traffic at 0930.

9.1.3 The period covered by this chapter is from 3 May 1953 to 15 May 1953, which is from D−1 for Dry, a dry run for Encore, to D−1 for Harry.

9.2 ON-SITE OPERATIONS

9.2.1 The On-Site Section operated in Frenchman Flat during Dry and Shot Encore as long as Rad-Safe control of the area was required. On D-day for Encore an assembly point was established at the old Ranger CP and was manned by personnel from the Dosimetry and Records Section, Plotting and Briefing Section, and Vehicle Decontamination Section. As soon as the road was declared clear, at approximately H+20 min, all sections moved into their respective positions at the junction of Mercury Highway and the main access road to Frenchman Flat.

9.2.2 Hickory 4, the On-Site sedan, was used as a mobile control in Frenchman Flat; Hickory 1, located in CP No. 2, acted as the control for activities continuing in Yucca Flat area and also recorded messages directed to Hickory 4. In this way readings taken by the survey teams were recorded and plotted simultaneously at the control station in Frenchman Flat and in the Plotting and Briefing room in CP No. 2. This made accurate information immediately accessible to personnel in both the CP area and the Frenchman Flat area.

9.2.3 The initial survey of Frenchman Flat was completed by H + 58 min, 0928, 8 May 1953. At 0900 D-day, the reading at GZ was 300 mr/hr. At 1300 D-day, the reading at GZ was 110 mr/hr. On D+1 the general area around GZ was reading around 10 mr/hr, and Rad-Safe control was lifted from the entire area. The results of the initial survey are shown in Incl. 1.

9.2.4 During this period there was considerable activity in the Yucca Flat area. Parties were processing both day and night into the area, and it was necessary to assign three standby monitors to parties working at night.

9.2.5 A total of 890 parties have been processed through Rad-Safe facilities during this

*Period covered, 3 May to 15 May 1953.

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reporting period. The majority of these personnel were construction workers from Reynolds Electric who were working in Areas 3A and 7. Dosimetry and Records processed 4500 film badges during the period, and the Vehicle Decontamination Section decontaminated 104 vehicles.

9.3 OFF-SITE OPERATIONS

9.3.1 The changes in the anticipated fall-out pattern resulting from the detonation are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). By shot time, the area of primary interest became the sector between St. George and Milford, Utah.

9.3.2 No ground levels were detected from this shot. A documentation of ground monitoring is given in Incl. 2.

9.3.3 Incl. 3 is a tabulation of air concentrations encountered from this detonation. It is evident from these results that no detectable activity greater than 10^{-4} $\mu c/M^3$ was collected by any of the equipment in use by the Off-Site group. One air sample containing sufficient activity for decay investigation was collected at Hurricane, Utah. The decay of this sample taken to D+4 days indicates origin prior to Shot Encore.

9.3.4 The results of water samples analyzed for fission product activity are presented in Incl. 4.

9.4 AIR PARTICIPATION

9.4.1 Weather information resulted in closing the air space at all levels out to a radius of 70 miles from ground zero from 0800 to 0930 PDT. In addition, the air space inclosed by the sector bounded by the 75° vector out to a distance of 495 miles (changed at 0800 to 50° vector out to Utah border) and the 125° (changed to 100° at 0800) vector out to a distance of 245 miles was closed at 24,000 ft msl and below from 0900 to 1430 PDT except Amber 2 and all air space west which was opened at 1130 PDT. The air space inclosed by a line from Las Vegas to Ely to Goodland (changed to North Platt at 0800) to Amarillo to Prescott to Las Vegas was also closed above 24,000 ft msl from 0900 to 1500 PDT. A warning circle of 290 mile radius of Bryce Canyon was recommended from 0800 to 1430 PDT. At 1130 PDT the air space below 24,000 ft msl was cleared, as well as all air space above 24,000 ft msl south of 37° N latitude.

9.4.2 The two B-29 cloud trackers were off from Kirtland AFB on schedule. One of them, however, aborted the mission owing to mechanical failure. The remaining B-29 and the B-25 from Indian Springs tracked the cloud at 22,000 and 12,000 ft msl, respectively. The data from these aircraft are attached as Incl. 5. Included in this inclosure are the data on the top of the cloud (40,500 ft msl) from the B-50 sampler control aircraft. These cloud track data are shown in Incl. 6. The predicted path is attached as Incl. 7.

9.4.3 The close-in aerial survey was performed by helicopter as planned. Communication difficulties prevented rapid transmission of the data. The data are attached as Incl. 8.

9.4.4 The L-20 and C-47 performed the terrain survey as in previous shots. Their data are attached as Incls. 9 and 10, respectively. The C-47 mission was not completed owing to bad weather conditions which affected the safety of flight. No ground contamination was found by either aircraft A low reading was obtained when the aircraft passed through some low scud which was hanging in the valleys.

9.5 LOGISTICS AND SUPPLY

9.5.1 For the period 3 May to 15 May 1953, inclusive, the Supply Section issued 882 protective caps, 1314 pairs of shoe covers, 1254 pairs of coveralls, 561 respirators, 1306 pairs of cotton gloves, 541 pairs of high intensity goggles, and 38 pairs of clear goggles. The laundry serviced 537 protective caps, 2239 pairs of shoe covers, 1487 pairs of coveralls, 617 respirators, 1627 pairs of cotton gloves, and 104 towels. One hundred eighty-three (183) instruments were issued, and 138 were repaired. Twenty-three (23) instruments were repaired for Camp Desert Rock. Five (5) vehicles were deadlined for radio maintenance during the period.

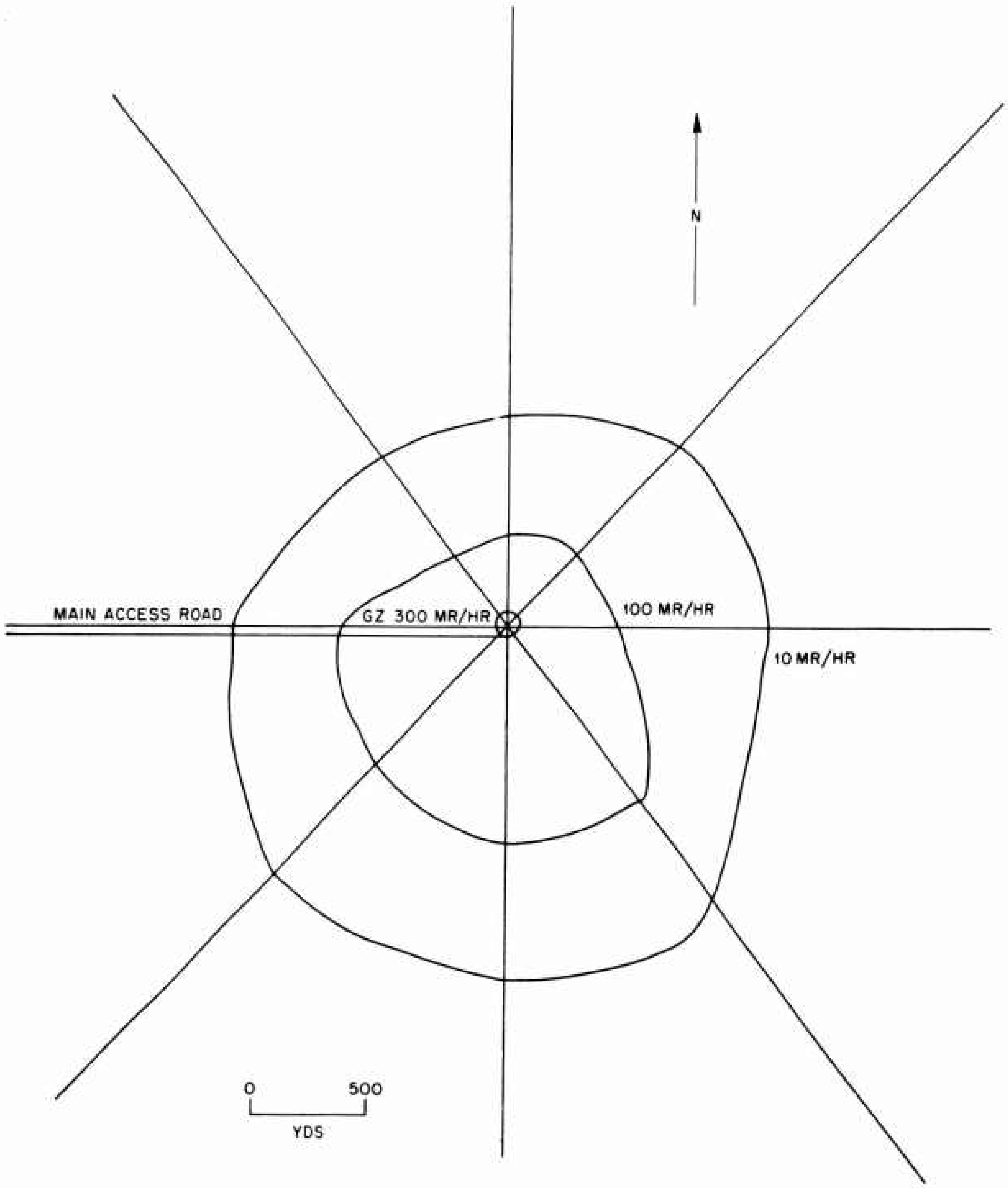
9.5.2 During this period, the Supply Section operated a mobile supply point, located with the processing station in the Frenchman Flat area, in addition to its regular service at the Rad-Safe Building. A $2\frac{1}{2}$ ton N135 cargo truck was borrowed from the 412th Engineer Battalion at Camp Desert Rock for use by the mobile supply point. This supply team was placed in operation at the Ranger CP at 0645. Immediately prior to Encore, 100 pairs of high intensity goggles and approximately 50 sets of protective clothing were issued at the Ranger CP. At 0900 the supply point was moved to the main access road to Frenchman Flat. The supply point arrived at 0920 and was in full operation by 0930. In addition to having 100 complete sets of protective clothing available for emergency issue, the Supply Team was responsible for the supply and transportation of necessary furniture and equipment in support of On-Site Operations, Plotting and Briefing, and Dosimetry and Records Sections. A taping station was maintained by the Supply Team for the convenience of all personnel entering the test area. This operation was secured at 1700 on D-day.

9.6 GENERAL

The radiological problem encountered in this shot was very minor. No contamination was found outside the Proving Grounds, and only minor contamination was found within the Proving Grounds. The problem of clearing people into the area required the establishment of a Rad-Safe plotting and briefing station at the junction of the main access road to Frenchman Flat and the Mercury Highway.

Inclosure 1

FRENCHMAN FLAT RADIOLOGICAL SITUATION, SHOT ENCORE



Frenchman Flat initial survey, 0900, 8 May 1953. H-hour, 0830, 8 May 1953.

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Inclosure 2

GROUND MONITORING DATA, SHOT ENCORE

Name of monitor	Time from H-hour	Location	Level, mr/hr
Carter	H + 3:05 to 24:00	Mercury	Background
Carter	H + 1:00 to 7:15	Indian Springs	Background
Carter	H + 3:00 to 3:40	Indian Springs to Mercury	Background
Carter	H + 6:45 to 7:15	Indian Springs to Mercury	Background
Fetz	H + 25:00 to 26:15	Las Vegas to Indian Springs	Background
Fetz	H + 0:35 to 25:00	Nellis AFB	Background
Fetz	H + 0:35 to 25:00	Las Vegas	Background
Claborn	H + 1:00 to 24:00	Glendale Junction	Background
Melton	H + 32:45	Glendale Junction	Background
Melton	H + 33:00	15 miles W of Glendale on Hwy 93	0.5 Shot 6 Residual
Melton	H + 33:05	17 miles W of Glendale on Hwy 93	1.0 Shot 6 Residual
Melton	H + 33:10	20 miles W of Glendale on Hwy 93	0.3 Shot 6 Residual
Melton	H + 33:12	21 miles W of Glendale on Hwy 93	0.2 Shot 6 Residual
Melton	H + 33:15 to 34:00	24 miles W of Glendale Junction to Nellis AFB	Background
Claborn	H + 2:30 to 2:45	Glendale Junction to 14 miles N on Hwy 93	Background
Claborn	H + 2:29	15 miles N of Glendale	0.9 Shot 7 Residual
Claborn	H + 8:00	15 miles N of Glendale	0.9 Shot 7 Residual
Larson	H + 32:25	16 miles N of Glendale	1.0 Shot 7 Residual
Larson	H + 32:20	19 miles N of Glendale	2.5 Shot 7 Residual
Claborn	H + 2:20	20 miles N of Glendale	4.5 Shot 7 Residual
Claborn	H + 8:00	20 miles N of Glendale	4.5 Shot 7 Residual

Name of monitor	Time from H-hour	Location	Level, mr/hr
Larson	H + 32:15	22 miles N of Glendale	3.0 Shot 7 Residual
Claborn	H + 2:15	25 miles N of Glendale	2.5 Shot 7 Residual
Larson	H + 32:12	25 miles N of Glendale	3.0 Shot 7 Residual
Larson	H + 32:10	26 miles N of Glendale	1.5 Shot 7 Residual
Larson	H + 32:07	28 miles N of Glendale	0.5 Shot 7 Residual
Larson	H + 32:04	29 miles N of Glendale	0.2 Shot 7 Residual
Paganini	H + 2:02 to 8:40	36 miles N of Glendale Junction to 50 miles N of Glendale Junction	0.2 Shot 7 Residual
Larson	H + 31:50	36 miles N of Glendale Junction to 50 miles N of Glendale Junction	0.2 Shot 7 Residual
Paganini	H + 2:30 to 9:15	50 miles N of Glendale to Alamo	Background
Paganini	H + 0:00 to 25:30	Alamo	Background
Paganini	H + 2:45 to 3:57	Alamo to Crystal Springs	Background
Paganini	H + 0:00 to 26:00	Crystal Springs	Background
Paganini	H + 12:05 to 12:15	Crystal Springs to Hiko	Background
Paganini	H + 26:00 to 27:35	Crystal Springs to Groom Lake	Background
Rossano	H + 1:00 to 24:00	Groom Mine	Background
Jenson	H + 1:00 to 31:10	Lincoln Mine	0.2
Weathersbee	H + 25:00 to 26:00	Crystal Springs to Caliente	Background
Williams	H + 3:00 to 25:00	Caliente	Background
Weathersbee	H + 14:15 to 14:55	Caliente to Pioche	Background
Weathersbee	H + 1:10 to 23:15	Pioche	Background
Larsen	H + 0:00 to 26:00	Ely	Background
Larsen	H + 26:30 to 28:50	Pioche to Ely	Background
Melton	H + 10:20 to 10:40	Ely to Currant	Background
Melton	H + 10:40	Preston	Background
Melton	H + 10:47	Lund	Background
Melton	H + 6:00 to 6:30	Currant to 30 miles SW on Hwy 93	Background
Melton	H + 0:20 to 12:00	Currant	Background
Smithson	H + 0:30 to 24:30	Warm Springs	Background
Smithson	H + 6:40 to 9:00	80 miles NE of Warm Springs to Tonopah	Background
Harrison	H + 6:10 to 25:30	Tonopah	Background
Harrison	H + 25:30 to 27:30	Tonopah to Beatty	Background
Frazier	H + 1:10 to 26:00	Beatty	Background

Name of monitor	Time from H-hour	Location	Level, mr/hr
Frazier	H + 26:00 to 27:10	Beatty to Mercury	Background
Butrico	H + 1:35 to 3:05	Beryl Junction to St. George, Utah, on Hwy 18	Background
Butrico	H + 5:05 to 6:23	St. George to Beryl Junction on Hwy 18	Background
Butrico	H + 6:30 to 7:35	Beryl Junction to Hwy 93	Background
Butrico	H + 26:10 to 27:05	Caliente to Crystal Springs	Background
Graber	H + 2:30 to 10:00	Cedar City	Background
Graber	H + 7:30 to 8:00	Cedar City to 20 miles E on Hwy 14	Background
Forsythe	H + 4:15 to 5:40	Cedar City to 35 miles W on Hwy 19	Background
Graber	H + 23:20 to 25:15	Cedar City to Panaca	Background
Platz	H + 2:00 to 9:00	Hurricane	0.12
Rowe	H + 3:05 to 4:45	St. George, Utah, to Cedar City	Background
Rowe	H + 4:45 to 7:15	Cedar City to Milford on Hwy 91	Background
Shipman	H + 0:00 to 25:20	St. George	0.13 Shot 7 Residual
Shipman	H + 25:30	10 miles W of St. George on Hwy 91	0.13 Shot 7 Residual
Shipman	H + 25:40	20 miles W of St. George on Hwy 91	0.15 Shot 7 Residual
Shipman	H + 25:50	30 miles W of St. George on Hwy 91	0.20 Shot 7 Residual
Shipman	H + 26:00	40 miles W of St. George on Hwy 91	0.30 Shot 7 Residual
Shipman	H + 26:15	50 miles W of St. George on Hwy 91	0.40 Shot 7 Residual
Shipman	H + 26:30	60 miles W of St. George on Hwy 91	0.20 Shot 7 Residual
Shipman	H + 26:45	70 miles W of St. George on Hwy 91	0.10 Shot 7 Residual

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Inclosure 3

AIR SAMPLING RESULTS

Location	Time of sample	Results
CP	0730 to 0830, 5/8 to 5/9/53	Background
CP (Shot area)	0907 to 0917, 5/8/53	Background
Mercury	0630 to 0845, 5/8 to 5/9/53	Background
Indian Springs	0550 to 0910, 5/8 to 5/9/53	Background
Las Vegas	0728 to 1005, 5/8 to 5/9/53	Background
Nellis Air Force Base	0807 to 0830, 5/8 to 5/9/53	Background
Glendale Junction	0730 to 0830, 5/8 to 5/9/53	Background
St. George, Utah	0730 to 0830, 5/8 to 5/9/53	Background
Hurricane, Utah	1045 to 1800, 5/8/53	Background
Cedar City, Utah	1143 to 1800, 5/8/53	Background
Alamo	0745 to 0905, 5/8 to 5/9/53	Background
Crystal Springs	0735 to 0815, 5/8 to 5/9/53	Background
Caliente	0730 to 0830, 5/8 to 5/9/53	Background
Pioche	0730 to 0800, 5/8 to 5/9/53	Background
Ely	0730 to 0835, 5/8 to 5/9/53	Background
Currant	0730 to 1815, 5/8/53	Background
Warm Springs	0730 to 0830, 5/8 to 5/9/53	Background
Tonopah	0730 to 0830, 5/8 to 5/9/53	Background
Beatty	0730 to 0830, 5/8 to 5/9/53	Background
Groom Mine	0730 to 0315, 5/8 to 5/9/53	Background
Lincoln Mine	0730 to 0840, 5/8 to 5/9/53	Background

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Inclosure 4

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at collection time, μc/liter
5/9/53	0830	Lincoln Mine	Instrument background
5/8/53	1530	Crystal Springs	Instrument background
5/8/53	2050	Lake Mead at Lake Mead Resort near Boulder	6.4×10^{-4}
5/8/53	1600	Groom Mine	4.15×10^{-3}
5/8/53	2430	Pahranagat Lake (upper)	1.87×10^{-3}
5/8/53	2100	Pahranagat Lake (lower)	4.85×10^{-3}

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Inclosure 5

DATA FOR CLOUD TRACKING AIRCRAFT B-29 AND B-25 AND CLOUD SAMPLER (SKULL CAP)

Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
			Cook Book 1 (B-29)			
C 44	0853	22,000	N		25	Rosie is NNE.
F 43	0900	22,000	N and above	17	18	Main part of Rosie is N and above.
H 41	0903	22,000	S and above	18	19	
G 42	0913	22,000	E	12	14	Top of Rosie is E. Cloud at this level not visible. Background 0.2.
F 42	0920	22,000	E		2,000	Main Rosie E.
H 42	0925	22,000	NE		40	Rosie NE. Background 0.8.
J 40	0938	22,000	Above	18	20	Rosie above.
N 39	0948	22,000	Above and NE	19	23	
Q 37	0957	22,000	Above	18	21	Rosie above. Background 6. Rosie dissipating and nearly invisible.
Z 32	1042	22,000	Negative	Negative	Negative	Rosie no longer visible. Covered from R-38 to Z-32.
Cook Book 1 sent home at 1055						
			Cook Book 3 (B-25)			
E 43	0925	12,000	SW	5	7	Background 0; high 10. Negative reading of Rosie, at 12,000 from this point.
D ½43	0935	12,000	N	5	8	Background 0; high 12.
E ½43	0953	12,000	SSW	5	8	Background 0; high 20.
F 42½	1007	12,000	Not same altitude	5	8	Background 0; high 15.
C 42½	1016	12,000	SW	5	0	Background 0; high 6.
Cook Book 3 sent home at 1108						

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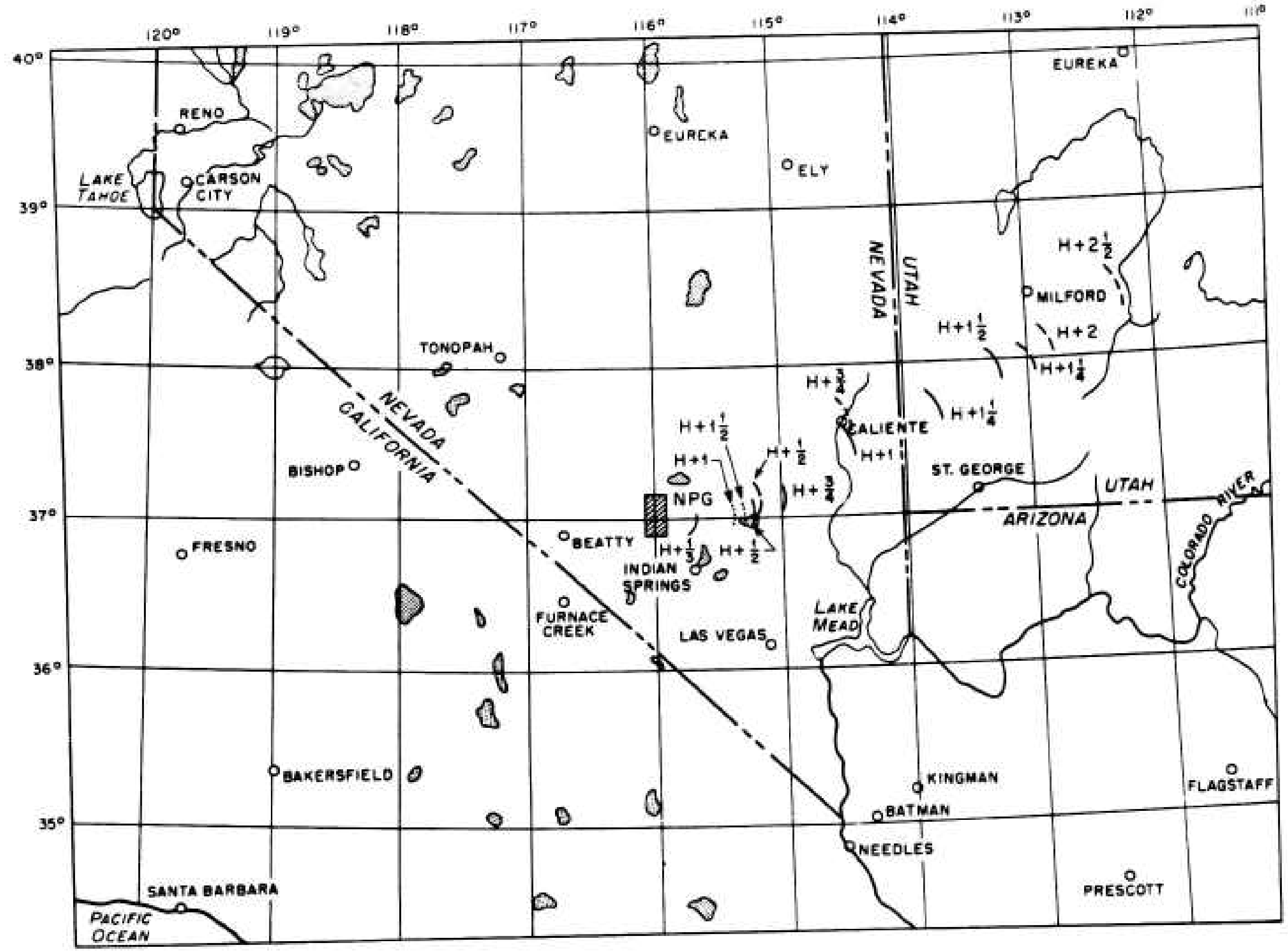
Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
			Skull Cap Cloud Sampler			
½I ½39	0915	40,000				Top of Rosie.
S ½38	0950					
T 36	1025					
W 35	1053	40,000				Maximum intensity 10 r/hr.

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 6

ACTUAL CLOUD TRACK, SHOT ENCORE, 8 MAY 1953



........, 12,000 ft msl. ———, 22,000 ft msl. - - - - - -, 40,000 ft msl.

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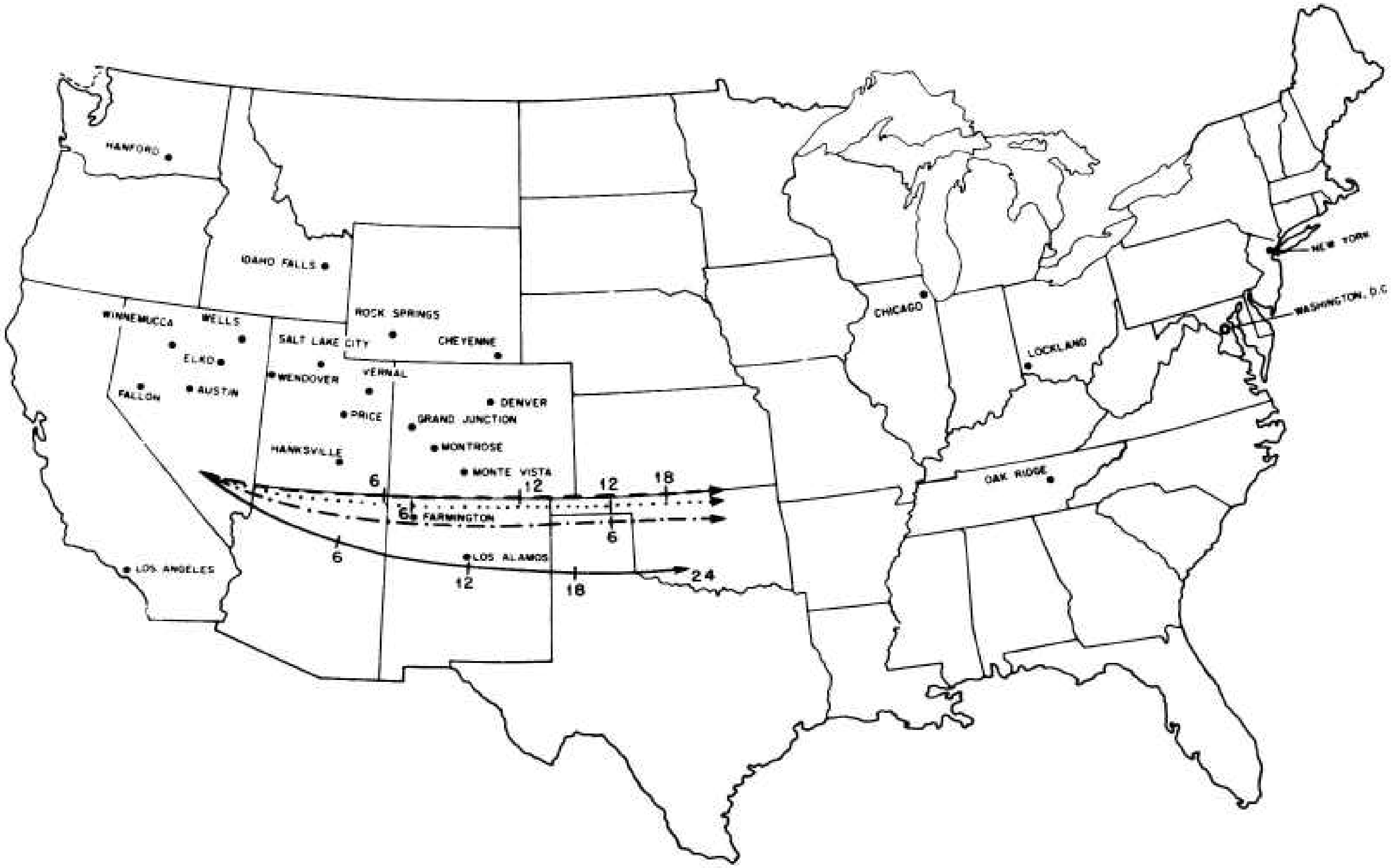
Inclosure 7

PREDICTED CLOUD TRAJECTORY, 0800, 8 MAY 1953



———, 10,000 ft msl. . . . ., 20,000 ft msl. - - - - - - -, 30,000 ft msl. —·—·—·—, 40,000 ft msl.

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Inclosure 8

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	TIB meter readings, mr/hr
R $^{1}/_{2}$32	0850	15	100
0	0851	15	220
S $^{1}/_{2}$33/34		15	350
Mercury Highway, main access road clear at 0850			

*Coordinates are those listed in Incl. 19, Chap. 3.

Inclosure 9

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"
A ½45/46	1010	500	0.4	0	0.01
A 45	1013	500	0.4	0	0.01
½A/B 45	1014	500	0.8	0	0.01
½A/B ½45/44	1017	500	10.0	18	180
½A/B 44	1018	500	0.4	0	0.01
½A/B 43	1022	500	0.66	0	0.01
B 43	1024	500	1.2	0.8	2.8
B 44	1029	500	0.8	0	0.01
B 45	1034	500	0.9	0	0.01
½B/C 45	1036	500	0.05	0	0.01
½B/C 44	1038	500	0.6	0	0.01
½B/C 43	1044	500	2	1	0.5
C 43	1045	500	5	1.2	0.57
C 44	1048	500	0.6	0	0.01
C 45	1054	500	1.4	0.8	0.18
D 45	1100	500	0.6	0	0.01
D 44	1108	500	1.0	1.2	0.73
D 43	1113	500	1.0	1.2	0.57
D ½42/43	1114	500	1.8	1.0	0.01
½D/E 43	1117	500	2	1.6	1.27
½D/E 44	1120	500	1.0	0.3	0.01
½D/E 45	1125	500	0.6	0.2	0.01

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 10

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	C-1 air foil
D 46	1131	2500	0.04	0.0	0.01	
E 45	1135	1000	0.03	0.0	0.01	
F 44	1141	1000	0.01	0.0	0.01	
F 43	1146	1000	0.06	0.0	0.042	
F 42	1150	700	0.02	0.0	0.01	0.03
F 41	1153	1200	0.02	0.0	0.01	
F 40	1156	1000	0.03	0.0	0.01	
F 38.5	1201	1000	0.02	0.0	0.01	
G 38	1206	700	0.01	0.0	0.01	0.3
H 38	1209	1000	0.02	0.0	0.01	0.01
H 39	1212	1000	0.02	0.0	0.01	
H 40	1216	1200	0.02	0.0	0.01	
H 41	1223	1000	0.02	0.0	0.01	0.4
H 42	1226	1000	0.07	0.1	0.01	
R 43	1231	1000	0.05	0.1	0.01	
I 43	1235	1200	0.0	0.0	0.01	0.4
I 42	1241	1000	0.03	0.0	0.01	
J 41	1245	1000	0.04	0.0	0.01	
I 40.5	1249	1000	0.01	0.0	0.01	
I 39	1253	1000	0.03	0.0	0.01	
J 38	1258	1200	0.03	0.0	0.01	
J 37	1302	600	0.02	0.0	0.01	0.4
J 36	1305	1000	0.02	0.0	0.01	
J 35	1309	1000	0.02	0.0	0.01	
K 34	1315	1000	0.03	0.0	0.01	
L 34	1319	1000	0.05	0.0	0.01	
L 35	1323	1000	0.03	0.0	0.01	
L 36	1329	1000	0.03	0.0	0.01	
L 38.5	1337	1000	0.02	0.0	0.01	

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Chapter 10

SHOT HARRY*

10.1 INTRODUCTION

10.1.1 The ninth shot of the Upshot-Knothole series, Harry, was detonated on a 300 ft tower in Area 3A, Yucca Flat NPG, at 0505 PDT, 19 May 1953. The period covered by this chapter is from 16 May to 24 May 1953. The decision to fire was made after a 72 hr delay. Areas to the southeast which had been subject to fall-out from previous shots were in the predicted fall-out path.

10.2 ON-SITE OPERATIONS

10.2.1 The initial On-Site ground survey started at 0535 and was completed by 0640. Extensive contamination was encountered during the survey, and iso-intensity lines were not closed in the Yucca Flat area. R (general recovery) hour was announced at 0631 for all except two projects. One party was released prior to R hour. Mercury Highway was declared open to all traffic at H+45 min. The initial survey and a subsequent survey during this period are inclosed as Incl. 1.

10.2.2 Fourteen hundred film badges were processed during this period, and 350 parties were processed through On-Site Operations. Fifty-seven (57) trucks, 16 sedans, 5 jeeps, 3 buses, 1 carry-all, 1 station wagon, 1 fifty-ton tractor and trailer, and 1 bulldozer, a total of eighty-five (85) vehicles, were decontaminated during the period. A party of three (3) monitors was dispatched on D-day to Las Vegas to assist the Las Vegas Field Office in decontaminating vehicles tnat had been caught in the fall-out area.

10.3 OFF-SITE OPERATIONS

10.3.1 The changes in the anticipated fall-out pattern resulting from Shot Harry are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705) The movement of personnel and equipment to provide maximum coverage in the communities in the fall-out path is described in the events listed in Incl. 2. This disposition of mobile teams was made with a certain degree of hesitancy owing to the conflicting nature of the low-level cloud tracker reports and the pattern of the Air Weather Reports.

10.3.2 Fall-out occurred over a wide sector, with the highest levels being recorded on U. S. Highway 93 between Alamo and Glendale Junction; St. George, Utah; and the area east of St. George. The Test Manager determined that it was again necessary to institute precautionary

* Period covered, 16 to 24 May 1953.

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measures, such as roadblocks and warnings to residents, at various points and times as shown in Incl. 2. For this shot these roadblocks were established by personnel of the Las Vegas Field Office. A documentation of the ground monitoring results is given in Incl. 3. Infinite dose readings in communities in the fall-out pattern are recorded in Incl. 4. The special attention given to St. George, Utah, resulted in the infinite dose calculations derived from Incl. 5. Extra film badges were exposed in different locations in St. George, Utah. The results are tabulated in Incl. 6. Inclosure 18 is a report from the Off-Site monitor at St. George.

10.3.3 Significant airborne concentrations (greater than 10^{-4} $\mu c/M^3$) were detected at the communities of Glendale Junction, CP, Alamo, Crystal Springs, Caliente, Pioche, Groom Mine, Lincoln Mine, Bunkerville, and Mesquite (Incl. 7). The average air concentration reported for St. George represents, by a factor of about 5, the highest such level ever encountered in an inhabited area within 200 miles of the Nevada Proving Grounds. However, particle size determinations indicate that the mass median diameter of the airborne material which produced this high concentration at St. George is considerably beyond the respirable range. Therefore, in this instance the operational tolerance level for airborne fission product particles does not appear to have been exceeded.

10.3.4 The pictorial presentation of the fall-out pattern is shown in Incl. 8.

10.3.5 The results of water samples analyzed for fission product activity are shown in Incl. 9.

10.4 AIR PARTICIPATION

10.4.1 The air space between the 0° and 180° vectors out to a radius of 70 miles and between the 180° and the 360° vector out to a radius of 50 miles was closed at all altitudes from 0430 to 0600 PDT. In addition, the air space bounded by the 70° vector out to radius of 100 miles thence east along the 37° 30 min north latitude meridian to intercept the 112° and 30 min west longitude (due north of Prescott) thence to Prescott, then along the north side of Green 4 and R15 Airways to 37° north and 116° west was closed at 25,000 ft msl and below from 0600 to 1130 PDT. Amber 2 and Red 6 Airways and all air space west was open at 0810 PDT. The air space inclosed by a line joining 37° north and 116° west to Blythe to Douglas to Albuquerque to St. George to 37° north and 116° west was closed at 25,000 ft and above from 0530 to 1330 PDT. The warning area consisted of a circle of 175 mile radius from Las Vegas from 0430 to 1130 PDT.

10.4.2 The two B-29 and one B-25 cloud trackers were off on schedule; however, one of the B-29's had mechanical trouble and aborted the mission early. The data from these aircraft are attached as Incl. 10. The top of the cloud reached 44,200 ft msl. These data are plotted and attached as Incl. 11. The predicted path of the cloud is shown in Incl. 12.

10.4.3 The helicopter performed a close-in terrain survey and a mission pertaining to a recovery operation. The data for the terrain survey flight are attached as Incl. 13.

10.4.4 The L-20 and C-47 performed the terrain survey as in previous shots. The data for the two flights are included as Incl. 14 for the L-20 and incl. 15 for the C-47. The C-47 performed a complete aerial survey of the fall-out area out to a distance of 250 miles on D+1. The data from this flight are attached as Incl. 16. These aerial data, along with Off-Site ground data, are analyzed and plotted as Incl. 17. Data on the location of livestock in the fall-out path are shown in Incl. 16.

10.5 LOGISTICS AND SUPPLY

For the period 16 to 24 May 1953, inclusive, the Supply Section issued 320 protective caps, 924 pairs of shoe covers, 803 pairs of coveralls, 295 respirators, 534 pairs of cotton gloves, 104 pairs of high intensity goggles, 2 pairs of leather gloves, and 150 each bath towels. The laundry serviced 125 protective caps, 832 pairs of shoe covers, 949 pairs of coveralls, 200 each respirators, 300 pairs of cotton gloves, and 121 towels. A total of 143 instruments were issued and 51 were repaired. Sixty-four (64) SU-10's were turned in to Reynolds Electric for storage. A total of 2 vehicles were deadlined for radio maintenance, and 41 vehicles were lubricated and received second echelon maintenance.

10.6 GENERAL

10.6.1 The fall-out from this shot covered more area than for any of the previous shots. The 1 r infinity dose line extended to as far as 250 miles from ground zero. The area surrounded by the 1 r infinity dose line was more than 50 miles wide.

10.6.2 Many complaints were received from people in the fall-out area. Complaints ranged from goats turning blue to miners getting radiation sickness. An investigation was made of all the claims, by members of the Test Manager's staff, and none were of such a nature to indicate that they were caused by the fall-out.

10.6.3 A highway Rad-Safe plan directed by the Test Manager, assigning the responsibility for roadblocks to the Las Vegas Field Office, was put into effect for this shot. Off-Site monitors were required to devote considerable time to the roadblocks established in the vicinity of Mesquite and St. George. This interfered to some extent with the performance of their monitoring duties in this area. A report from the Off-Site monitor at St. George is included as Incl. 18.

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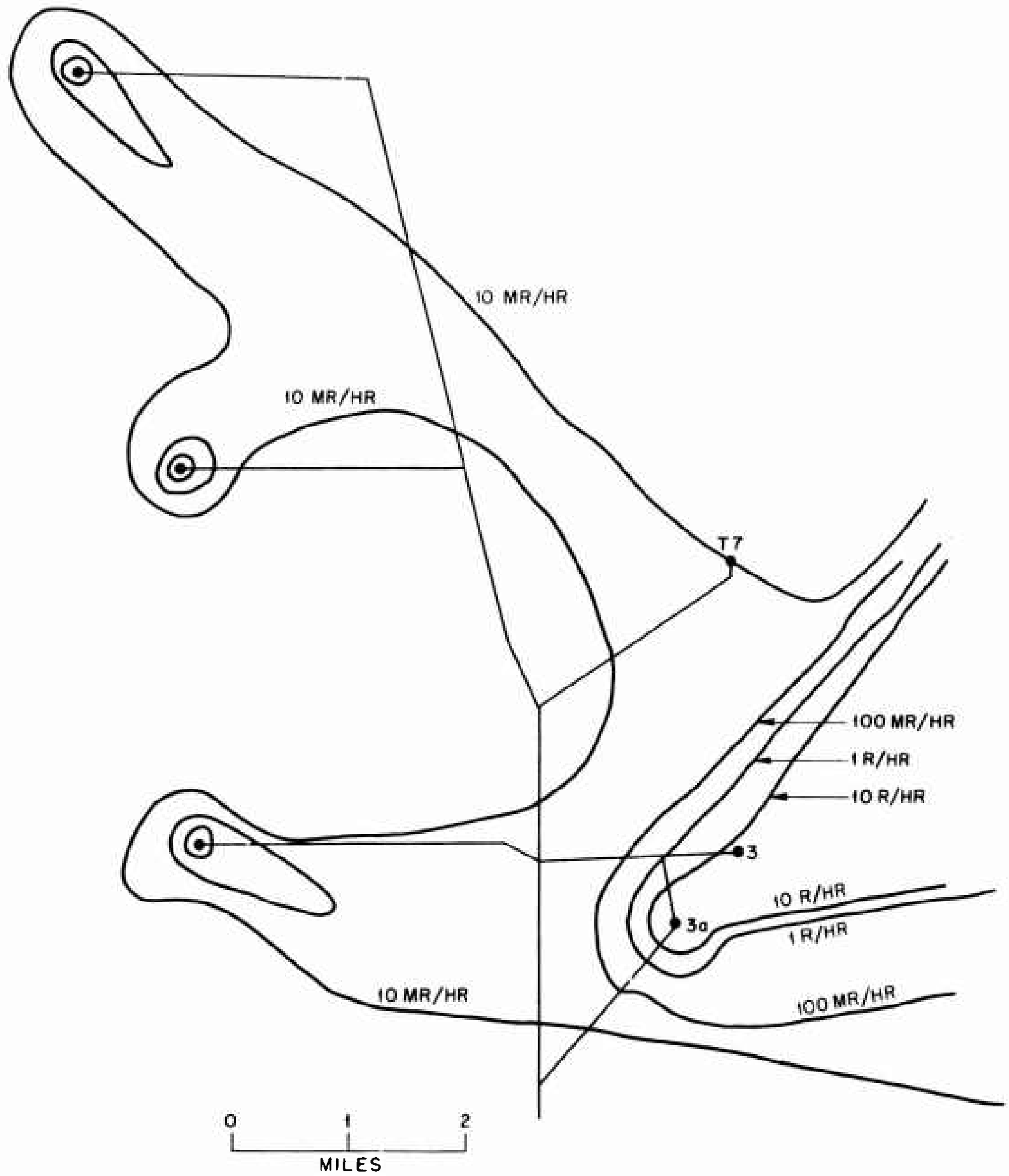
Inclosure 1

YUCCA FLAT RADIOLOGICAL SITUATION, SHOT HARRY



Yucca Flat initial survey, 0600, 19 May 1953 (including 15 May resurvey of Test Areas 1, 2, 4, and 7).

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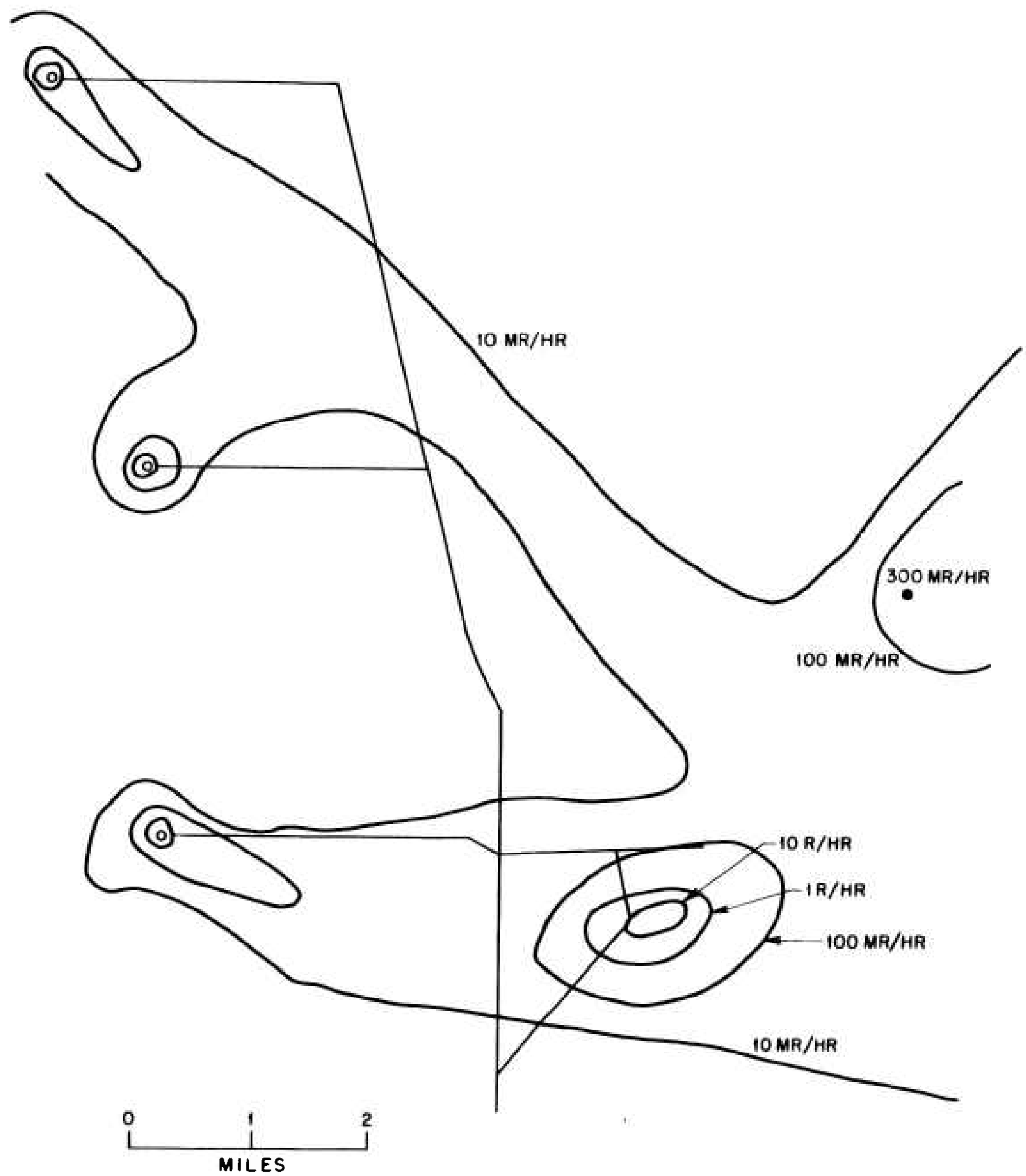

Yucca Flat resurvey, 0700, 20 May 1953 (including 15 May resurvey of Test Areas 1, 2, 4, and 7).

Inclosure 2

OFF-SITE ACTIVITIES JOURNAL, SHOT HARRY

17 May 1953

1500	All fixed station teams dispatched for their respective stations and instructed to stand by at 2300 for a report to follow 2200 weather meeting. Radio contact with all teams established. The mobile monitoring and mobile air sampling teams were held at Mercury pending further weather information. Arrangements were completed for the three LVFO Roadblock teams to assemble at Mercury at the appropriate time.
2300	Result of the weather meeting was a 24 hr postponement. All teams were advised of this action via radio or telephone and instructed to stand by at 1500 May 18 for further instructions.

18 May 1953

1500	All teams contacted via radio and telephone. Instructed to set up and proceed in usual manner for D−1 day. Instructed to stand by radio at 2300 for further confirmation.
2300	All teams contacted via radio and telephone. Advised of the results of 2200 weather briefing; namely, shot time would be five minutes earlier. Possibility of postponement; stand by for contact at 0330 to 0400 for results of 0300 weather meeting. Mobile monitoring teams instructed to stand by at Mercury until 0145 when they would receive further instructions for movement.
2345	LVFO representative advised of possible roadblock locations on the basis of the latest fall-out forecast and of the necessity for early departure of teams.

19 May 1953

0145	All mobile units dispatched from Mercury for Glendale Junction and instructed to contact CP upon arrival.
0320	Off-Site Operations Officer was advised that one LVFO roadblock team left Mercury for St. George at 0230 and one left for Glendale Junction at 0300. The third team was being dispatched to Alamo.
0420 to 0455	All mobile off-site teams standing by at Glendale Junction. Instructions for movement were issued as follows: When LVFO team arrives in Glendale have him return to Nellis AFB guard gate to receive roadblock instructions. Mobile monitor No. 1 to stand by in Glendale. Mobile monitor No. 2 to proceed at H+1 from Glendale Junction to Moapa and attempt to establish radio contact, if this is not possible then

proceed to 20 miles north of Glendale and at H + 2 begin to monitor back via Warm Springs Ranch and phone in results.

Mobile air sampling team No. 1 to proceed to Overton and set up station near a telephone. If fall-out occurs and intensity is sufficient to require emergency measures, try to contact CP. If contact not possible, use own best judgement and work through local law enforcement officials whose names and telephone numbers were given. Plan to have assistant monitor to Logandale, Overton landing, and return to Overton.

Mobile Air Sampling team No. 2 to proceed to Bunkerville and set up near a telephone. At H + 3 send assistant to monitor to Mesquite and return.

Glendale station operator instructed to contact CP immediately should fall-out intensity reach 100. If emergency measures ordered, utilize a local official to help get people under cover.

0455 Mobile Air Sampling team No. 1 instructed to stand by present location (Logandale) for further orders pending completion of 0500 wind run.

0530 Fixed station operator at Nellis AFB guard gate reported that roadblock team had not yet arrived from Glendale.

0532 Mobile Air Sampling team No. 1 instructed to proceed from Logandale to Glendale and stand by.

0545 Mobile Air Sampling team No. 1 and Mobile Monitoring team No. 1 at Glendale Junction instructed to stand by until effect of wind shift data could be determined.

0605 Mobile Air Sampling team No. 1 instructed to proceed to Mesquite and report upon arrival.

Mobile Monitoring team No. 2 instructed to proceed to Alamo, establish contact and monitor back to Glendale.

0620 Alamo fixed station operator instructed by radio to find Mr. Sharp, Deputy Sheriff, and set up precautionary roadblock on U. S. Highway 93 at Alamo, warning cars proceeding south, and monitoring cars traveling north from Glendale. Message acknowledged at 0632.

0622 Received instructions from J-3 representative to set up a roadblock on U. S. Highway 91 between Glendale Junction and St. George at 0645. Instructions issued via radio.

0622 Groom Mine station reported fall-out occurring and level was 140 at 0620. Instructed to warn residents to remain under cover until further notice.

0635 Report from St. George stating that roadblock team had not arrived. Instructed to notify CP via telephone when roadblock actually becomes established.

0647 Radio report from Mobile Monitoring team No. 2 that fall-out is occurring on U. S. Highway 93, 26 miles north of Glendale Junction. (Level 13 at 0642.) Instructed to continue monitoring run to Alamo, report readings, and assist at the roadblock.

0655 Instructed Mobile Monitoring team No. 1 to leave one man at Glendale, to assist as communications man for the two roadblocks there, and to proceed immediately to make a monitoring run to St. George.

0658 Mobile Air Sampling team No. 1 reported set up at Mesquite at phone No. 97.

0710 Off-Site Rad-Safe Operations Officer instructed to establish complete roadblocks on Highway 93. Radio instructions given.

0712 St. George station operator reported arrival of roadblock team and instructed to set up precautionary roadblock at St. George on Highway 91 and report by 0800.

UNCLASSIFIED [redacted]

0715	First two contaminated vehicles reported at Alamo, levels between 40 and 50. Being sent to Caliente for washing because no automobile washing facilities located at Alamo.
0725	Glendale Junction station contacted by telephone and instructed to initiate complete roadblock on cars proceeding north on Highway 93.
0730	Radio message issued to Mobile Air Sampling units to ask people in Mesquite and Bunkerville to remain indoors.
0735	Operations Officer instructed to block Highway 91 from Nellis AFB to St. George, Utah. Instructions to field teams issued immediately via radio.
0745	Complete roadblock established at St. George.
0748	Groom Mine residents released from under cover.
0800	Caliente monitor notified of two contaminated cars proceeding to Caliente for decontamination. Use washing station as listed in roadblock instruction sheet.
0805	Roadblock lifted for cars traveling U. S. Highway 91 between Las Vegas and Glendale Junction. No contaminated cars had been picked up at Glendale.
0815	Residents at Mesquite and Bunkerville authorized to come out from under cover.
0830	St. George monitor reported roadblock in operation for 45 min. Five trucks stopped at weighing station, only one active car read 10 outside and three inside, very little traffic.
0831	Mobile Monitoring team No. 2 at Alamo instructed to monitor Highway 93, rapidly, to 35 miles north of Glendale Junction.
0835	Mobile Air Sampling unit at Mesquite instructed via radio to contact local constable and set up roadblock to stop all travel to St. George on Highway 91. Roadblock accomplished at 0840.
0845	Rad-Safe Staff Officer requested roadblock be lifted on Highway 93 between Glendale and Alamo and from Glendale and Mesquite on Highway 91, but cars be monitored. Message of instructions acknowledged almost immediately.
0848	St. George roadblock has picked up three contaminated cars which had left Las Vegas about 0630. Inside readings were 58, 64, and 70.
0920	Groom Mine reported present level to be 11. (Maximum level was 140 at 0620.)
0930	Mobile Air Sampling team at Mesquite reported a truck from St. George reading 30 inside and 100 outside. Will wash at Mesquite. Fall-out occurring at St. George. Present reading 300 in middle of St. George. Cars backed up from roadblock for about one mile. On the advice of the Test Director, instructions were issued for St. George residents to remain indoors or under cover.
0952	Mobile Air Sampling team at Mesquite instructed to send its vehicle with fresh instruments to St. George.
1000	Mobile Monitoring team No. 1 reported level of 110 at 1000 at Santa Clara. Instructed to proceed to St. George.
1015	St. George monitor reported level of 320 at 1010.
1020	St. George monitor reported level of 220 using fresh instruments brought in by Mobile Monitoring team No. 1.
1025	Rad-Safe Staff Officer issued instructions that the cars being held at the St. George roadblock be allowed to travel. Accordingly, Mobile Monitoring team No. 1 was instructed to proceed to Cedar City, Utah, and set up a vehicle monitoring station there to monitor and wash, if necessary, approximately 100 of the north bound cars presently at the St. George roadblock. South bound cars permitted to proceed on Highway 91 for remonitoring check at Glendale, Nellis AFB, and washing at Las Vegas.

~~CONFIDENTIAL~~ UNCLASSIFIED

1045	Caliente monitor reported light fall-out began at 0840. Reading at 1040 was 0.5. Three automobiles and four of the passengers have been decontaminated to approved tolerance levels. Names and addresses and radiation levels on the people were recorded.
1115	St. George monitor reported levels by telephone, community all under cover for about $1\frac{1}{2}$ hr and will remain so until school lets out for lunch. He was instructed to (1) send one Mobile Monitoring team (in pick-up truck) on monitoring run to Mt. Carmel Junction, to Long Valley and to Cedar City; (2) send Mobile Monitoring team No. 2 to monitor 10 miles south; (3) be prepared to meet three AEC officials flying to St. George, ETA 1130.
1200	Report from Mesquite. Present level, 12.
1215	Report from Alamo. Present level, 3. Has monitored 15 cars from Glendale in past two hours and none read over background. Upon advice of Test Director, Alamo check point on Highway 93 was ordered removed.
1230 to 1300	Efforts to establish communication with vehicles east of St. George negative.
1310	Glendale check point reported 20 contaminated vehicles from the east need washing. Instructed to send them in to check point near Las Vegas.
1315	Advised Nellis roadblock of contaminated cars proceeding from Glendale and St. George. Instructed to monitor every car from the east and report to CP every hour. Advise north bound cars they would be subject to monitoring at Cedar City, Utah.
1325	Assistant Chief of Police in Cedar City, Utah, contacted by telephone and re-requested to contact Mobile Monitoring unit No. 1 at the monitoring check point for report on the situation. It was reported that within the past $1\frac{1}{2}$ hr about six or seven cars and six or seven trucks had been washed in Cedar City.
1335	Report from Washington, Utah. Level, 75 at 1300.
1340	Report from Hurricane, Utah. Level, 120 at 1327.
1350	Report from Cedar City, Utah. Level, 10 at 1330.
1355	Report from Virgin, Utah. Level, 42 at 1355.
1405	Mobile Monitoring unit No. 1 in Cedar City reported by telephone that 10 trucks and 15 cars had been washed in Cedar City. One Greyhound bus with level of 170 on radiator had been sent on to Salt Lake City, Utah, for washing.
1415	Rad-Safe Officer issued instructions for Cedar City check station to be lifted in 30 min. Message transmitted to Mobile Monitoring unit No. 1 with instructions to monitor back to St. George and report.
1425	St. George monitor reported having monitored 10 vehicles since 1300 and none read above background (40). Community residents had been released at 1125. Instructed to remove highway check point and make a monitoring run north to Veyo and Gunlock and report.
1440	Glendale check point reported 120 vehicles all above tolerance levels have passed and are enroute to Las Vegas.
1500	Mesquite check point reported one vehicle above tolerance in past 30 minutes.
1540	Check points at Glendale and Mesquite removed.
1555	At request of the Test Director, arrangements were made by telephone for monitoring of two Greyhound buses upon arrival in Salt Lake City. These buses were enroute from Cedar City to Salt Lake.
1620	Monitor at Glendale instructed to remonitor Highway 93 to Alamo and return.
1645	Mobile Air Sampling units at Bunkerville and Mesquite instructed to secure stations at 2000 and spend the night.

1710	Monitor at Pioche instructed to return D+1 day monitoring from Alamo to Glendale. This was necessary because two previous runs on this road had been made in vehicles with broken speedometers.
1715	Check point at Nellis AFB reported only one car in need of washing out of 100 monitored in past hour. Instructed to remove the check point at 1730 and assist with remonitoring of washed vehicles.
1715 to 1915	Received monitors' reports on radiation levels at various points north and east of St. George, Utah.
1915	Telephone call received from City Manager of Cedar City, Utah, re: apprehension among residents over a local radio broadcast about illness among some uranium miners working about 50 miles southeast of Cedar City during the fall-out period. The information obtained was passed through Rad-Safe Staff Officer to the Assistant Test Manager who gave instructions for handling the matter. A written report on this subject has been made.
2000	St. George station operator advised of the instructions of the Assistant Test Manager, that immediate telephone contact be established with Mr. E. H. Ellett at Orderville, Utah, and arrangements be made for visiting him on May 20 and for monitoring his work place at the Salinas Mining Company uranium mine. He was further instructed to call on the City Manager of Cedar City, Utah. Mobile Monitoring team No. 1 was instructed to remain in St. George on May 20 in touch with the Chief of Police in order to monitor and supervise decontamination of any local vehicles whose owners might request the service. Mobile Monitoring team No. 2 instructed to remain in St. George overnight and return to CP on D+1, monitoring Utah Highways 18 and 56 to Nevada Highway 25 to Panaca, Nev., thence to Caliente, Crystal Springs, Groom Lake, etc.
2330	Operations in CP No. 1 secured and telephone watch maintained in Off-Site headquarters in CP No. 2 throughout the night.

20 May 1953

D+1 day	During this day additional reports of radiation levels were received and reported. The mission to the uranium mine near Orderville, Utah, was accomplished as directed. All but the St. George monitor returned to Mercury, and the routine Postshot analysis of field data began according to schedule. Instructions were issued for an Off-Site monitor to remain in St. George, Utah, for the remainder of the week for the purpose of answering local questions and obtaining additional data as requested.

21 May 1953

D+2 day	Routine analysis of field data for the report continued. Following a conference with the Rad-Safe Staff Officer and Dr. Dunning, DBM representative, instructions were issued for the collection and examination of milk samples from the St. George milk shed. LASL was requested to furnish a laboratory procedure for examination of milk for fission products, and a chemist was detailed to perform such work at NPG. The Senior Public Health Service Officer for Off-Site Rad-Safe Operations made a special airplane trip to St. George for direct consultation with the St. George monitor about the local situation. Because of apprehension reported to exist among the residents of St. George, an indirect approach for the collection of milk and water samples was worked out. Fresh survey instruments were delivered to the St. George monitor, and special film badges

which had been placed at several locations in St. George on D-day were collected and returned to CP for evaluation.

22 May 1953

D + 3 day — Analysis of field data completed for report on Shot Harry. Preparations for Shot Grable begun. Frequency changes for radios in all Rad-Safe Off-Site vehicles were begun. Special monitoring activities in St. George area continued.

23 May 1953

D + 4 day — Weekly briefing session for all Rad-Safe Off-Site personnel was held at 1000. Assignments were made for the next shot. Special monitoring runs in the Utah area east of St. George continued and reports of readings were received. Frequency changes on vehicle radios completed. A description of the present Off-Site communications setup was given to Major Harper, a communications specialist now conducting a special study of the subject. Work on the preparation of report on Shot Harry continued. Final preparations of Rad-Safe Off-Site monitoring teams for Shot Grable completed.

Inclosure 3

GROUND MONITORING DATA, SHOT HARRY

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stevens	H+4:57	3 miles N of Glendale Junction on U. S. Hwy 93	0.3	$2\frac{1}{4}$	0.75
Williams	H+11:25	Moapa	0.04	$2\frac{1}{4}$	
Stevens	H+4:51	8 miles N of Glendale Junction on U. S. Hwy 93	0.3	$2\frac{1}{4}$	0.74
Platz	H+33:31	8 miles N of Glendale Junction on U. S. Hwy 93	0.05	$2\frac{1}{4}$	
Williams	H+11:45	9 miles N of Glendale Junction on U. S. Hwy 93	0.05	$2\frac{1}{4}$	
Stevens	H+4:45	13 miles N of Glendale Junction on U. S. Hwy 93	1.2	$2\frac{1}{4}$	2.75
Platz	H+33:25	13 miles N of Glendale Junction on U. S. Hwy 93	0.7	$2\frac{1}{4}$	13.0
Stevens	H+4:38	18 miles N of Glendale Junction on U. S. Hwy 93	3.5	$2\frac{1}{4}$	7.8
Platz	H+33:19	18 miles N of Glendale Junction on U. S. Hwy 93	1.3	$2\frac{1}{4}$	35.0
Williams	H+12:10	20 miles N of Glendale Junction on U. S. Hwy 93	0.7	$2\frac{1}{4}$	5.2
Stevens	H+1:32	23 miles N of Glendale Junction on U. S. Hwy 93	4.0	2	Fall-out occurring
Stevens	H+4:30	23 miles N of Glendale Junction on U. S. Hwy 93	140.0	2	360.0
Platz	H+33:13	23 miles N of Glendale Junction on U. S. Hwy 93	1.2	2	32.0
Stevens	H+1:37	24 miles N of Glendale Junction on U. S. Hwy 93	12.5	2	Fall-out occurring
Stevens	H+1:40	26 miles N of Glendale Junction on U. S. Hwy 93	26.0	2	Fall-out occurring
Platz	H+33:10	26 miles N of Glendale Junction on U. S. Hwy 93	8.0	2	220.0
Stevens	H+1:45	27 miles N of Glendale Junction on U. S. Hwy 93	70.0	2	Fall-out occurring
Stevens	H+1:47	28 miles N of Glendale Junction on U. S. Hwy 93	110.0	2	Fall-out occurring
Stevens	H+4:22	28 miles N of Glendale Junction on U. S. Hwy 93	200.0	2	520
Stevens	H+1:50	29 miles N of Glendale Junction on U. S. Hwy 93	170.0	2	Fall-out occurring
Williams	H+12:19	29 miles N of Glendale Junction on U. S. Hwy 93	6.0	2	54
Platz	H+33:05	29 miles N of Glendale Junction on U. S. Hwy 93	17.5	2	500
Stevens	H+1:53	30 miles N of Glendale Junction on U. S. Hwy 93	280.0	2	Fall-out occurring
Platz	H+33:03	30 miles N of Glendale Junction on U. S. Hwy 93	17.0	2	480
Stevens	H+1:56	31 miles N of Glendale Junction on U. S. Hwy 93	400.0	2	Fall-out occurring

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Platz	H+33:02	31 miles N of Glendale Junction on U. S. Hwy 93	18.0	2	500
Stevens	H+1:58	32 miles N of Glendale Junction on U. S. Hwy 93	490.0	2	Fall-out occurring
Williams	H+12:22	32 miles N of Glendale Junction on U. S. Hwy 93	12.0	2	115
Platz	H+33:00	32 miles N of Glendale Junction on U. S. Hwy 93	18.0	2	500
Stevens	H+2:00	32.7 miles N of Glendale Junction on U. S. Hwy 93	1000.0	2	Fall-out occurring
Stevens	H+4:13	33 miles N of Glendale Junction on U. S. Hwy 93	450.0	2	1100
Platz	H+32:59	33 miles N of Glendale Junction on U. S. Hwy 93	12.0	2	330
Stevens	H+2:05	34 miles N of Glendale Junction on U. S. Hwy 93	1000.0	2	Fall-out occurring
Platz	H+32:57	34 miles N of Glendale Junction on U. S. Hwy 93	10.0	2	280
Stevens	H+2:10	35 miles N of Glendale Junction on U. S. Hwy 93	900.0	2	980
Platz	H+32:55	35 miles N of Glendale Junction on U. S. Hwy 93	12.0	2	325
Stevens	H+2:13	36 miles N of Glendale Junction on U. S. Hwy 93	900.0	2	1000
Smithson	H+14:32	36 miles N of Glendale Junction on U. S. Hwy 93	30.0	2	330
Platz	H+32:52	36 miles N of Glendale Junction on U. S. Hwy 93	8.5	2	240
Stevens	H+2:15	37 miles N of Glendale Junction on U. S. Hwy 93	800.0	2	900
Smithson	H+14:29	37 miles N of Glendale Junction on U. S. Hwy 93	28.0	2	310
Platz	H+32:50	37 miles N of Glendale Junction on U. S. Hwy 93	7.5	2	200
Stevens	H+4:04	38 miles N of Glendale Junction on U. S. Hwy 93	275.0	2	640
Williams	H+12:30	38 miles N of Glendale Junction on U. S. Hwy 93	40.0	2	370
Smithson	H+14:28	38 miles N of Glendale Junction on U. S. Hwy 93	28.0	2	305
Platz	H+32:45	38 miles N of Glendale Junction on U. S. Hwy 93	7.0	2	190
Stevens	H+2:19	39 miles N of Glendale Junction on U. S. Hwy 93	600.0	2	700
Smithson	H+14:27	39 miles N of Glendale Junction on U. S. Hwy 93	24.0	2	270
Williams	H+12:33	40 miles N of Glendale Junction on U. S. Hwy 93	46.0	2	410
Smithson	H+14:26	40 miles N of Glendale Junction on U. S. Hwy 93	20.0	2	220
Platz	H+32:45	40 miles N of Glendale Junction on U. S. Hwy 93	5.5	2	150
Stevens	H+2:22	41 miles N of Glendale Junction on U. S. Hwy 93	400.0	2	480
Smithson	H+14:25	41 miles N of Glendale Junction on U. S. Hwy 93	18.0	2	190
Smithson	H+14:23	42 miles N of Glendale Junction on U. S. Hwy 93	19.0	2	205
Stevens	H+2:26	43 miles N of Glendale Junction on U. S. Hwy 93	260.0	2	300

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stevens	H+3:59	43 miles N of Glendale Junction on U. S. Hwy 93	110.0	2	260
Platz	H+32:40	43 miles N of Glendale Junction on U. S. Hwy 93	1.8	2	52
Stevens	H+2:30	45 miles N of Glendale Junction on U. S. Hwy 93	170.0	2	210
Stevens	H+2:33	47 miles N of Glendale Junction on U. S. Hwy 93	140.0	2	170
Stevens	H+3:51	48 miles N of Glendale Junction on U. S. Hwy 93	110.0	2	255
Platz	H+32:35	48 miles N of Glendale Junction on U. S. Hwy 93	1.2	2	30
Stevens	H+2:41	49 miles N of Glendale Junction on U. S. Hwy 93	100.0	2	140
Stevens	H+2:47	51 miles N of Glendale Junction on U. S. Hwy 93	120.0	2	165
Stevens	H+2:50	53 miles N of Glendale Junction on U. S. Hwy 93	100.0	2	150
Stevens	H+3:45	53 miles N of Glendale Junction on U. S. Hwy 93	30.0	2	62
Platz	H+32:38	53 miles N of Glendale Junction on U. S. Hwy 93	1.0	2	27
Stevens	H+2:53	55 miles N of Glendale Junction on U. S. Hwy 93	110.0	2	160
Stevens	H+2:56	57 miles N of Glendale Junction on U. S. Hwy 93	100.0	2	150
Stevens	H+3:37	58 miles N of Glendale Junction on U. S. Hwy 93	18.0	2	36
Smithson	H+14:00	58 miles N of Glendale Junction on U. S. Hwy 93	0.8	2	8.2
Platz	H+32:22	58 miles N of Glendale Junction on U. S. Hwy 93	[illegible]	2	17
Stevens	H+3:00	59 miles N of Glendale Junction on U. S. Hwy 93	100.0	2	160
Stevens	H+3:04	61 miles N of Glendale Junction on U. S. Hwy 93	17.0	2	27
Smithson	H+13:55	61 miles N of Glendale Junction on U. S. Hwy 93	0.5	2	5.2
Smithson	H+1:00 to 1:20	Alamo	Background	2	
Smithson	H+2:20	Alamo	7.0	2	8.3
Smithson	H+2:30	Alamo	10.0	2	13.0
Smithson	H+2:35	Alamo	12.0	2	15.0
Stevens	H+3:07	Alamo	17.0	2	28.0
Smithson	H+4:25	Alamo	4.0	2	11.0
Smithson	H+6:35	Alamo	3.3	2	15
Smithson	H+13:35	Alamo	0.8	2	7.5
Platz	H+32:17	Alamo	0.6	2	16
Smithson	H+1:00 to 1:20	Alamo to Crystal Springs	Background	2	
Smithson	H+3:25	5 miles N of Alamo on U. S. Hwy 93	20.0	2	40

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Smithson	H + 7:13	5 miles N of Alamo on U. S. Hwy 93	4.0	2	19
Smithson	H + 13:20	5 miles N of Alamo on U. S. Hwy 93	0.8	2	7.5
Platz	H + 32:05	5 miles N of Alamo on U. S. Hwy 93	0.6	2	16
Smithson	H + 7:15	Crystal Springs	2.8	2	13
Smithson	H + 13:10	Crystal Springs	1.0	2	9
Platz	H + 32:00	Crystal Springs	0.5	2	13
Smithson	H + 7:25	2 miles N of Crystal Springs on Nevada Hwy 38	2.5	2	12
Smithson	H + 7:35	Hiko	3.5	2	17
Platz	H + 31:55	4 miles NE of Crystal Springs on U. S. Hwy 93	0.4	2	10
Larsen	H + 33:35	7 miles NE of Crystal Springs on U. S. Hwy 93	0.2	2	5
Platz	H + 31:45	14 miles NE of Crystal Springs on U. S. Hwy 93	0.4	$2\frac{1}{4}$	9
Stevens	H + 32:45	14 miles NE of Crystal Springs on U. S. Hwy 93	0.8	$2\frac{1}{4}$	18
Platz	H + 31:35	24 miles NE of Crystal Springs on U. S. Hwy 93	0.5	$2\frac{1}{4}$	12
Stevens	H + 32:31	24 miles NE of Crystal Springs on U. S. Hwy 93	1.0	$2\frac{1}{4}$	24
Larsen	H + 33:18	26 miles NE of Crystal Springs on U. S. Hwy 93	0.3	$2\frac{1}{4}$	7
Platz	H + 31:25	34 miles NE of Crystal Springs on U. S. Hwy 93	0.4	$2\frac{1}{2}$	8.8
Stevens	H + 32:15	35 miles NE of Crystal Springs on U. S. Hwy 93	1.0	$2\frac{1}{2}$	24
Larsen	H + 33:05	39 miles NE of Crystal Springs on U. S. Hwy 93	0.3	$2\frac{1}{2}$	7.2
Platz	H + 4:25	Caliente	5.0	3	8.2
Platz	H + 7:50	Caliente	1.8	3	6.0
Platz	H + 30:40	Caliente	0.6	3	10
Stevens	H + 32:00	Caliente	1.0	3	16
Larsen	H + 32:50	Caliente	0.2	3	3.5
Platz	H + 30:30	5 miles N of Caliente on U. S. Hwy 93	0.25	$3\frac{1}{2}$	3.4
Platz	H + 4:15	10 miles N of Caliente on U. S. Hwy 93	4.0	$3\frac{1}{2}$	5.0
Platz	H + 31:45	14 miles N of Caliente and Panaca Junction	0.4	$3\frac{1}{2}$	5.2
Platz	H + 4:00	15 miles N of Caliente on U. S. Hwy 93	3.5	$3\frac{1}{2}$	4.8
Platz	H + 30:20	15 miles N of Caliente on U. S. Hwy 93	0.4	$3\frac{1}{2}$	5.2
Platz	H + 3:55	20 miles N of Caliente on U. S. Hwy 93	1.2	4	Fall-out occurring
Platz	H + 1:00 to 4:05	Pioche	Background	4	

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Platz	H+5:55	Pioche	0.4	4	0.8
Platz	H+30:05	Pioche	0.06	4	0.6
Platz	H+5:50	5 miles N of Pioche on U. S. Hwy 93	1.0	4	1.6
Rowe	H+1:55	Glendale Junction	Background		
Stevens	H+5:50	Glendale Junction	0.4	2¼	1.3
Rowe	H+2:05	5 miles E of Glendale Junction on Hwy 91	Background		
Stevens	H+6:03	5 miles E of Glendale Junction on Hwy 91	0.5	2¼	1.7
Rowe	H+2:10	7 miles E of Glendale Junction on Hwy 91	0.3	2½	
Stevens	H+6:10	10 miles E of Glendale Junction on Hwy 91	1.5	2½	4.3
Rowe	H+2:21	12 miles E of Glendale Junction on Hwy 91	2.2	2½	
Stevens	H+6:19	15 miles E of Glendale Junction on Hwy 91	1.8	2½	5.3
Rowe	H+2:31	17 miles E of Glendale Junction on Hwy 91	1.1	2½	
Weathersbee	H+30:05	18 miles E of Glendale Junction on Hwy 91	1.5	2½	29*
Stevens	H+6:25	20 miles E of Glendale Junction on Hwy 91	1.7	2¾	5
Weathersbee	H+29:55	24 miles E of Glendale Junction on Hwy 91	2.8	2¾	50*
Stevens	H+6:31	25 miles E of Glendale Junction on Hwy 91	1.5	2¾	4.2
Rowe	H+2:50	27 miles E of Glendale Junction on Hwy 91	1.9	2¾	
Weathersbee	H+0:35	Bunkerville	1.0 (this is from previous shot)		
Weathersbee	H+2:20	Bunkerville	3.0	2¾	
Weathersbee	H+2:25	Bunkerville	10.0	2¾	
Weathersbee	H+2:50	Bunkerville	11.0	2¾	11
Weathersbee	H+3:10	Bunkerville	9.0	2¾	11
Weathersbee	H+3:25	Bunkerville	8.0	2¾	12
Stevens	H+6:37	Bunkerville	4.8	2¾	13
Weathersbee	H+11:40	Bunkerville	3.8	2¾	22
Rowe	H+39:10	Bunkerville	1.1	2¾	22
Rowe	H+3:00	32 miles E of Glendale on U. S. Hwy 91	12.5	3	Fall-out occurring
Fetz	H+1:50	Mesquite	Background	3	
Fetz	H+2:15	Mesquite	0.3	3	
Fetz	H+2:27	Mesquite	20.0	3	Fall-out occurring

[redacted]

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Fetz	H+2:32	Mesquite	60.0	3	Fall-out occurring
Fetz	H+2:44	Mesquite	75.0	3	Fall-out occurring
Fetz	H+3:20	Mesquite	46.0	3	52
Stevens	H+6:46	Mesquite	18.0	3	49
Fetz	H+8:15	Mesquite	5.5	3	18
Fetz	H+9:15	Mesquite	4.2	3	17
Rowe	H+38:51	Mesquite	2.0	3	42
Rowe	H+3:17	38 miles E of Glendale Junction on U. S. Hwy 91	80.0	3	Fall-out occurring
Rowe	H+3:21	40 miles E of Glendale Junction on U. S. Hwy 91	100.0	$3\frac{1}{4}$	Fall-out occurring
Stevens	H+8:16	40 miles E of Glendale Junction on U. S. Hwy 91	70.0	$3\frac{1}{4}$	220
Rowe	H+38:45	40 miles E of Glendale Junction on U. S. Hwy 91	4.5	$3\frac{1}{4}$	88
Rowe	H+3:25	42 miles E of Glendale Junction on U. S. Hwy 91	120.0	$3\frac{1}{4}$	Fall-out occurring
Melton	H+5:15	42 miles E of Glendale Junction on U. S. Hwy 91	70.0	$3\frac{1}{4}$	125
Rowe	H+3:30	44 miles E of Glendale Junction on U. S. Hwy 91	130.0	$3\frac{1}{4}$	Fall-out occurring
Stevens	H+8:25	45 miles E of Glendale Junction on U. S. Hwy 91	36.0	$3\frac{1}{4}$	120
Rowe	H+38:39	45 miles E of Glendale Junction on U. S. Hwy 91	5.0	$3\frac{1}{4}$	98
Rowe	H+3:40	46 miles E of Glendale Junction on U. S. Hwy 91	100.0	$3\frac{1}{4}$	Fall-out occurring
Rowe	H+3:45	48 miles E of Glendale Junction on U. S. Hwy 91	105.0	$3\frac{1}{4}$	Fall-out occurring
Rowe	H+3:50	50 miles E of Glendale Junction on U. S. Hwy 91	100.0	$3\frac{1}{2}$	Fall-out occurring
Stevens	H+8:32	50 miles E of Glendale Junction on U. S. Hwy 91	40.0	$3\frac{1}{2}$	120
Rowe	H+38:31	50 miles E of Glendale Junction on U. S. Hwy 91	4.5	$3\frac{1}{2}$	70
Rowe	H+3:55	52 miles E of Glendale Junction on U. S. Hwy 91	120.0	$3\frac{1}{2}$	Fall-out occurring
Melton	H+5:32	52 miles E of Glendale Junction on U. S. Hwy 91	70.0	$3\frac{1}{2}$	130
Rowe	H+3:58	54 miles E of Glendale Junction on U. S. Hwy 91	125.0	$3\frac{1}{2}$	Fall-out occurring
Stevens	H+8:40	55 miles E of Glendale Junction on U. S. Hwy 91	38.0	$3\frac{1}{2}$	105
Rowe	H+38:25	55 miles E of Glendale Junction on U. S. Hwy 91	4.0	$3\frac{1}{2}$	69
Rowe	H+4:07	56 miles E of Glendale Junction on U. S. Hwy 91	115.0	$3\frac{1}{2}$	145
Rowe	H+4:11	58 miles E of Glendale Junction on U. S. Hwy 91	110.0	$3\frac{1}{2}$	130
Stevens	H+8:48	60 miles E of Glendale Junction on U. S. Hwy 91	28.0	$3\frac{1}{2}$	85
Beutler	H+13:55	60 miles E of Glendale Junction on U. S. Hwy 91	16.0	$3\frac{1}{2}$	83

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H+38:20	60 miles E of Glendale Junction on U. S. Hwy 91	4.0	3½	70
Rowe	H+4:20	63 miles E of Glendale Junction on U. S. Hwy 91	80.0	3½	105
Stevens	H+8:57	65 miles E of Glendale Junction on U. S. Hwy 91	80.0	3½	250
Rowe	H+38:13	65 miles E of Glendale Junction on U. S. Hwy 91	6.0	3½	110
Rowe	H+4:29	68 miles E of Glendale Junction on U. S. Hwy 91	160.0	3¾	190
Stevens	H+9:05	70 miles E of Glendale Junction on U. S. Hwy 91	80.0	3¾	225
Beutler	H+13:40	70 miles E of Glendale Junction on U. S. Hwy 91	20.0	3¾	240
Rowe	H+38:05	70 miles E of Glendale Junction on U. S. Hwy 91	10.0	3¾	170
Rowe	H+4:40	73 miles E of Glendale Junction on U. S. Hwy 91	165.0	3¾	220
Stevens	H+9:13	75 miles E of Glendale Junction on U. S. Hwy 91	90.0	3¾	270
Rowe	H+37:53	75 miles E of Glendale Junction on U. S. Hwy 91	7.0	3¾	120
Rowe	H+4:50	78 miles E of Glendale Junction on U. S. Hwy 91	170.0	4	220
Melton	H+6:30	Santa Clara	100	4	180
Stevens	H+9:20	Santa Clara	90.0	4	250
Beutler	H+13:25	Santa Clara	40.0	4	175
Rowe	H+37:45	Santa Clara	10.0	4	150
Rowe	H+4:55	81 miles E of Glendale Junction on U. S. Hwy 91	110.0	4	140
Butrico	H+4:40	St. George	350	4	Fall-out occurring
Butrico	H+4:55	St. George	300	4	Fall-out occurring
Butrico	H+5:00	St. George	320	4	Fall-out occurring
Rowe	H+5:15	St. George	260	4	350
Butrico	H+5:25	St. George	290	4	420
Butrico	H+5:35	St. George	240	4	360
Butrico	H+5:45	St. George	220	4	340
Butrico	H+6:05	St. George	200	4	330
Butrico	H+6:30	St. George	150	4	265
Butrico	H+6:40	St. George	120	4	200
Butrico	H+6:55	St. George	80	4	160
Melton	H+7:35	St. George	140	4	310
Butrico	H+9:10	St. George	60	4	160

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stevens	H+9:35	St. George	100	4	275
Rowe	H+12:50	St. George	44	4	180
Rowe	H+25:25	St. George	25	4	220
Stevens	H+26:55	St. George	25	4	230
Butrico	H+36:35	St. George	12	4	165
Rowe	H+37:25	St. George	10	4	150
Butrico	H+53:05	St. George	8	4	180
Lawrence	H+59:00	St. George	9	4	730
Butrico	H+78:00	St. George	7	4	250
Voelz	H+102:00	St. George	5	4	240
Beutler	H+11:50	5 miles NE of St. George on U. S. Hwy 91 at Washington	30.0	4	110
Melton	H+7:55	5 miles NE of St. George on U. S. Hwy 91 at Washington	75.0	4	165
Rowe	H+12:50	5 miles NE of St. George on U. S. Hwy 91 at Washington	28.0	4	120
Melton	H+14:31	5 miles NE of St. George on U. S. Hwy 91 at Washington	28.0	4	140
Butrico	H+26:45	5 miles NE of St. George on U. S. Hwy 91 at Washington	10.0	4	98
Voelz	H+103:15	10 miles NE of St. George on U. S. Hwy 91	5.0	4	230
Rowe	H+12:43	10 miles NE of St. George on U. S. Hwy 91	34.0	4	140
Melton	H+8:05	Junction of U. S. Hwy 91 and Utah Hwy 17	95.0	4	220
Beutler	H+11:45	Junction of U. S. Hwy 91 and Utah Hwy 17	70.0	4	250
Melton	H+14:23	Junction of Hwy 91 and Utah Hwy 17	41.0	4	190
Butrico	H+36:00	Junction of Hwy 91 and Utah Hwy 17	8.0	4	110
Rowe	H+12:36	15 miles NE of St. George on U. S. Hwy 91	27.0	4	105
Melton	H+14:14	Leeds	32.0	$4\frac{1}{4}$	145
Butrico	H+35:55	Leeds	6.0	$4\frac{1}{4}$	78
Voelz	H+107:30	Leeds	4.25	$4\frac{1}{4}$	200

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H+12:30	20 miles NE of St. George on U. S. Hwy 91	55.0	$4\frac{1}{4}$	210
Beutler	H+11:16	Junction of U. S. Hwy 91 and Utah Hwy 15	26.0	$4\frac{1}{4}$	85
Butrico	H+35:50	Junction of U. S. Hwy 91 and Utah Hwy 15	8.0	$4\frac{1}{4}$	105
Melton	H+14:07	Junction of U. S. Hwy 91 and Utah Hwy 15	32.0	$4\frac{1}{4}$	140
Rowe	H+12:15	Pintura	21.5	$4\frac{1}{4}$	75
Beutler	H+11:10	Pintura	32.0	$4\frac{1}{4}$	100
Melton	H+14:01	Pintura	28.0	$4\frac{1}{4}$	120
Rowe	H+12:10	30 miles NE of St. George on U. S. Hwy 91	18.0	$4\frac{1}{4}$	65
Melton	H+13:55	33 miles NE of St. George on U. S. Hwy 91	18.0	$4\frac{1}{4}$	78
Rowe	H+12:01	35 miles NE of St. George on U. S. Hwy 91	23.0	$4\frac{1}{4}$	80
Melton	H+13:49	35 miles NE of St. George on U. S. Hwy 91	24.0	$4\frac{1}{4}$	98
Rowe	H+11:58	40 miles NE of St. George on U. S. Hwy 91	18.5	$4\frac{1}{4}$	65
Beutler	H+10:53	Kanarraville	20.0	$4\frac{1}{4}$	63
Melton	H+13:41	Kanarraville	18.0	$4\frac{1}{4}$	76
Butrico	H+35:30	Kanarraville	8.0	$4\frac{1}{4}$	100
Rowe	H+11:50	45 miles NE of St. George on U. S. Hwy 91	18.5	$4\frac{1}{4}$	63
Melton	H+13:33	45 miles NE of St. George on U. S. Hwy 91	14.0	$4\frac{1}{4}$	50
Melton	H+13:28	49 miles NE of St. George on U. S. Hwy 91	10.0	$4\frac{1}{2}$	38
Butrico	H+35:20	49 miles NE of St. George on U. S. Hwy 91 at Hamilton Fort	3.0	$4\frac{1}{2}$	35
Rowe	H+11:43	50 miles NE of St. George on U. S. Hwy 91	14.0	$4\frac{1}{2}$	46
Rowe	H+11:35	Cedar City	6.0	$4\frac{1}{2}$	18
Melton	H+12:47	Cedar City	4.0	$4\frac{1}{2}$	14
Butrico	H+33:55	Cedar City	3.0	$4\frac{1}{2}$	34
Stevens	H+9:41	2 miles S of St. George on Utah Hwy 64	120.0	4	340
Stevens	H+27:02	2 miles S of St. George on Utah Hwy 64	26.0	4	260
Stevens	H+9:45	4 miles S of St. George on Utah Hwy 64	110.0	4	300
Stevens	H+27:07	4 miles S of St. George on Utah Hwy 64	15.5	4	160
Stevens	H+9:54	7 miles S of St. George on Utah Hwy 64	60.0	4	180
Stevens	H+27:17	7 miles S of St. George on Utah Hwy 64	14.5	4	140
Stevens	H+10:01	9 miles S of St. George on Utah Hwy 64	60.0	4	180

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stevens	H+27:27	9 miles S of St. George on Utah Hwy 64	6.5	4	64
Melton	H+8:22	Hurricane	120.0	$4\frac{1}{4}$	270
Beutler	H+11:35	Hurricane	80.0	$4\frac{1}{4}$	270
Butrico	H+27:00	Hurricane	25.0	$4\frac{1}{4}$	230
Voelz	H+104:00	Junction of Utah Hwys 15 and 17	8.0	$4\frac{1}{4}$	375
Beutler	H+11:25	Junction of Utah Hwys 15 and 17	40.0	$4\frac{1}{4}$	135
Melton	H+8:05	Virgin	42.0	$4\frac{1}{4}$	100
Butrico	H+27:15	Virgin	10.0	$4\frac{1}{4}$	95
Voelz	H+105:00	Virgin	3.5	$4\frac{1}{4}$	160
Melton	H+9:10	Rockville	80.0	$4\frac{1}{2}$	190
Butrico	H+27:25	Rockville	12.0	$4\frac{1}{2}$	100
Voelz	H+105:10	Rockville	4.0	$4\frac{1}{2}$	175
Melton	H+9:23	Springdale	100.0	$4\frac{1}{2}$	245
Butrico	H+27:35	Springdale	15.0	$4\frac{1}{2}$	130
Voelz	H+105:20	Springdale	4.5	$4\frac{1}{2}$	200
Melton	H+9:54	Zion National Park	37.5	$4\frac{3}{4}$	90
Melton	H+10:31	Mt. Carmel Junction	26.0	5	70
Butrico	H+28:20	Mt. Carmel Junction	10.0	5	80
Voelz	H+106:00	Mt. Carmel Junction	1.25	5	50
Butrico	H+28:40	Kanab at Salina Mining Co.	15.0	5	120
Butrico	H+30:40	Kanab at Salina Mining Co.	15.0	5	120
Melton	H+10:43	Mt. Carmel	20.0	5	48
Melton	H+10:49	Orderville	15.0	5	38
Butrico	H+31:55	Orderville	14.0	5	150
Voelz	H+106:30	Orderville	1.1	5	40
Melton	H+10:55	Glendale, Utah	18.0	5	48
Butrico	H+32:10	Glendale, Utah	13.0	5	110
Melton	H+11:10	Junction of Hwys U. S. 89 and Utah 136	18.0	5	48
Melton	H+11:18	Long Valley Junction	14.0	5	35
Butrico	H+32:25	Long Valley Junction	13.0	5	110

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Melton	H+11:42	10 miles W of Long Valley Junction on Utah Hwy 14	16.0	5	44
Melton	H+11:50	14 miles W of Long Valley Junction on Utah Hwy 14	20.0	$4^3/_4$	60
Melton	H+12:03	20 miles W of Long Valley Junction on Utah Hwy 14	12.0	$4^3/_4$	34
Melton	H+12:25	30 miles W of Long Valley Junction on Utah Hwy 14	8.0	$4^1/_2$	26
Melton	H+12:37	40 miles W of Long Valley Junction on Utah Hwy 14	8.0	$4^1/_2$	26
Melton	H+6:32	Junction of Hwys U. S. 91 and Utah 18	120	4	210
Stevens	H+10:58	Junction of Hwys U. S. 91 and Utah 18	90.0	4	300
Stevens	H+14:35	Junction of Hwys U. S. 91 and Utah 18	60.0	4	280
Stevens	H+27:59	Junction of Hwys U. S. 91 and Utah 18	22.0	4	220
Stevens	H+11:23	Veyo	75.0	4	260
Stevens	H+15:02	Veyo	38.0	4	175
Stevens	H+28:29	Veyo	20.0	4	210
Stevens	H+28:54	Junction to Pinto on Utah Hwy 18	11.0	4	110
Stevens	H+15:45	Enterprise	10.0	4	52
Stevens	H+29:07	Enterprise	2.0	4	22
Stevens	H+29:25	Junction of Utah Hwys 18 and 56	1.5	4	16
Stevens	H+30:09	Modena	1.2	$3^1/_2$	16
Stevens	H+30:50	Panaca	0.9	3	14
Paganini	H+1:00 to 7:10	Nellis AFB	Background		
Paganini	H+13:50 to 17:30	Nellis AFB	0.10		
Paganini	H+24:00	Nellis AFB	0.04		
Paganini	H+1:00 to 12:25	Las Vegas	Background		
Paganini	H+16:15	Las Vegas	0.10		
Paganini	H+28:40 to 30:25	Las Vegas to Indian Springs	Background		
Claborn	H+1:00 to 24:00	Indian Springs	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Claborn	H+24:55 to 25:25	Indian Springs to Mercury	Background		
Carter	H+1:00 to 24:00	Mercury	Background		
Rossano	H+1:55	Lincoln Mine	0.15		
Rossano	H+2:30	Lincoln Mine	1.1	2¼	Fall-out occurring
Rossano	H+14:25	Lincoln Mine	0.30	2¼	2.7
Ponzell	H+5:20	Road junction 9 miles S of Lincoln Mine	12	2	38
Rossano	H+9:10	Road junction 9 miles S of Lincoln Mine	8	2	49
Jensen	H+1:00	Groom Mine	10	1¼	Fall-out occurring
Jensen	H+1:15	Groom Mine	140	1¼	Fall-out occurring
Jensen	H+1:25	Groom Mine	100	1¼	Fall-out occurring
Jensen	H+1:45	Groom Mine	80	1¼	Fall-out occurring
Jensen	H+2:25	Groom Mine	60	1¼	140
Jensen	H+3:30	Groom Mine	24	1¼	85
Jensen	H+7:45	Groom Mine	10	1¼	90
Jensen	H+13:25	Groom Mine	5	1¼	88
Jensen	H+26:55	Groom Mine	2.5	1¼	98
Larsen	H+1:00 to 24:00	Ely	Background		
Williams, G.	H+15:00 to 16:00	Currant to Ely	Background		
Williams, G.	H+1:00 to 15:00	Currant	Background		
Williams, G.	H+7:30	Preston	Background		
Williams, G.	H+7:55	Lund	Background		
Graber	H+9:45 to 10:55	Warm Springs to 47 miles NE on U. S. Hwy 6	Background		
Graber	H+1:00 to 24:00	Warm Springs station	Background		
Graber	H+25:55 to 26:55	Warm Springs to Tonopah	Background		
Harrison	H+1:00 to 24:00	Tonopah station	Background		
Harrison	H+11:45 to 12:20	Tonopah to 30 miles N on Nevada Hwy 8A	Background		
Harrison	H+27:10 to 28:55	Tonopah to Beatty on U. S. Hwy 95	Background		
Frazier	H+1:00 to 24:00	Beatty	Background		
Frazier	H+29:20 to 30:30	Beatty on Hwy Nevada 58 to junction with California Hwy 190	Background		
Frazier	H+30:30 to 31:45	Junction of Hwy Nevada 58 and California Hwy 190 to Death Valley Junction	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Frazier	H+31:45 to 32:40	Death Valley Junction to Lathrop Wells	Background		
Frazier	H+32:40 to 33:11	Lathrop Wells to Mercury	Background		
Harrison	H+28:55 to 30:10	Beatty to Mercury	Background		
Stevens	H+33:00	Crystal Springs	0.6	2	17
Larsen	H+33:45	Crystal Springs	0.2	2	5.6
Stevens	H+33:30	Junction of Nevada Hwy 25 and Groom Mine road, 15 miles S of Crystal Springs	1.5	$1\frac{1}{2}$	62
Larsen	H+34:10	20 miles S of Crystal Springs	2.0	$1\frac{1}{2}$	110
Larsen	H+34:45	Groom Lake	5.0	$1\frac{1}{2}$	270
Larsen	H+35:05	Groom Pass guard station	0.05		

* Calculated intensities will be high because of influence of Shot Simon on later readings.

Inclosure 4

RADIATION DOSES FOR INFINITE EXPOSURE

Location	Time of reading, H+hours	Ground level, mr/hr	Fall-out time, H+hours	Infinite dose Shot Harry, mr	Total infinite dose,* mr
Highway 93, hot spot north of Glendale	33:00	18.0	2	5,000	12,500
Bunkerville	6:37	4.8	2¾	180	5,000 to 8,000
Mesquite	38:51	2.0	3	630	1,900
St. George	36:00	16	4	4,200	4,750
Washington	12:50	28	4	2,500	
Hurricane	11:35	80	4¼	5,200	7,700
Virgin, Utah	8:50	42	4¼	2,000	2,100
Rockville, Utah	9:10	80	4½	3,000	6,000
Springdale, Utah	9:30	80	4½	4,000	4,600
Mt. Carmel Junction	10:30	26	5	1,600	
Kanab, Utah	28:40	15	5	3,000	
Orderville, Utah	32	14	5	3,000	
Long Valley, Utah	11:18	22	5	1,500	
Cedar City, Utah	12	7	4½	500	500
Kanarraville	13:40	18	4¼	1,700	
Anderson Junction	14	22	4¼	2,000	
Veyo, Utah	28:30	20	4	3,500	
Enterprise, Utah	29	2.5	4	500	

* This is for the Spring Series, 1953, including Shot Harry.

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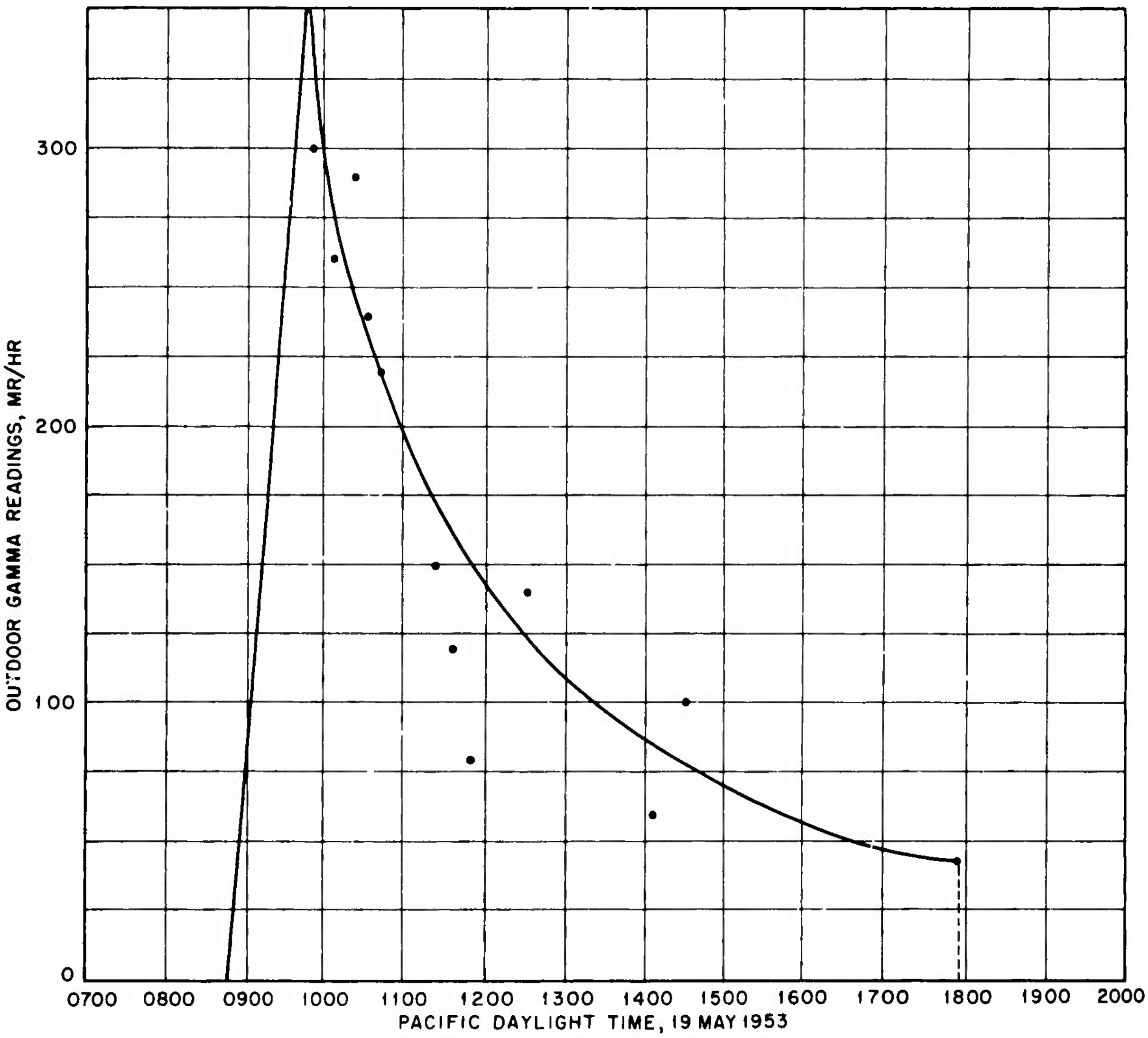
Inclosure 5

FALL-OUT AT ST. GEORGE, UTAH, SHOT HARRY, 19 MAY 1953



Fall-out calculations. 1 sq in. = 83.3 mr. Area (0845 to 1755) = 13.43 sq in. Equivalent dose (9 hr 10 min) = 1.12 r. Dose from 1755 to infinity = 3.00 r. Infinity dose = 4.12 r.

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Inclosure 6

FILM BADGES EXPOSED IN ST. GEORGE, UTAH

Badge No.	Location	Time out	Time in	Total time, hr	Dose, mr/hr
012919	Big Hand Cafe (inside)	5/19, 1205	5/20, 1810	30	560
012922	Dixie College (shoproom)	5/19, 1200	5/20, 1800	30	645
014059	Dixie College (on window of drafting room)	5/19, 0505	5/21, 1500	58	1770
012921	Dixie College (shoproom)	5/19, 1210	5/22, 1340	73.5	820
012917	Sheriff's Office (inside)	5/19, 1215	5/21, 1615	52	460
014076	Off-Site Monitor	5/19, 0505	5/21, 1700	60	1720
015104	Off-Site Monitor	5/21, 1500	5/22, 1400	23	210
012920	City Hall (inside)	5/19, 1215	5/23, 1100	78	590
	Big Hand Motel room	5/23, 1100	5/24, 1430	27.5	

Inclosure 7

AIR SAMPLING RESULTS

Location	Time of sample	Results, $\mu c/M^3$
Shot Area (10 mr line)	0543–0553, 5/19/53	4.86×10^{-4}
CP station	0405–0605, 5/19/53	2.0×10^{-4}
	0605–0805, 5/19/53	2.68×10^{-2}
	0805–1005, 5/19/53	5.55×10^{-5}
	1005–1205, 5/19/53	2.81×10^{-5}
	1205–1405, 5/19/53	3.00×10^{-5}
	1405–1805, 5/19/53	1.04×10^{-5}
	2205–0505, 5/19 to 5/20/53	0
	Average concentration for sampling period	2.52×10^{-5}
	0615–1005, 5/19/53	MMD = 0.52 μ
Mercury	0340–0630, 5/19 to 5/20/53	Background
Indian Springs	0250–0505, 5/19 to 5/20/53	Background
Las Vegas	0425–0500, 5/19 to 5/20/53	Background
Nellis AFB	0340–0550, 5/19 to 5/20/53	Background
Glendale Junction	0410–0639, 5/19/53	3.2×10^{-6}
	0630–1030, 5/19/53	6.47×10^{-6}
	1030–1530, 5/19/53	9.0×10^{-4}
	1530–2130, 5/19/53	0
	2130–0830, 5/19 to 5/20/53	1.44×10^{-5}
	Average concentration for sampling period	1.69×10^{-4}
St. George	0430–0610, 5/19/53	4.35×10^{-3}
	0610–1130, 5/19/53	4.17
	1130–1445, 5/19/53	2.38
	1450–1845, 5/19/53	6.3×10^{-1}
	1845–2300, 5/19/53	4.4×10^{-2}
	2305–0635, 5/19 to 5/20/53	1.4×10^{-2}
	Average concentration for sampling period	1.26
	0610–1130, 5/19/53	MMD = 42.3 μ
	1140–1445, 5/19/53	MMD = 18.0 μ
	1450–2300, 5/19/53	MMD = 25.7 μ
	2305–0635, 5/19/53	MMD = 2.4 μ

Location	Time of sample	Results, $\mu c/M^3$
Alamo	0430–0630, 5/19/53	1.14×10^{-4}
	0630–0740, 5/19/53	5.56×10^{-2}
	0840–1100, 5/19/53	8.65×10^{-3}
	1100–1430, 5/19/53	1.04×10^{-3}
	1435–1845, 5/19/53	1.17×10^{-5}
	1845–2110, 5/19/53	2.11×10^{-5}
	2115–0930, 5/19 to 5/20/53	2.95×10^{-6}
	Average concentration for sampling period	3.44×10^{-3}
	0630–1110, 5/19/53	MMD = 5.1 μ
Crystal Springs	0355–0555, 5/19/53	6.4×10^{-4}
	0600–0610, generator failure	
	1245–1700, 5/19/53	1.58×10^{-4}
	1700–2150, 5/19/53	2.0×10^{-5}
	2150–0113, 5/19 to 5/20/53	4.8×10^{-5}
	Average concentration for sampling period	1.59×10^{-4}
Caliente	0405–0605, 5/19/53	8.4×10^{-4}
	0605–0935, 5/19/53	7.9×10^{-2}
	0935–1135, 5/19/53	2.2×10^{-2}
	1145–1405, 5/19/53	1.07×10^{-2}
	1405–1805, 5/19/53	2.00×10^{-3}
	1805–2235, 5/19/53	7.35×10^{-4}
	2235–0505, 5/19 to 5/20/53	1.46×10^{-4}
	Average concentration for sampling period	1.07×10^{-2}
	0605–0935, 5/19/53	MMD = 1.02 μ
Pioche	0415–0605, 5/19/53	0
	0605–0805, 5/19/53	0
	0805–1030, 5/19/53	9.05×10^{-2}
	1030–1355, 5/19/53	1.4×10^{-3}
	1400–1805, 5/19/53	3.94×10^{-4}
	1805–2150, 5/19/53	1.13×10^{-4}
	2200–0500, 5/19 to 5/20/53	0
	Average concentration for sampling period	1.12×10^{-3}
Ely	0620–0805, 5/19 to 5/20/53	Background
Currant	0405–2005, 5/19/53	Background
Warm Springs	0508–0620, 5/19 to 5/20/53	Background
Tonopah	0405–0505, 5/19 to 5/20/53	Background
Beatty	0405–0505, 5/19 to 5/20/53	Background
Groom Mine	0410–0605, 5/19/53	1.09×10^{-4}
	0610–0625, 5/19/53	2.25
	0625–0635, 5/19/53	8.9×10^{-1}
	0635–0650, 5/19/53	8.17×10^{-2}
	0650–0750, 5/19/53	0
	0750–1000, 5/19/53	3.17×10^{-2}

Location	Time of sample	Results, $\mu c/M^3$
	1000–1230, 5/19/53	1.79×10^{-2}
	1230–1430, 5/19/53	5.2×10^{-3}
	1430–1830, 5/19/53	1.66×10^{-3}
	1830–2230, 5/19/53	3.35×10^{-4}
	2230–0400, 5/19 to 5/20/53	5.82×10^{-4}
	Average concentration for sampling period	3.36×10^{-2}
Lincoln Mine	0415–0620, 5/19/53	3.53×10^{-5}
	0630–0727, 5/19/53	3.28×10^{-2}
	0730–0745, 5/19/53	1.26×10^{-1}
	0745–0800, 5/19/53	2.34×10^{-2}
	0800–0830, 5/19/53	2.52×10^{-2}
	0830–0900, 5/19/53	4.46×10^{-2}
	0900–1100, 5/19/53	8.4×10^{-3}
	1105–1515, 5/19/53	2.6×10^{-3}
	1520–1910, 5/19/53	2.15×10^{-3}
	1915–0530, 5/19 to 5/20/53	1.79×10^{-5}
	Average concentration for sampling period	5.23×10^{-3}
	0755–1315, 5/19/53	MMD = 4.4 μ
Bunkerville	0600–0725, 5/19/53	5.75×10^{-4}
	0725–0825, 5/19/53	1.76×10^{-2}
	0825–0925, 5/19/53	5.5×10^{-3}
	0925–1125, 5/19/53	4.38×10^{-3}
	1125–1525, 5/19/53	7.0×10^{-6}
	1620–1800, 5/19/53	1.16×10^{-3}
	Average concentration for sampling period	3.1×10^{-3}
Mesquite	0712–0805, 5/19/53	5.61×10^{-2}
	0806–1140, 5/19/53	1.12×10^{-2}
	1635–1902, 5/19/53	2.41×10^{-3}
	Average concentration for sampling period	1.35×10^{-2}
	1722–1902, 5/19/53	MMD = 0.99 μ

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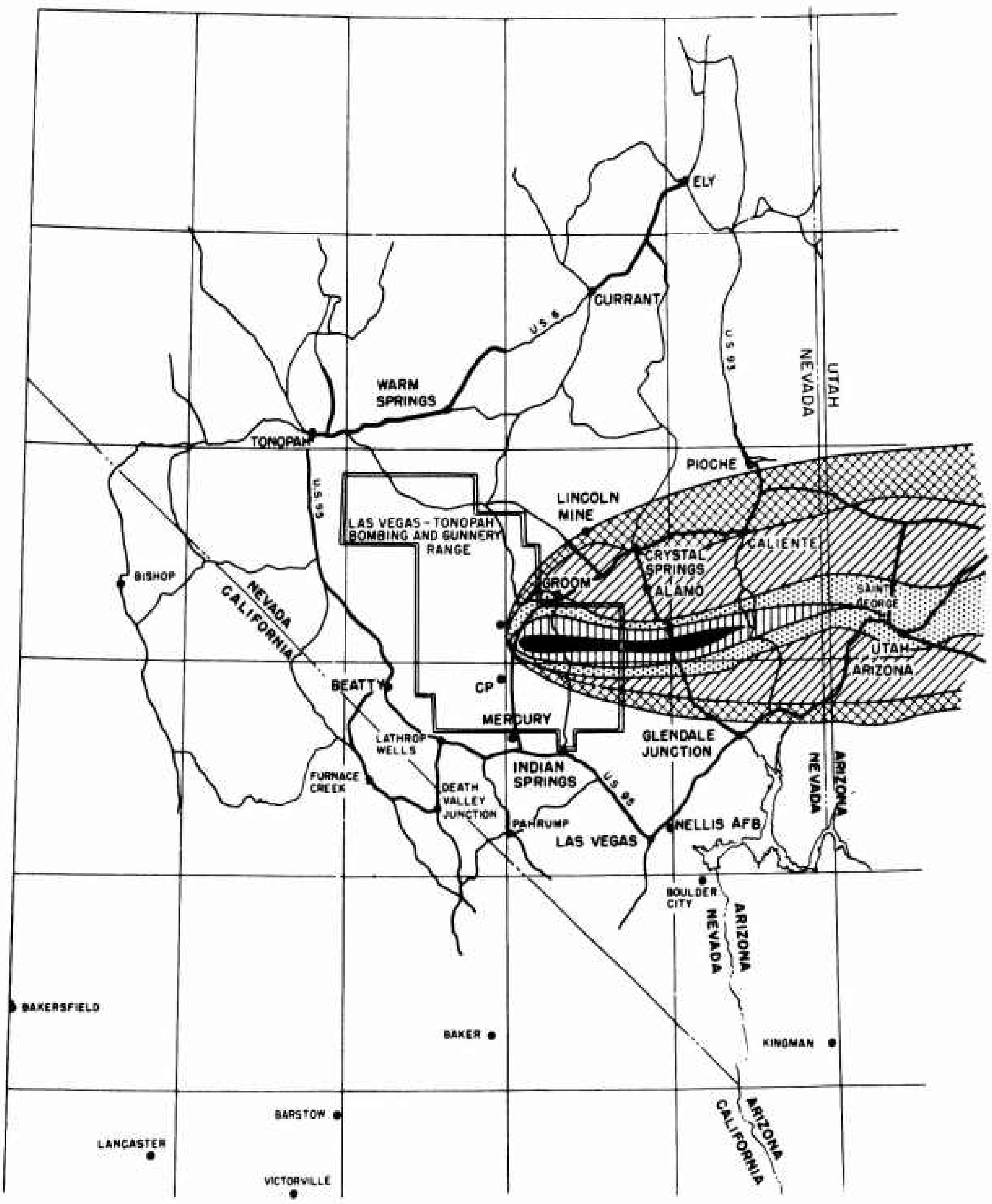
Inclosure 8

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT HARRY



(cross-hatched), 2 to 20 mr/hr. (hatched), 20 to 200 mr/hr. (dotted), 200 to 400 mr/hr. (vertical lines), 400 to 1000 mr/hr. (solid black), over 1000 mr/hr. Heavy lines indicate the monitor runs.

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Inclosure 9

WATER SAMPLE RESULTS

Location	Date of collection	Time of collection	Activity at collection time, μc/liter
Groom Mine	5/20/53	0730	Instrument background
Lincoln Mine	5/20/53	0800	Instrument background
Canyon Lake, near U. S. Hwy 93	5/19/53	2000	1.38×10^{-2}
Crystal Springs (at Springs)	5/20/53	0830	3.68×10^{-4}
Virgin River, 1 at bridge on U. S. 91 between Mesquite and Bunkerville	5/19/53	1850	3.41×10^{-2}
Virgin River, 2 at Mesquite	5/20/53	2005	5.75×10^{-3}
Hiko Lake, east shore	5/19/53	1345	1.52×10^{-3}

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Inclosure 10

DATA FOR CLOUD TRACKING AIRCRAFT B-29 AND B-25

Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
			Cook Book 1 (B-29)			
A 44	0518	22,000	Above and E		0.5	
B 44	0524	22,000	NW and above		6	
B 44	0531	22,000	Below		2,500	
C 44	0537	22,000	Rosie above		10	
D 44	0544	22,000	Main SE		13	
E 43	0548	21,000	Main Rosie SE		28	
C 44	0554	21,000	Rosie is E		145	
F 44	0559	21,000	Main Rosie is S		1,000	Top of Rosie has disappeared.
G 44	0620	20,500	S and above		120	
H 45	0613	20,000	Rosie above		95	Main Rosie is not visible.
H 44	0625	20,000			160	Background 70 on C-1 air foil.
J 45	0632	20,000	SE		115	
J 46	0636	20,000	Top of Rosie not visible		280	Background 75 on C-1 air foil.
L 46	0650	20,000	Rosie NW		30	Not visible.
K 45	0654	20,000	SE		320	Background 75 on C-1 air foil.
M 47	0704	20,000	Not visible		550	Background 80 on C-1 air foil.
			Cook Book 2 (B-29)			
A 42	0529	18,000	NE		30	
D 43	0538	18,000	West		220	
F 41	0545	18,000	South		39	
F 44	0600	18,000	Above		1,200	
I 43	0621	22,000	SE		110	
J 43	0625	22,000	SE		90	
J 46	0637	22,000	Unknown		110	Unable to distinguish Rosie.
M 49	0657	22,000	Unknown		.44	
K 45	0703	22,000	Unknown		42	No indication since last message.
M 44	0710				800	

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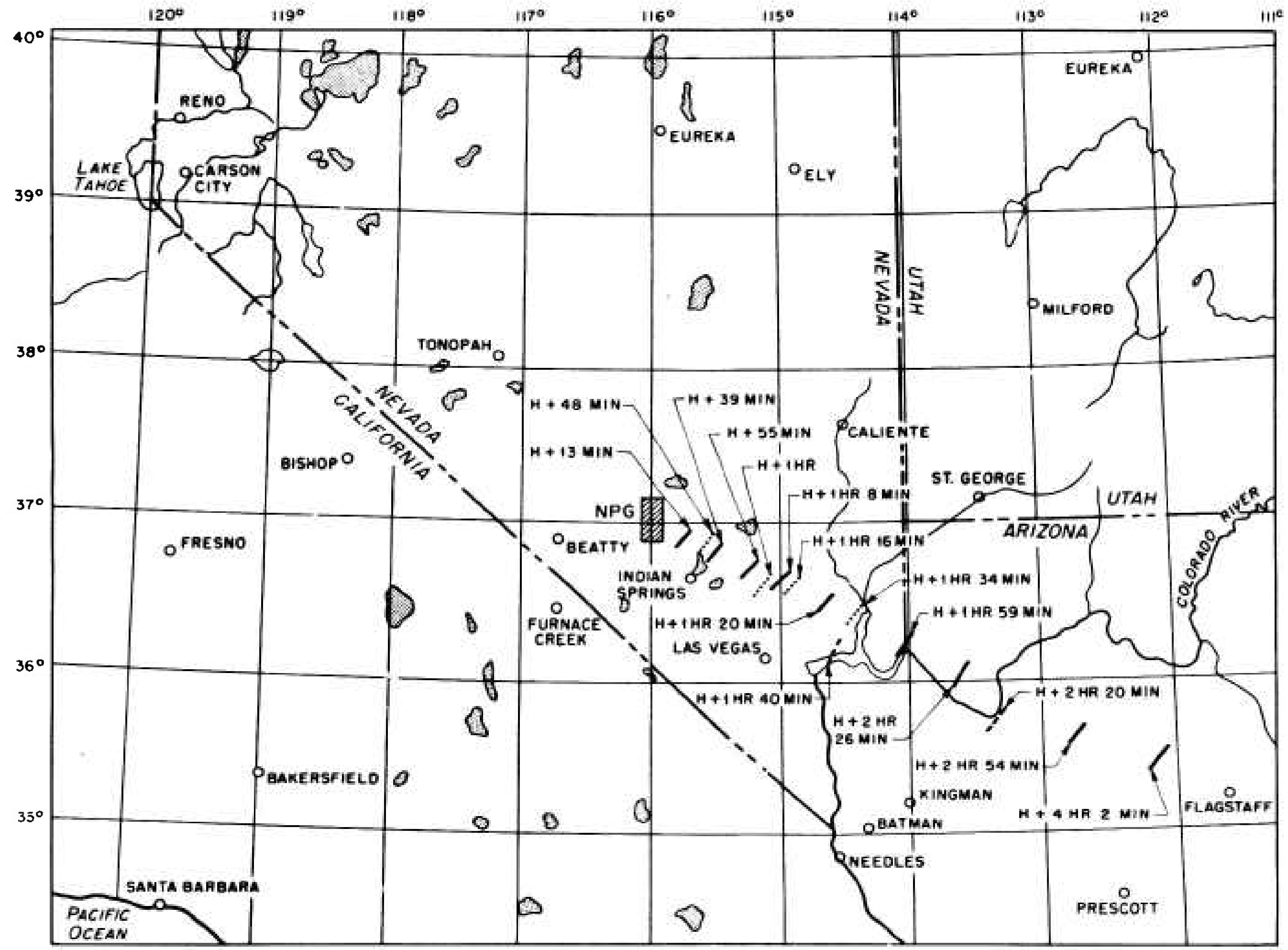
Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
N 45	0722	22,000	Unknown		60	
N 47	0729	22,000	Unknown		28	Background count.
P 46	0731	22,000	Unknown		48	
Q 47	0743	22,000	Unknown		400	
U 48	0759	22,000	Unknown		110	
T 50	0806	22,000	Unknown		46	
V 46	0825	22,000	Unknown		37	Background count.
U 45	0835	22,000	Unknown		54	
U 52	0845	22,000	Unknown		26	Requesting further instructions.
V 50	0907	22,000	Unknown		80	Sent home.
			Cook Book 3 (B-25)			
D 43	0553	12,000	South	0.4		Background 0.4.
F ½45	0605	12,000	South	11	17	Background 0.6. High 17.
G ½44	0621	12,000	South	8	13	Background 0.5. High 13.
J ½45½	0639	12,000	SE	5	6	Background 1.0. High 9.
K ½45	0654	12,000	SE	7	9	Background 0.6. High 9.
I ½ 44½	0702	12,000	SE	6	8	Background 0.6. High 10.
B 44	0724	12,000	SE	7	9	Background 0.5. High 9.
M 44 to B 42	0735 0840	12,000		0	0	Background 0.3. Zigzag course.

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 11

ACTUAL CLOUD TRACK, SHOT HARRY, 19 MAY 1953



........, 12,000 ft msl. ———, 18,000 ft msl. -------, 22,000 ft msl. Cloud top, 44,200 ft msl.

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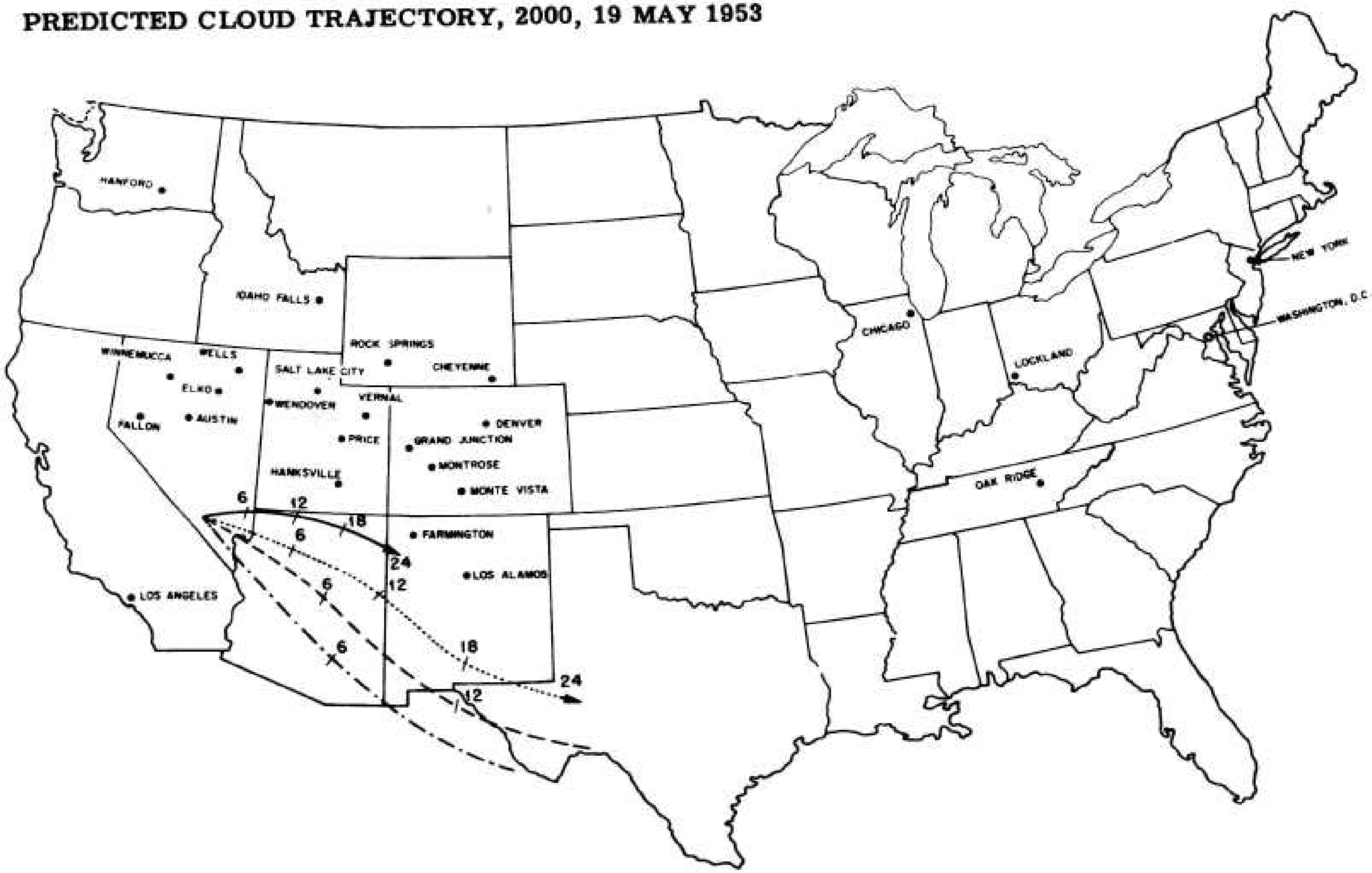
Inclosure 12

PREDICTED CLOUD TRAJECTORY, 2000, 19 MAY 1953



———, 10,000 ft msl. ·······, 20,000 ft msl. -------, 30,000 ft msl. -·-·-·-, 40,000 ft msl.

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Inclosure 13

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter readings, mr/hr
L-18	0517	20	0
M-17	0518	20	0
L-19	0521	20	0
$M+\frac{1}{4}16+\frac{3}{4}$	0520	20	10
Stake line 114	0521	20	100
Stake line 111	0522	20	1000
$M+\frac{3}{4}17+\frac{3}{4}$	0523	20	10000
Stake line 728	0540	20	100
$M+\frac{1}{4}16+\frac{1}{2}$	0541	20	1000
$M+\frac{1}{2}16+\frac{1}{2}$	0542	20	10000
N-12	0551	20	0
$N+12+\frac{3}{4}$	0552	20	10
$M+\frac{3}{4}14+\frac{1}{2}$	0553	20	100
$M+\frac{1}{2}15\frac{1}{4}$	0554	20	1000
$M+\frac{1}{2}15\frac{1}{2}$	0554	20	10000
$N-12+\frac{3}{4}$	0605	20	10
$N+\frac{1}{4}12+\frac{3}{4}$	0606	20	100
$N+\frac{1}{2}12+\frac{3}{4}$	0606	20	1000
$N+\frac{3}{4}12+\frac{3}{4}$	0607	20	10000

*The coordinates are those listed in Incl. 19, Chap. 3.

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Inclosure 14

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B
A ½45/46	0816	500	0.03	0
A 45	0820	500	0.03	0
A 44	0823	500	0	0.06
A 43	0829	500	0.04	0
A ¼42/43	0831	500	20	800
A 42	0833	500	2	0.05
A 41	0837	500	0.03	0
½A/B 42	0845	500	11	14
½A/B ⅓ 42/43	0847	500	>20	160
½A/B 43	0849	500	0.04	0
½A/B 44	0853	500	0.04	0
½B/C 44	0856	500	0.03	0
½B/C 43	0902	500	0.04	0
½B/C 42	0907	500	5	4.8
½B/C ½41/42	0910	500	10	10
C 42	0915	500	8	8
C 43	0920	500	>20	28
C 44	0930	500	0.05	0.2
D 45	0932	500	0.03	0.1
D 44	0935	500	0.05	0.2
D 43	0939	500	0.7	1.2
D 42	0945	500	0.04	0.6
½D/E 42	0946	500	0.4	0.6
½D/E 43	0952	500	6	8
½D/E 44	0958	500	0.03	0.4
½D/E 45	1001	500	0.03	0.4

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 15

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	Meter readings, mr/hr T1B	C-1 Air foil
D 1/4 45/46	0907	500	0.03	0	
E 45	0910	500	0.03	0	
F 44	0915	500	0.05	0	
F 43	0920	500	1.6	1.4	
F 42	0924	500	0.8	0.8	
G 32	0926	500	0.3	0	
G 43	0931	500	3	2.4	
G 44	0935	500	0.1	0	
G 45	0941	500	0.04	0	
G 46	0947	500	0.02	0	2
H 47	0957	500	0.015		
I 46	0956	500	0.04		
I 45	1000	500	0.04		
I 44	1004	500	0.03		
I 43	1008	500	0.6	0.8	
J 42	1012	500	0.09	0.13	
K 42	1015	500	0.25	0.5	
K 43	1019	500	0.7	0.7	
K 44	1025	500	0.04	0	
K 45	1030	500	0.025	0	
K 46	1034	500	0.025	0	5
K 47	1037	500	0.025	0	
L 46	1041	500	0.025	0	
L 45	1046	500	0.025	0.1	
L 44	1049	500	0.05	0	
L 43	1055	500	0.2	0.2	
V 42	1108	1500	0.25	0.2	
P 42	1112	2000	0.15	0.2	
P 43	1116	2000	0.5	0.5	
P 44	1121	2000	0.2	0.2	

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	C-1 Air foil
P 45	1129	2000	0.2	0.2	
P 46	1132	2000	0.03	0	
O 47	1137	2500	0.1	0.2	
N 48	1145	2000	0.02	0.1	

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

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Inclosure 16

DATA FOR D+1 TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

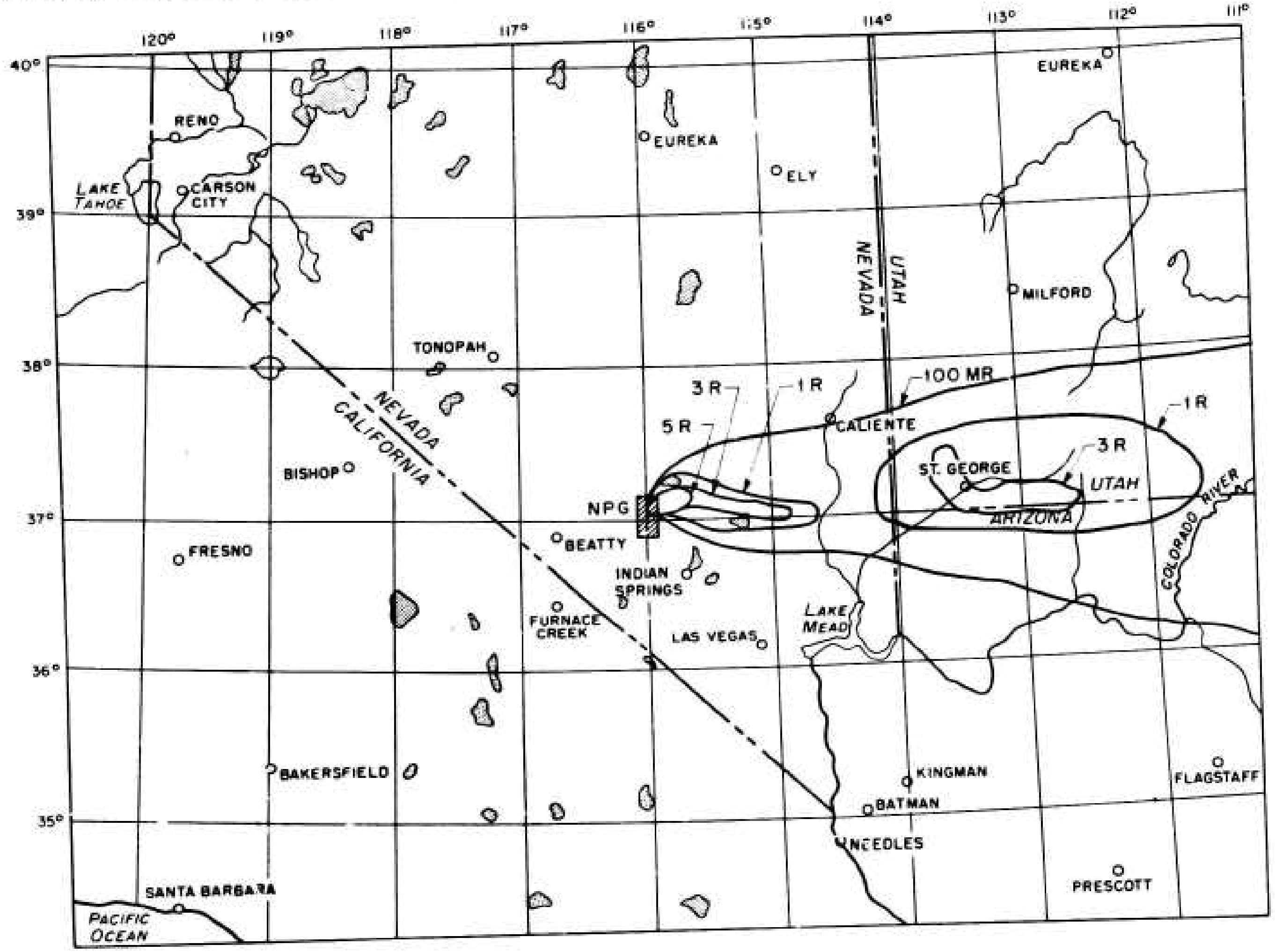
Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	Meter readings, mr/hr T1B	Calculated ground intensity	Infinite dose, r	Remarks
A-½42/43	0840	500	>20	80	800	100	
¾A/B-¼42/41	0850	550	2	2	20	4.5	50 head of cattle
B-42	0853	600	6	4.5	60	10	
C-43/44	0857	500	1	0.7	8	2	
C-44	0909	1000	0.1	0.1	2.5	0.4	
C-43	0912	750	0.1	0.1	1.5	0.3	
C-½42/43	0914	550	1.3	0.8	13	2.5	
C-41	0918	400	0.2	0.2	1.4	0.2	
E-½42/43	0929	450	0.3	0.14	2.4	0.5	
½E/F-43	0931	200	5	4	20	4.5	
½F/G-½42/43	1013	450	0.2	0.15	1.6	0.3	
G-43	1016	650	2	1.2	24	4.5	
H-45	1023	550	0.1	0.1	1	0.2	
I-44	1029	500	0.3	0.3	2.4	0.5	
I-½43/44	1031	400	0.2	0.16	1.5	0.2	
I-43	1034	200	0.5	0.6	1.5	0.3	
J-42	1037	300	0.3	0.15	2	0.5	
K-½42/43	1046	500	0.3	0.2	2.4	0.4	
½K/L-43	1048	300	0.5	0.4	3	0.7	
	1056	500	0.2	0.2	1.6	0.3	Bunkerville
	1058	400	0.4	0.3	3	0.6	Mesquite
N-44	1101	550	1.4	1.0	12	2	
½M/N-43	1103	550	1.8	1.4	15	3	
½M/N-42	1110	600	1.4	1.2	15	3	
O-52	1117	400	2	1.5	15	3	Santa Clara
	1120	500	2.4	1.8	20	4	St. George
	1121	500	1	0.7	10	2	Washington
	1124	500	1.3	0.8	13	3	Leeds
	1128	500	1.3	0.8	13	3	Hurricane
R-43	1132	500	3.1	2.5	25	5	

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	Calculated ground intensity	Infinite dose, r	Remarks
R-½43/44	1135	500	1	0.6	10	2	
S-44	1136	500	1	0.5	10	2	
U-44	1145	300	0.2	0.2	1	0.2	
	1150	500	2.4	1.6	20	3.5	Fedonia
	1155	500	2	1.2	16	3	Kanab
V-42	1204	500	1	0.8	8	1.5	
Z-42	1220	400	0.4	0.4	3	0.4	
V-44	1234	400	0.2	0.4	1.5	0.2	

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 17

INFINITE DOSE FALL-OUT PATTERN, SHOT HARRY



Pattern based on combined air and ground survey data. 19 May 1953, Shot Harry.

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Inclosure 18

REPORT ON SEQUENCE OF EVENTS IN ST. GEORGE, UTAH, FOLLOWING SHOT HARRY

May 30, 1953

TO: Lt. Colonel T. D. Collison, Radiological Safety Officer, N.P.G.

FROM: William S. Johnson, Off-Site Rad/Safe Operations Officer, N.P.G.

SUBJECT: LETTER OF TRANSMITTAL

The attached memorandum has been compiled by Frank A. Butrico, Off-Site Monitor, to elaborate on the sequence of events surrounding the situation which developed at St. George, Utah, following Shot Harry. It is felt that this report will be of interest to the parties listed in the distribution below, though not strictly appropriate for inclusion in the body of the shot report previously submitted.

WILLIAM S. JOHNSON
Off-Site Operations Officer
Nevada Proving Grounds

WSJ/js

cc: Advisory Panel (6)
Rad/Safe Staff Officer (3)
P. A. Lawrence
F. A. Butrico
J-3 (Lyon)
File

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TO: Mr. William Johnson, Off-Site Rad/Safe Officer, NPG

FROM: Mr. Frank A. Butrico, Off-Site Monitor, NPG

SUBJECT: REPORT ON THE SEQUENCE OF EVENTS OCCURRING IN ST. GEORGE, UTAH, AS A RESULT OF THE DETONATION OF SHOT IX.

This report covers the period from 0650 on May 18, when I was notified by radio to await the arrival of Mr. Sullivan (AEC) and establish a precautionary roadblock in St. George, Utah, to May 23, 1953.

At 0720 contact was made with Mr. Sullivan and his two assistants. We all proceeded to the State truck weighing station in Santa Clara, where it was thought best to set up the roadblock. The Sheriff in St. George was notified of the situation in the event we later had to solicit his assistance. The roadblock was in operation at 0745. At 0750, instructions were received by radio to stop all traffic moving southwest towards Mesquite and Las Vegas. At this time, it was decided to move the roadblock from the weighing station to a point closer to St. George, so that motorists would have somewhere to wait. The intersection of Highways 18 and 91 was selected and at 0800, this roadblock was in operation. The procedure for making the change-over from one location to the other was such that no cars passed through to the west.

The location of the second roadblock later proved to be a good choice in that when fall-out occurred in the center of St. George, the readings obtained at this checkpoint were much less. (The peak reading obtained in St. George was 320 mr/hr, while at the roadblock, 180 mr/hr was the highest obtained.) At 0805 the roadblock was extended to include the monitoring of cars coming from the west over Highway 91. On the average, one out of every five cars monitored required decontamination. A decontamination station was set up at the Utah Oil Service Station on Main Street.

At about 0845, it was noticed that the number of cars requiring decontamination was increasing as well as the readings being obtained. (Appendix A contains the readings on cars exceeding the set tolerance levels, which were obtained from the time the roadblock was started until fall-out was discovered.) As a result, it became necessary to arrange for additional decon stations. Negotiations were completed with the Texaco Service Station and the Texaco Pioneer Service Station for this additional work.

At about 0910 readings of 300 to 320 mr/hr were being obtained in and out of the cars. It then became evident that something else was happening, probably fall-out. A quick trip was made to Dixie College to check the background recorder. As was suspected, fall-out had started at 0845, and at 0915 the peak had not as yet been reached.

Immediately, the decontamination operation was stopped. Word was sent to the people at the roadblock to stop monitoring and have the motorists stand by for 20 minutes to an hour. A telephone call was made to CP to inform them of the situation. At 0925 instructions were received to have the people in St. George take cover. The Sheriff was notified and he in turn contacted the radio station in Cedar City to get the announcement over the air. In addition, the school principals were notified of the situation so that children would not be sent out into the open during recess periods. At 0940 the bulk of the population in the city of St. George was under cover. The effectiveness of the operation was amazing.

By this time we had about 200 cars at the roadblock, 100 going in each direction, and about 25 cars and 3 trucks at the service stations in St. George.

While everything was at a standstill, monitoring of the area continued. A high reading of 320 was obtained at 1015.

At 1020 Alpha 65 arrived to assist in the roadblock. Their instruments were used to take check readings during the fall-out.

At 1100 telephone instructions were received, requesting Alpha 65 to proceed to Cedar City to monitor and decontaminate cars that would be coming from St. George. It was also indicated that cars proceeding south be allowed to go, since roadblocks had been established between Mesquite and Las Vegas to take care of any vehicles requiring decontamination. The cars going south were released immediately and Alpha 65 made plans to leave for Cedar City. My original thought was to wait 45 minutes or so before starting the traffic moving towards Cedar City. This would allow Alpha 65 time to get there and get organized. However, after making a trip to the roadblock and noting that people were getting annoyed at being delayed so long, it was decided to start them moving as soon as possible. Alpha 65 was informed of the situation before departing. Traffic to Cedar City was started 15 minutes after Alpha 65 departed. Some time was gained by moving traffic one vehicle at a time and explaining the situation to each one.

At 1135 one of the AEC roadblock monitors was sent to the airport to meet Mr. Saunders and a few others that were arriving to look over the situation. I was informed of their arrival from CP by telephone.

At 1150, Bravo 71 arrived and was instructed to proceed on a monitoring run to Cedar City along the route suggested by CP.

At 1245, Mr. Saunders arrived in St. George and was briefed on the local situation as it was at that time. It was decided that his group could best assist by proceeding to Cedar City and contacting Alpha 65 at the roadblock.

The five additional film badges brought in by Mr. Saunders' group were located at various points in St. George as follows:

012919	Big Hand Cafe
012917	Sheriff's Office
012920	City Hall
012922	Dixie College, work shop
012918	Dixie College, laboratory

At 1830 Alpha 65 returned to St. George and informed me of a communication he received from CP to the effect that I would remain in St. George a few days longer to answer questions and decontaminate any vehicles that might stop for this purpose. A press release was coming out informing the residents and the motorists of my presence in St. George.

At 1900 a Mr. Leroy J. Bailey of La Verkin, Utah, stopped me and told me a story of some goats owned by a friend of his that turned blue after each atomic explosion at the NPG. I decided to go out to the farm with him and investigate. When we got there, we saw the goats with the blue patches as he mentioned. He also indicated that they would be white again in a few days. I decided I would return each day for the next few days to observe this change.

At 2200 CP called by telephone to inform me of a change in plan for the assignments on May 20. I was to proceed to Orderville, Utah, and contact a Mr. E. H. Ellett, a mine operator who reported that three people including himself had become ill as a result of radioactive fall-out from Shot IX. It was further suggested that I contact Mr. Ellett that evening and make an appointment. In the meantime, Alpha 65 was to remain in St. George and do the public relations work until I returned.

The call was made to Mr. Ellett in Ordersville and an appointment made for 10 a.m., May 20.

At 0730, Mr. Lefler and I departed for Ordersville, arriving there at 1005. We explained the purpose of our visit to Mr. Ellett and said that we would like to see the mine area where the illness occurred.

At the mine area, readings were taken at various points, and the highest obtained was 15 mr/hr at 1200. An inside reading of 8 mr/hr was obtained in one of the homes. Mr. Ellett's clothes read 8 to 10 mr/hr. Mr. Ellett was next asked to recapitulate the sequence of events preceding the onset of the illness. The following is the story as related to me by Mr. Ellett.

At about 0945 on May 19, the 10 residents at the Salina Mining Co. received news, via the radio, of the fall-out occurring in St. George and the residents being told to take cover. At about 1045 Mr. Ellett noted that his MX-5 instrument was off scale on what he called the third stage (20 scale). They immediately became concerned. At about 1110 a Mr. Davies, who is connected with the mine operation, arrived to inform them of the situation in St. George and that in view of the readings they were getting on their instruments, it would be best to evacuate the camp. Apparently, Mr. Davies had a scintillation counter that was also off scale. (This instrument was not available for us to see.) In the meantime, Mr. Ellett and two others became ill. They felt nauseated, vomited, and got a headache. At about 12:15 everyone left camp. Mr. Ellett explained that when he got over the ridge (about 2 to 3 miles) he felt much better. When he arrived in Orderville, he went to a physician and was told he could not get help from him, since he knew nothing about radiation illness. The doctor did not perform any tests nor did he give him any medication. The next morning, Mr. Ellett had fully recovered, but Mr. Davies and Mrs. Stevens were still ill. In addition, Mrs. Ellett had a headache that morning and was breaking out with a rash.

In the discussion that followed, I explained that on the basis of the readings we were presently obtaining, their maximum reading the day before was probably about 40 to 60 mr/hr, which was considerably less than we had obtained in St. George. These, as well as those readings obtained in St. George, were not considered dangerous or sufficiently high to cause radiation sickness. As for Mr. Ellett's illness, it might have been some gastro-intestinal disturbance and the fact that it happened that morning could have been coincidental. In addition it was indicated that the cause of the other illnesses might have been anxiety over learning the news of the situation in St. George, followed by Mr. Davies' statements about the "high" fall-out and his suggestion to evacuate the camp.

It was further explained to Mr. Ellett that another factor ruling out radiation sickness in his case was the short time elapsing between exposure and the onset of the illness and his rather quick recovery after leaving camp. Mr. Ellett explained, however, that Mr. Davies had not recovered as fast and was still ill.

Although this and some other questions could not be answered, due to the many variables involved, Mr. Ellett seems to be satisfied with our explanations and thanked us for the interest we had taken in making the investigation.

In reviewing Mr. Ellett's story, there are a number of points that should be stressed. Everyone at the mine left within $1\frac{1}{2}$ hr after the fall-out was detected on their instruments. Mr. Davies, who was reported as still being ill, was at the mine only long enough to tell the rest to evacuate. According to Mr. Ellett, this was only 30 min. When questioning Mr. Ellett about the doctor he consulted and whether he could be reached for questioning, he was rather evasive with his answers. However, I later obtained the information I wanted. The following persons were at the mine on May 19: Mr. and Mrs. E. H. Ellett, Mr. and Mrs. George Stevens and three children, Mr. Byron Davies, and two other miners whose names Mr. Ellett could not remember.

Only Mr. and Mrs. Ellett, Mrs. George Stevens and Mr. Davies became ill. Mr. Ellett obtained medical advice from Dr. P. H. Fulstow in Kanab (telephone number 229).

We next proceeded to Cedar City to inform the city manager, Mr. Thorson, of our visit with Mr. Ellett. Apparently the illness was originally reported to him and he in turn notified AEC on the evening of May 19.

While in Mr. Thorson's office, Mr. Saunders and members of the Advisory Panel arrived. I repeated my story to them of my visit with Mr. Ellett. They appeared to be satisfied with my handling of the situation and decided not to pursue it further.

Mr. Saunders gave me the telephone number of a Mrs. Arthur Blake in St. George requesting that I call regarding her sister's illness.

I returned to St. George that evening and relieved Alpha 65 for the return trip to Mercury.

At 10:15 on May 21, I called Mrs. Blake. She informed me that everything was all right and that her sister had fully recovered by noon May 20 and was in St. George that evening. She was taken ill in Gunlock. Her name is Mrs. Richard Bowler.

At 10:30, I again visited Mrs. Mills' farm to look at the goats and obtain a sample of milk. The goats were losing some of the blue color observed the night before. Mrs. Mills gave me a sample of milk she had obtained from the goats at 0700 that morning.

At 10:45, I was informed from CP to remain in St. George a few days longer and told that Mr. Lawrence might arrive by plane to bring me additional instruments.

At 1515 Mr. Lawrence arrived and we proceeded to start collecting some of the film badges I had located at various places in town a few days before. We next visited Mrs. Mills' farm to look at the goats. While there, Mr. Lawrence made an interesting observation which may explain the blue color. The goats were observed rubbing against the zinc-coated wire-mesh enclosure and it is likely that the zinc coating on the wire is the source of the blue color. It might be that when fall-out occurs their skin is irritated and they rub against the fence more frequently. However, Mrs. Mills said she thought of this but that this same thing happened last year when they had no wire enclosure.

Mr. Lawrence and I then discussed the milk situation. I had already contacted the county agent's office to obtain the names of the milk producers in the area. He was not in, but I did get the name of the president of the Washington County Dairymen Association. He also was not available. In discussing this with Mr. Lawrence, I explained that it was just as well neither one was available, since I was afraid it might create a disturbance, should it become generally known that we were collecting milk samples for analysis. In view of Tuesday's episode, everyone in St. George was a little concerned over any unusual incident connected with the radioactive fall-out and it would not take much to start wild rumors. For this reason, it was agreed that the direct approach for the collection of milk samples would not be pursued further at this time. We already had one sample of the goats milk and if at all possible, I would try to buy some local milk from a store.

That evening I purchased a quart of milk from a store in town. I located the producer and in discussing his milk supply in a general way, I was able to learn that the milk I had purchased that evening was obtained from the St. George herd on Tuesday evening.

At 1200 on May 22, Dr. Voelz replaced me in St. George so that I could return to Mercury. Enroute back, stops were made in Mesquite, Bunkerville and Las Vegas to obtain milk samples and to collect more information for the sanitary survey report being prepared.

RECOMMENDATIONS

The events, as they occurred in St. George, point up the need for educating the people in the communities within the 200-mile radius of the Proving Grounds. Most of them are not aware of the precautions being taken to safeguard them. Most of them are informed by individuals who do not understand the significance of instrument readings and who delight in exhibiting the movement of a needle over the dial of an instrument. Invariably, these "amateurs" use MX-5 instruments for their demonstrations. I think it would be advisable to organize demonstration teams that could visit these communities and talk before their civic groups. It is important that they reach lay people who have little understanding of the effects of radiation, but who are the ones concerned when something happens. Visiting the local officials helps, but in my estimation, it is not sufficient.

If this is not possible, some thought might be given to preparing information bulletins or cards, not too detailed, which could be distributed to most of the people. These sheets or cards could be made up similar to the pocket size civil defense information cards, which are widely distributed around the country.

FRANK A. BUTRICO
Off-Site Rad/Safe Monitor
Nevada Proving Grounds

Appendix A — Roadblock Operation, Shot IX, May 19, 1953, St. George, Utah*

Car license	Car owner	Address	Readings Inside	Readings Outside	Approximate time passed roadblock
California 5Z2834	E. B. Jones	517 N. Labray Inglewood, Calif.	30	32	0815
Arizona T-1352	Phillip Reber	Littlefield, Ariz.	60	80	0820
Utah K L 210	Ronald Stewart	Spanish Fork, Utah	64	90	0825
Utah W J 864	B. V. Butler	310 G Court, Todd Park Tivale, Utah	20	20	0830
Wyoming 4D11	John Frullo	Rock Springs, Wyo.	64	90	0835
Utah C F 638	A. J. Thompson	33 S. 11 East Salt Lake City, Utah	100	110	0840
California 1V83774	Ethel Flanagan	3030 Cortlandt Detroit, Michigan	260†	300†	0845
N. H. L E 458	Joseph Dumont	72 Beloc St. Nashua, New Hampshire	360†	360†	0850
California 1N49533	E. Drinkwater	1224 N. Alameda Glendale, California	340†	360†	0855

* List of cars showing readings in excess of tolerance levels from the time roadblock began until fall-out was discovered.

† When these readings were taken, fall-out was occurring.

Chapter 11

SHOT GRABLE*

11.1 INTRODUCTION

11.1.1 The tenth shot of the Upshot-Knothole series, Grable, was detonated at about 500 ft above the ground in Frenchman Flat, NPG, at 0830 PDT, 25 May 1953. The winds at the higher levels carried the cloud out of the area very rapidly. The cloud had passed Salt Lake City by 1200. No fall-out was detected in either Salt Lake City or Ogden. The maximum fall-out encountered was 7 mr/hr at Lincoln Mine.

11.2 ON-SITE OPERATIONS

11.2.1 The initial ground survey reports began at 0846, and the survey was completed by 0940. The survey was difficult to make because of the heavy dust clouds in the test area. Delay in completing the survey in the northeast quadrant was caused by damage to the fence around a mine field in that quadrant. Mercury Highway was open for all traffic at 0915. R (general recovery) hour was announced at 0952 for all scheduled events except those projects located in the northeast quadrant of the test area. Three projects were cleared into the area before R hour. The initial survey and subsequent surveys are shown in Incl. 1.

11.2.2 The usual dry runs for the radiological survey teams were conducted previous to D-day. On D−1 a survey was conducted in Areas 7 and 3A and in Frenchman Flat to determine the levels of contamination in these areas prior to the shot in Frenchman Flat. The Frenchman Flat area was free of any contamination.

11.2.3 The assembly point for the various sections for this shot was the General Observer Area located approximately five miles northwest of the junction of Mercury Highway and the Frenchman Flat access road. A Rad-Safe processing station was established here and was moved at 0910 to the Frenchman Flat access road. A check point was maintained in the Yucca Flat area and by 0930 a continuous check point was established in Frenchman Flat on the main access road near the 10 mr/hr line.

11.2.4 During the period of this report approximately 281 parties were processed into Yucca Flat and approximately 216 parties were processed into Frenchman Flat. The heavy work load encountered made it imperative that everyone, including administrative personnel, who had a low accumulative dosage of radiation to date be utilized as monitors on D-day, D+1, and D+2. Approximately 3,000 film badges were processed during this period. The vehicle decontamination section decontaminated 35 trucks, 3 jeeps, 9 sedans, 1 bus, 1 station wagon, 1 semi-tractor and trailer, and a great deal of equipment used in the test.

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*Period covered, 25 May to 30 May 1953.

11.3 OFF-SITE OPERATIONS

11.3.1 The changes in the anticipated fall-out pattern from Shot Grable are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705).

11.3.2 Minimal fall-out was detected within the 200 mile region with levels only slightly above normal background recorded at Groom Mine, Lincoln Mine, Ely, Currant, Preston, and Lund. Also at various points along highways connecting these communities measurable levels were found. A documentation of the ground monitoring results is given in Incl. 2.

11.3.3 In addition to certain communities noted in paragraph 11.3.2, air sampling data indicate that significant, though minor, airborne concentrations were detected at Crystal Springs, Caliente, Panaca, Pioche, and Milford. The air sampling results are presented in Incl. 3.

11.3.4 The pictorial presentation of the fall-out pattern is shown in Incl. 4.

11.3.5 The results of water samples analyzed for fission product activity are given in Incl. 5.

11.4 AIR PARTICIPATION

11.4.1 All air space within a 50 mile radius of ground zero was closed at all altitudes from 0730 to 0900 PDT. The air space inclosed by the 30° and 90° vectors from ground zero out to a radius of 250 miles was closed at 25,000 ft msl and below from 0900 to 1200 PDT. This was changed to the 30° and 60° vectors closed out to a distance of 325 miles, except Airway Red 49 remained open. Another change was made at 1130 PDT which extended the closure time until 1400 PDT. The high level closure was from ground zero to Ely to Fairfield to Fort Bridger to Laramie to Pueblo to Las Vegas to ground zero at 25,000 ft and above from 0830 to 1430 PDT. This was changed to an area bounded by a line from ground zero to Fairfield to Fort Bridger to Cheyenne to ground zero closed until 1200 PDT. At 1140 PDT another change was made in the high level area. At this time the air space above 25,000 ft and bounded by a line from Salt Lake City to Price to Rapid City to Miles City to Salt Lake City was closed from 1200 to 1500 PDT. The warning circle had a radius of 150 miles around Enterprise Radio from 0730 to 1200 PDT. This was changed to a 230 mile radius at 1015. At 1200 all air space west of a line from Price to Salt Lake was opened. Green Airway 3 and all air space south was opened at all altitudes at 1300. Red Airway 1 and all air space south was open at all altitudes at 1330.

11.4.2 The cloud reached a maximum altitude of 34,800 ft msl as reported by sampler aircraft. The cloud tracking B-2_'s were able to track the cloud at 18,000 and 22,000 ft msl to about 75 miles northwest of Salt Lake City. The low level B-25 tracked the cloud at 12,000 ft. The data and plot from these aircraft are attached as Incls. 6, 7, 8, and 9. The predicted path is shown in Incl. 10.

11.4.3 The helicopter made the close-in survey. The data are attached as Incl. 11. On a special mission a maximum reading over ground zero at 500 ft was 17 r/hr. This would give a maximum ground reading of approximately 150 r/hr at H + 1 hr.

11.4.4 The L-20 was off on its portion of the terrain survey at H + 3 hr. The pattern flown and data are attached as Incl. 12. The C-47 was off at H + 4 hr. The data for this flight are attached as Incl. 13. The aircraft did not complete the mission due to severe turbulence. No fall-out was detected, and thus no fall-out plot is included.

11.5 LOGISTICS AND SUPPLY

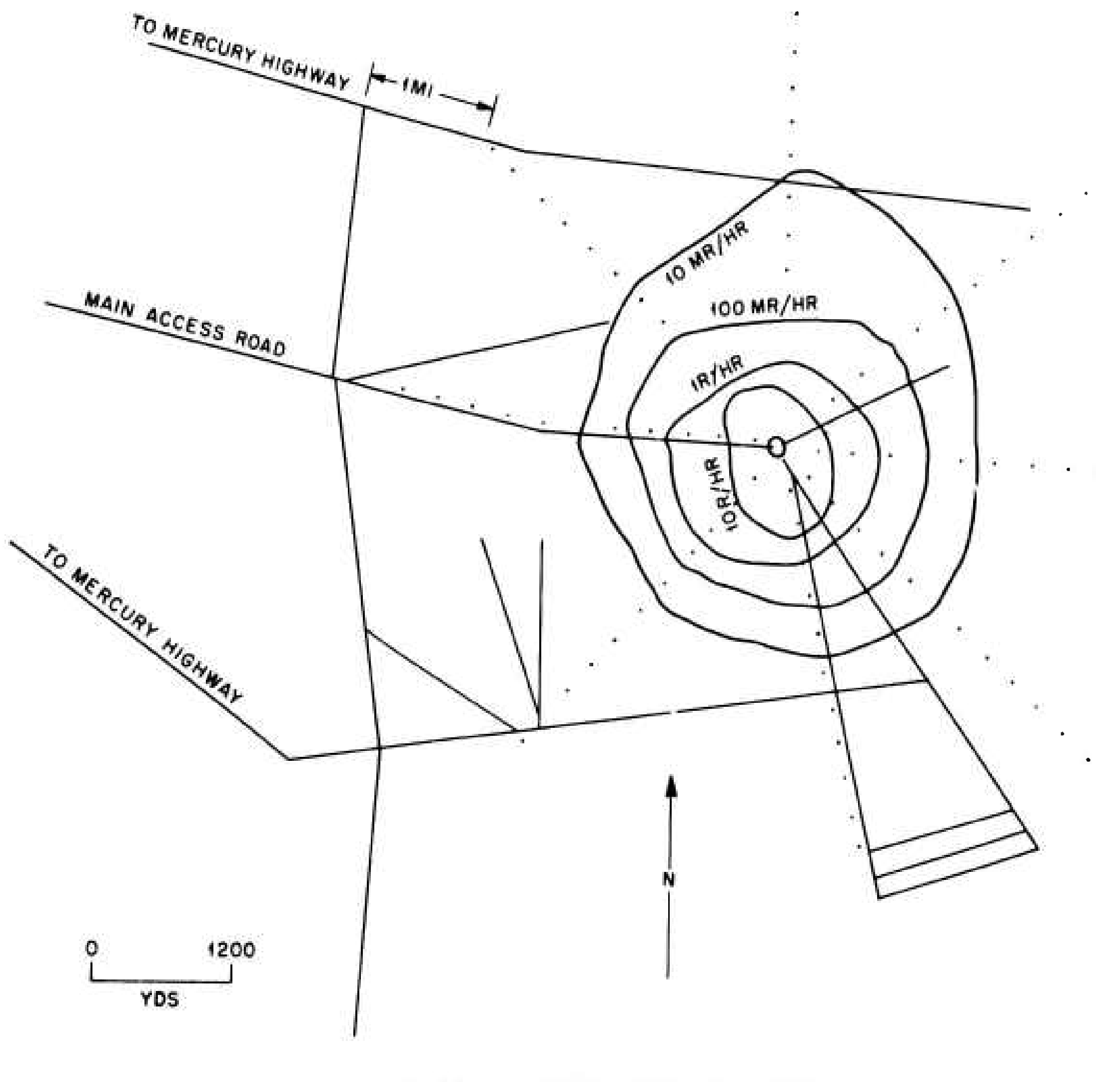
For this period, the Supply Section issued 194 protective caps, 316 pairs of shoe covers, 342 pairs of coveralls, 154 respirators, 310 pairs of cotton gloves, and 16 pairs of clear goggles. The laundry serviced 219 protective caps, 690 pairs of shoe covers, 1,006 pairs of coveralls, 321 respirators, 251 pairs of cotton gloves, and 92 towels. The Supply Section operated a mobile supply point which was located on the main access road to Frenchman Flat in addition to regular supply issue in the Rad-Safe Building. This supply point was in operation until 1700 hr on D+3 and processed an average of 75 sets of protective clothing. A total of 50 instruments were issued, and 15 were repaired. Seventy-three (73) AN/PDR-39's were packed for shipment to Army Signal Laboratory, Fort Monmouth, New Jersey. Weekly maintenance was performed on 25 vehicles, and 8 vehicles were deadlined for ordnance maintenance.

11.6 GENERAL

The radiological problem with this shot was very minor. The highest intensity of fall-out was 7 mr/hr at Lincoln Mine. The cloud passed directly over Salt Lake City; however, no detectable fall-out was found in this area. The On-Site Rad-Safe problem presented a considerable problem in logistics and personnel control. Rad-Safe roadblocks were run down in many instances, and personnel entered the area without Rad-Safe clearances. Processing personnel to enter the contaminated area at both the Rad-Safe Building and at the processing point at the access road to Frenchman Flat made control of the exposure of personnel to radiation complex as it was necessary to telephone cumulative dosage records from the building to the advance processing point.

Inclosure 1

FRENCHMAN FLAT SURVEYS, SHOT GRABLE



Initial Survey, 25 May 1953, R hour, 0950.

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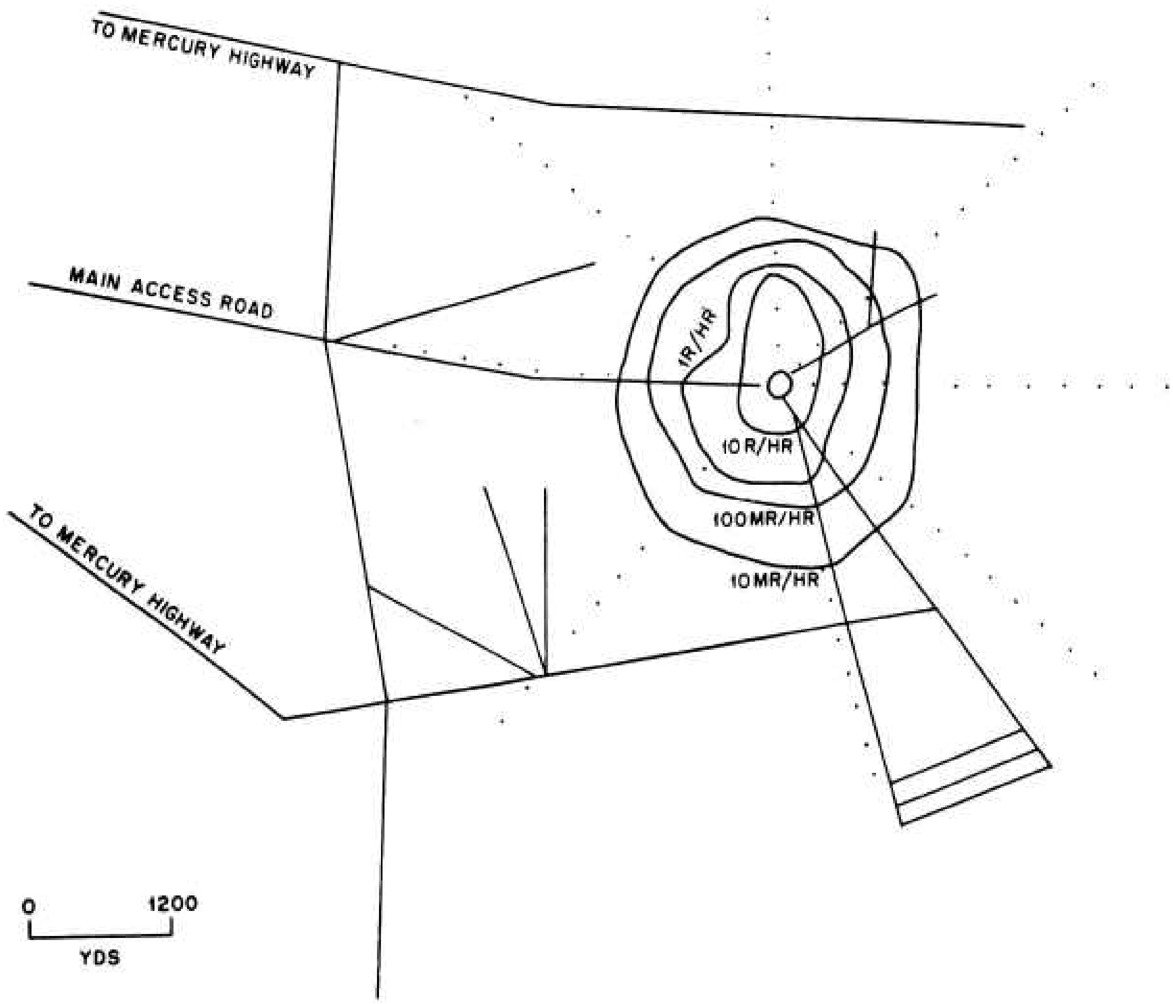
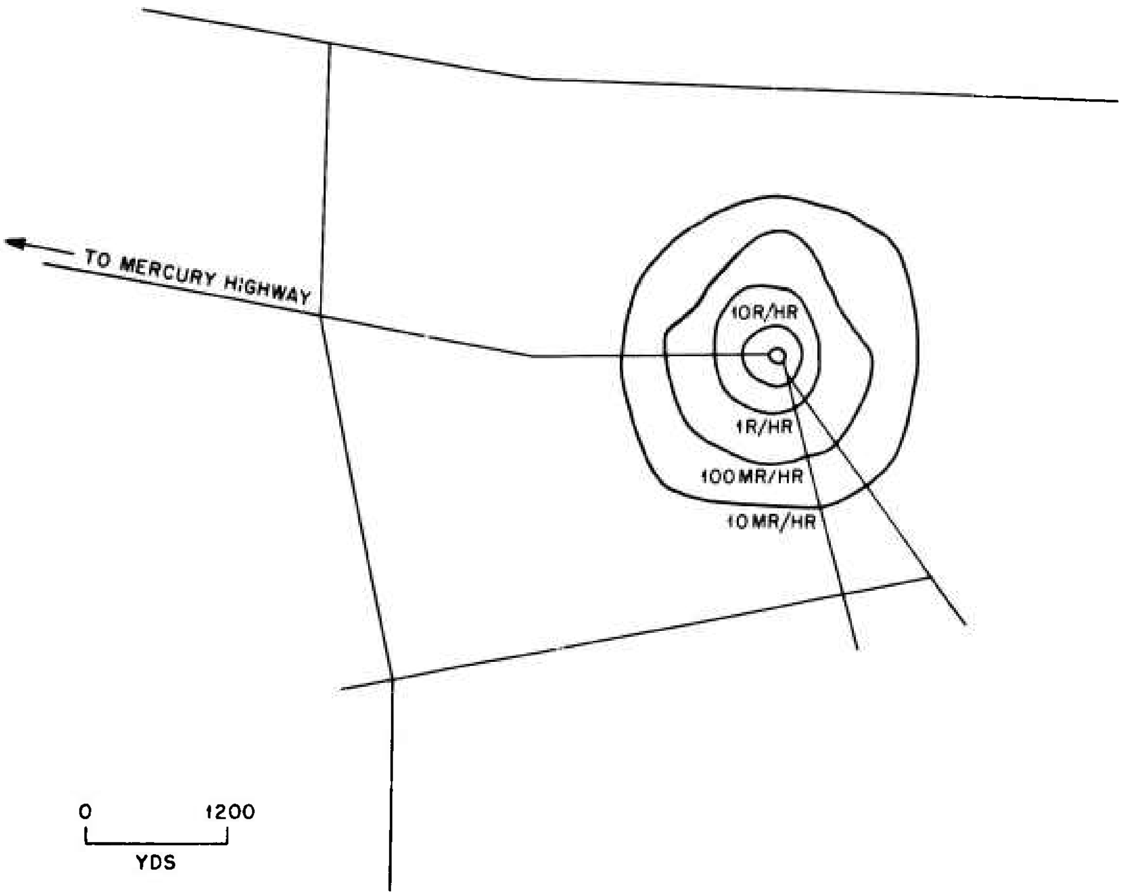
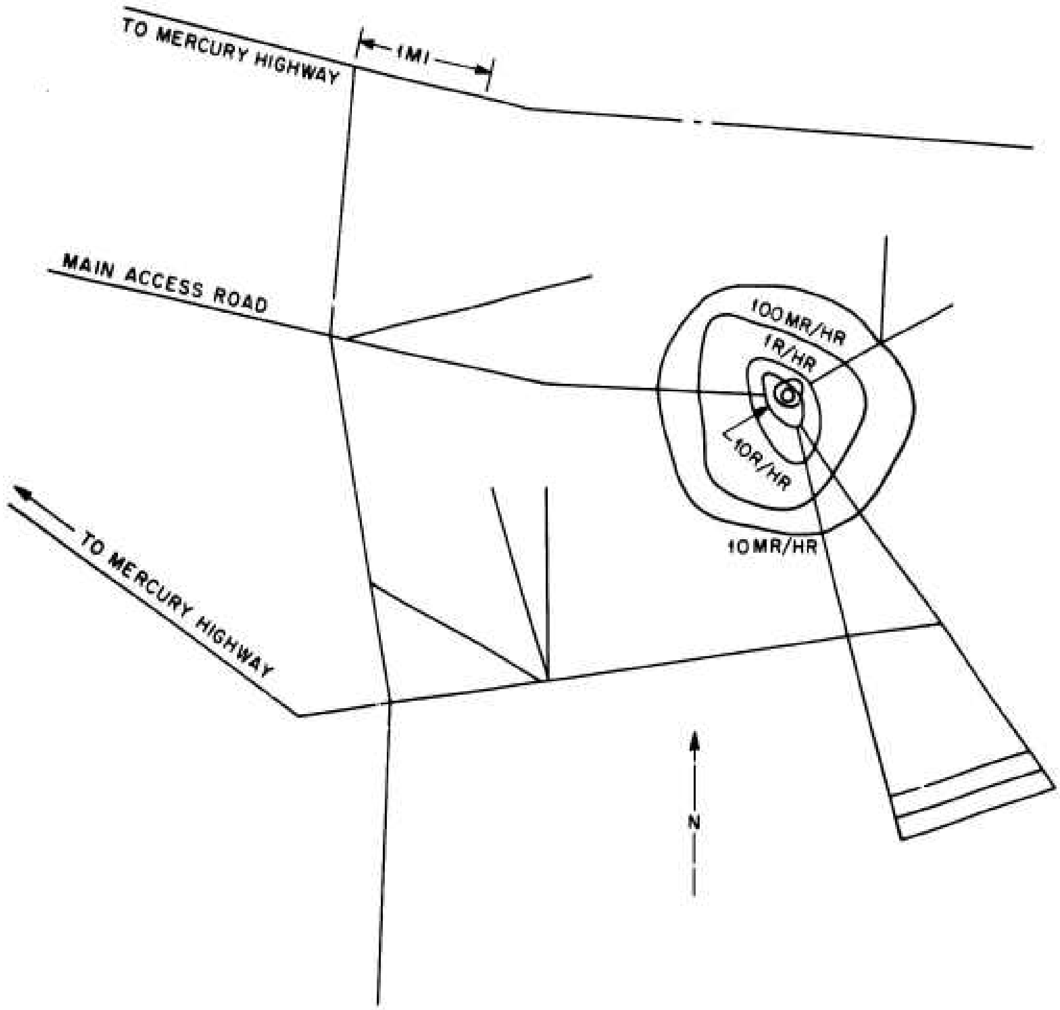
~~CONFIDENTIAL~~



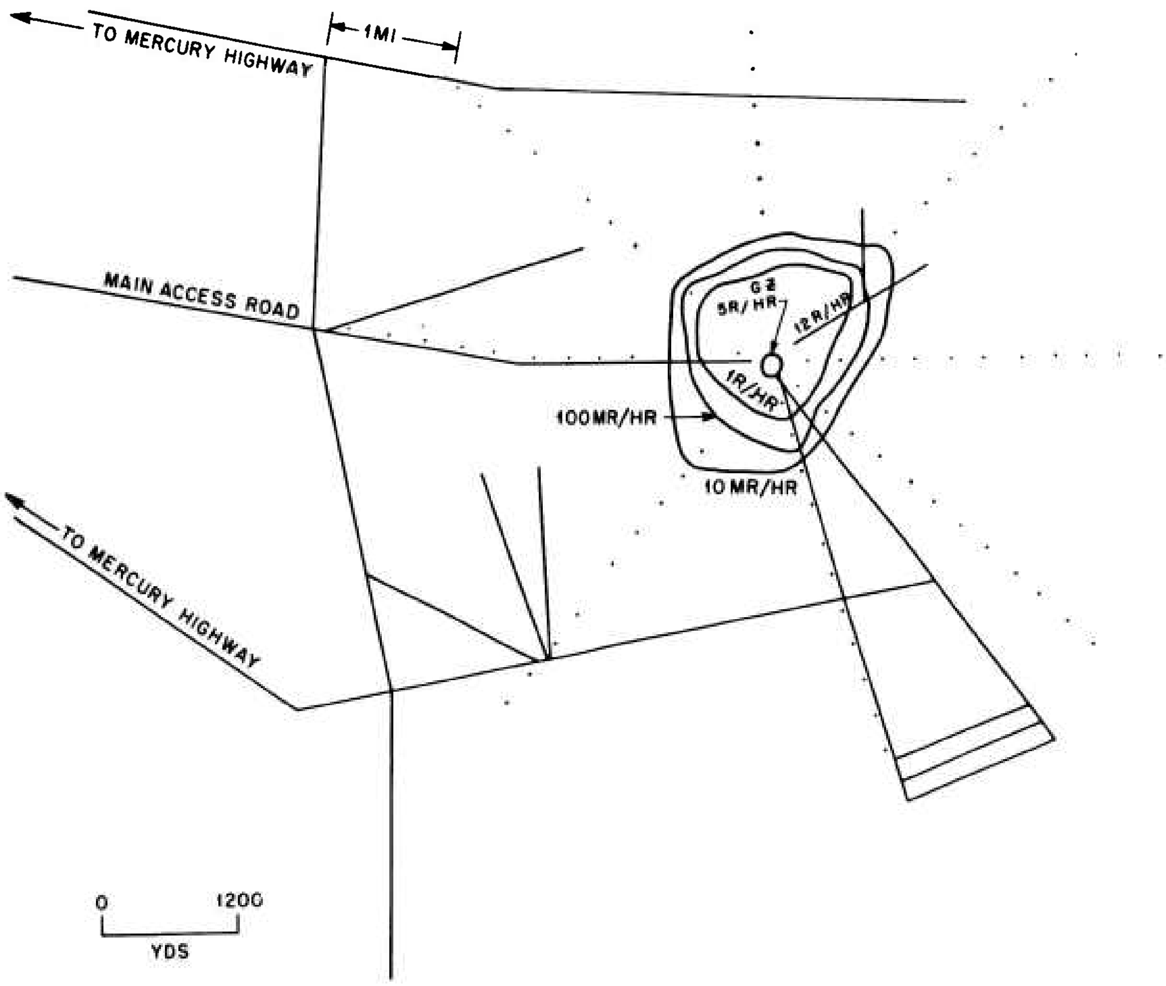
Resurvey, 1630, 25 May 1953.



Resurvey 0630, 26 May 1953.



Resurvey, 1330, 27 May 1953.



Resurvey, 1100, 28 May 1953.

Inclosure 2

GROUND MONITORING DATA, SHOT GRABLE

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Smithson	H + 1:30	Groom Mine	0.3		Shot 9 residual
Smithson	H + 0:55	Groom Mine	0.8		Fall-out occurring
Smithson	H + 1:39	Groom Mine	1.4		Fall-out occurring
Smithson	H + 1:45	Groom Mine	3.0		Fall-out occurring
Smithson	H + 2:00	Groom Mine	3.2	2	Fall-out occurring
Smithson	H + 2:20	Groom Mine	2.5	2	2.9
Smithson	H + 2:25	Groom Mine	1.1	2	1.4
Smithson	H + 3:45	Groom Mine	0.5	2	1.1
Smithson	H + 7:30	Groom Mine	0.35	2	Shot 9 residual
Smithson	H + 26:30	Groom Mine	0.35	2	Shot 9 residual
Smithson	H + 5:49	Groom Lake	0.8	2	2.8
Smithson	H + 5:54	3 miles W of Groom Lake	0.9	2	3.1
Smithson	H + 6:20	Security gate	0.1	2	0.4
Rossano	H + 0:50	Lincoln Mine	0.25	2	Fall-out occurring
Rossano	H + 1:30	Lincoln Mine	0.6	2	Fall-out occurring
Rossano	H + 1:37	Lincoln Mine	4.4	2	Fall-out occurring
Rossano	H + 1:45	Lincoln Mine	7.3	2	Fall-out occurring
Rossano	H + 2:30	Lincoln Mine	4.5	2	5.8
Rossano	H + 3:30	Lincoln Mine	3.5	2	6.8
Rossano	H + 4:30	Lincoln Mine	1.7	2	4.3
Rossano	H + 8:00	Lincoln Mine	0.8	2	4.1
Rossano	H + 24:00	Lincoln Mine	0.25	2	4.6
Rossano	H + 5:50	Lincoln Mine residential area	1.4	2	4.8
Rossano	H + 27:15	Lincoln Mine residential area	0.17	2	3.4
Rossano	H + 6:18	Road junction S of Lincoln Mine	1.2	2	4.6

[redacted] UNCLASSIFIED

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rossano	H + 27:40	Road junction S of Lincoln Mine	0.17	2	3.5
Rossano	H + 6:58	5 miles N of Lincoln Mine Junction	1.7	2	7.4
Rossano	H + 7:05	6.6 miles N of Lincoln Mine Junction	3.0	2	13
Rossano	H + 7:15	10 miles N of Lincoln Mine Junction	2.5	2	11
Rossano	H + 7:35	13 miles N of Lincoln Mine Junction	1.5	2	7.2
Rossano	H + 7:48	15 miles N of Lincoln Mine Junction	1.2	2	5.8
Rossano	H + 27:55	5 miles S of Lincoln Mine Junction	0.14	2	2.8
Rowe	H + 2:00	Pioche	Background	2	
MacMurray	H + 3:57	Pioche	Background		
Rowe	H + 10:05	Pioche	Background		
Jensen	H + 1:00 to 24:00	Pioche	Background		
Rowe	H + 9:59	2 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 2:05	3 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 2:12	8 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 9:47	12 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 2:20	13 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 2:28	18 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 9:36	22 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 2:35	23 miles N of Pioche on U.S. Hwy 93	Background		
Rowe	H + 2:45	28 miles N of Pioche on U.S. Hwy 93	Background		
MacMurray	H + 4:35	29 miles N of Pioche on U.S. Hwy 93	0.15	3	0.24
MacMurray	H + 26:25	29 miles N of Pioche on U.S. Hwy 93	0.07	3	0.8
MacMurray	H + 4:39	30 miles N of Pioche on U.S. Hwy 93	0.5	3	0.8
MacMurray	H + 4:45	32 miles N of Pioche on U.S. Hwy 93	1.25	3	1.9
Rowe	H + 9:23	32 miles N of Pioche on U.S. Hwy 93	0.5	3	1.8
MacMurray	H + 26:20	32 miles N of Pioche on U.S. Hwy 93	0.12	3	1.5
Rowe	H + 2:53	33 miles N of Pioche on U.S. Hwy 93	2.0	3	Fall-out occurring

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H + 2:55	34 miles N of Pioche on U. S. Hwy 93	2.6	3	Fall-out occurring
Rowe	H + 2:58	35 miles N of Pioche on U. S. Hwy 93	4.7	3	Fall-out occurring
MacMurray	H + 26:14	35 miles N of Pioche on U. S. Hwy 93	0.14	3	1.7
Rowe	H + 3:00	36 miles N of Pioche on U. S. Hwy 93	5.5	3	Fall-out occurring
MacMurray	H + 4:52	36 miles N of Pioche on U. S. Hwy 93	1.8	3	3.4
Rowe	H + 3:02	37 miles N of Pioche on U. S. Hwy 93	4.8	3	Fall-out occurring
Rowe	H + 9:19	37 miles N of Pioche on U. S. Hwy 93	0.8	3	2.9
Rowe	H + 3:04	38 miles N of Pioche on U. S. Hwy 93	4.5	3	Fall-out occurring
MacMurray	H + 26:08	38 miles N of Pioche on U. S. Hwy 93	0.15	3	1.8
Rowe	H + 3:08	40 miles N of Pioche on U. S. Hwy 93	3.6	3	Fall-out occurring
MacMurray	H + 5:00	41 miles N of Pioche on U. S. Hwy 93	1.25	3	2.3
MacMurray	H + 26:02	41 miles N of Pioche on U. S. Hwy 93	0.12	3	1.6
Rowe	H + 9:14	42 miles N of Pioche on U. S. Hwy 93	0.6	3	2.2
MacMurray	H + 5:05	44 miles N of Pioche on U. S. Hwy 93	0.8	3	1.5
MacMurray	H + 25:55	44 miles N of Pioche on U. S. Hwy 93	0.08	3	0.85
Rowe	H + 3:14	45 miles N of Pioche on U. S. Hwy 93	3.0	3	Fall-out occurring
Rowe	H + 9:08	47 miles N of Pioche on U. S. Hwy 93	0.3	3	1.1
MacMurray	H + 25:48	49 miles N of Pioche on U. S. Hwy 93	0.08	3	0.83
Rowe	H + 3:20	50 miles N of Pioche on U. S. Hwy 93	2.0	3	2.2
Rowe	H + 9:02	52 miles N of Pioche on U. S. Hwy 93	0.4	$3\frac{1}{2}$	1.2
MacMurray	H + 5:17	54 miles N of Pioche on U. S. Hwy 93	0.7	$3\frac{1}{2}$	1.2
Rowe	H + 3:25	55 miles N of Pioche on U. S. Hwy 93	1.5	$3\frac{1}{2}$	Fall-out occurring
Rowe	H + 8:55	57 miles N of Pioche on U. S. Hwy 93	0.6	$3\frac{1}{2}$	1.8
MacMurray	H + 25:35	59 miles N of Pioche on U. S. Hwy 93	0.1	$3\frac{1}{2}$	0.98
Rowe	H + 8:50	62 miles N of Pioche on U. S. Hwy 93	0.4	$3\frac{1}{2}$	1.2
MacMurray	H + 5:30	64 miles N of Pioche on U. S. Hwy 93	0.5	$3\frac{1}{2}$	0.85
Rowe	H + 3:33	65 miles N of Pioche on U. S. Hwy 93	1.5	$3\frac{1}{2}$	Fall-out occurring
MacMurray	H + 25:17	69 miles N of Pioche on U. S. Hwy 93	0.08	$3\frac{1}{2}$	0.65
Rowe	H + 8:40	72 miles N of Pioche on U. S. Hwy 93	0.3	$3\frac{1}{2}$	0.85
MacMurray	H + 5:44	74 miles N of Pioche on U. S. Hwy 93	0.4	$3\frac{1}{2}$	0.72

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Rowe	H + 3:45	75 miles N of Pioche on U. S. Hwy 93	1.2	3½	1.3
MacMurray	H + 5:57	79 miles N of Pioche on U. S. Hwy 93	0.15	3½	0.41
MacMurray	H + 25:00	79 miles N of Pioche on U. S. Hwy 93	0.08	3½	0.58
Rowe	H + 8:30	82 miles N of Pioche on U. S. Hwy 93	0.1	3½	0.28
MacMurray	H + 6:00 to 6:30	82 miles N of Pioche to Ely	Background		
Rowe	H + 3:55	83 miles N of Pioche to Ely	0.5	3½	0.58
Rowe	H + 4:15	93 miles N of Pioche to Ely	0.2	3½	0.25
Rowe	H + 4:25	106 miles N of Pioche to Ely	0.2	3½	0.26
Rowe	H + 4:31	Ely	0.2	4	0.23
Fetz	H + 1:00	Ely	0.1	4	
Fetz	H + 3:30	Ely	0.15	4	Fall-out occurring
Fetz	H + 3:52	Ely	0.25	4	Fall-out occurring
Fetz	H + 3:57	Ely	0.4	4	Fall-out occurring
Fetz	H + 4:05	Ely	0.3	4	Fall-out occurring
Fetz	H + 4:35	Ely	0.2	4	0.24
Fetz	H + 5:30	Ely	0.15	4	0.22
Fetz	H + 9:30	Ely	0.05	4	0.14
Fetz	H + 25:15 to 26:35	Ely to Currant	0.1	4	
Melton	H + 2:30	Currant	0.03	4	
Melton	H + 3:20	Currant	0.2	4	Fall-out occurring
Melton	H + 3:38	Currant	0.4	4	Fall-out occurring
Melton	H + 4:00	Currant	0.50	4	Fall-out occurring
Melton	H + 7:00	Currant	0.25	4	0.48
Melton	H + 10:40	Currant	0.1	4	0.32
Melton	H + 4:50	5 miles S of U. S. Hwy 6 on Nevada Hwy 38	0.4	4	0.50
Melton	H + 6:45	5 miles S of U. S. Hwy 6 on Nevada Hwy 38	0.2	4	0.38
Melton	H + 5:00	8 miles S of U. S. Hwy 6 on Nevada Hwy 38	0.3	4	0.40
Melton	H + 6:15	8 miles S of U. S. Hwy 6 on Nevada Hwy 38	0.25	4	0.42

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Melton	H + 5:10	17 miles S of U. S. Hwy 6 on Nevada Hwy 38	0.25	4	0.34
Melton	H + 5:30	Preston	0.2	4	0.30
Melton	H + 5:44	Lund	0.2	4	0.31
Melton	H + 7:25	Duckwater	0.15	4	0.31
Melton	H + 26:35 to 27:55	Currant to 61 miles SW on U. S. Hwy 6	0.09	4	0.68
Melton	H + 28:00 to 28:10	6 miles NE of Warm Springs to Warm Springs	Background		
Forsythe, C.	H + 1:00 to 24:00	Warm Springs	Background		
Melton	H + 28:10 to 29:00	Warm Springs to Tonopah	Background		
Larsen	H + 1:00 to 24:00	Tonopah	Background		
Larsen	H + 25:00 to 27:00	Tonopah to Beatty	Background		
Claborn	H + 1:00 to 24:00	Beatty	Background		
Larsen	H + 27:00 to 28:30	Beatty to Mercury	Background		
Forsythe, C.	H + 27:00 to 28:30	Beatty to Mercury	Background		
Carter	H + 00:40 to 14:50	Mercury	Background		
Stevens	H + 00:27 to 01:40	Mercury to Indian Springs	Background		
Stevens	H + 2:50 to 3:45	Indian Springs to Mercury	Background		
Graber	H + 2:30 to 3:33	Las Vegas to Indian Springs	Background		
Graber	H + 1:00 to 24:30	Las Vegas	Background		
Graber	H + 00:30 to 23:48	Nellis AFB	Background		
Graber	H + 7:15 to 8:30	Las Vegas to Hoover Dam	Background		
Platz	H + 25:09 to 25:25	15 miles W of Glendale Junction on U. S. Hwy 91	Background		
Platz	H + 25:26	Crystal	0.25		Shot 6 residual
Platz	H + 25:36	20 miles W of Glendale Junction on U. S. Hwy 91	0.15		Shot 6 residual
Platz	H + 25:36 to 25:58	20 miles W of Glendale to Nellis	Background		
Platz	H + 1:05 to 4:00	Glendale	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Platz	H + 7:50	Mesquite	0.35		Shot 7 residual
Platz	H + 7:55	Bunkerville	0.75		Shot 7 residual
Platz	H + 8:16	Riverside	0.70		Shot 7 residual
Platz	H + 8:20 to 8:25	20 miles E of Glendale to 15 miles E of Glendale	0.15		Shot 7 residual
Platz	H + 8:30	10 miles E of Glendale	0.40		Shot 7 residual
Platz	H + 8:35	5 miles E of Glendale	0.10		Shot 7 residual
Platz	H + 8:40	Glendale Junction	Background		
Platz	H + 11:25 to 11:35	Glendale Junction to 10 miles N	Background		
Platz	H + 11:20	15 miles N of Glendale Junction	0.4		Residual from previous shots
Platz	H + 11:15	20 miles N of Glendale Junction	0.90		Residual from previous shots
Platz	H + 11:08	25 miles N of Glendale Junction	0.55		Residual from previous shots
Platz	H + 11:00	30 miles N of Glendale Junction	0.70		Residual from previous shots
Jensen	H + 27:55	31 miles S of Alamo	0.30		Residual from previous shots
Jensen	H + 27:19 to 27:55	Alamo to 31 miles S of Alamo	0.10		Residual from previous shots
Jensen	H + 27:19	Alamo	0.10		Residual from previous shots
Weathersbee	H + 00:45 to 24:30	Alamo	Background		
Jensen	H + 27:06 to 27:19	Crystal Springs to Alamo	0.10		Residual from previous shots
Weathersbee	H + 00:15 to 23:45	Crystal Springs	Background		
Jensen	H + 26:54 to 27:06	33 miles W of Caliente to Crystal Springs	0.10		Shot 9 residual
Jensen	H + 26:17 to 26:54	Caliente to 33 miles W of Crystal Springs	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Jensen	H + 25:00 to 26:17	Pioche to Caliente	Background		
Jensen	H + 1:45 to 24:30	Pioche	Background		
Williams, G., and Paganini	H + 2:25 to 3:35	Milford, Utah, to Wahwa	Background		
Williams, G., and Paganini	H + 00:10 to 06:15	Milford	Background		
Williams, G., and Paganini	H + 9:15 to 9:50	Milford to Beaver on Utah Hwy 21	Background		
Williams, G., and Paganini	H + 10:15	11 miles S of Beaver on U. S. Hwy 91	0.2		Shot 9 residual
Williams, G., and Paganini	H + 10:45	40 miles S of Beaver on U. S. Hwy 91	0.3		Shot 9 residual
Williams, G., and Paganini	H + 11:00	54 miles S of Beaver on U. S. Hwy 91	0.5		Shot 9 residual
Williams, G., and Paganini	H + 11:25	Pintura, Utah	0.8		Shot 9 residual
Williams, G., and Paganini	H + 11:30	13 miles N of St. George on U.S. Hwy 91	1.0		Shot 9 residual
Williams, G., and Paganini	H + 11:50	St. George	3.0		Shot 9 residual
Butrico	H + 2:15	St. George	3.5		Shot 9 residual
Butrico	H + 5:15	St. George	3.0		Shot 9 residual
Butrico	H + 28:30	St. George	3.0		Shot 9 residual

Inclosure 3

AIR SAMPLING RESULTS

Location	Time of sample	Results, $\mu c/M^3$
Shot Area (10 mr line)	0920-0930, 5/25/53	1.7×10^{-3}
CP	0730-0830, 5/25 to 5/26/53	Background
Mercury	0620-0830, 5/25 to 5/26/53	Background
Indian Springs	0600-0830, 5/25 to 5/26/53	Background
Las Vegas	0727-0847, 5/25 to 5/26/53	Background
Nellis AFB	0750-0815, 5/25 to 5/26/53	Background
Glendale Junction	0730-0830, 5/25 to 5/26/53	Background
St. George, Utah	0730-0830, 5/25 to 5/26/53	Background*
	0930-1330, 5/25/53	MMD = 1.4 μ
	1330-1730, 5/25/53	MMD = 0.75 μ
	1730-0130, 5/25 to 5/26/53	MMD = 2.70 μ
	0130-0830, 5/26/53	MMD = 0.79 μ
Alamo	0740-0840, 5/25 to 5/26/53	Background
Crystal Springs	0715-0930, 5/25/53	4.2×10^{-4}
	0930-1200, 5/25/53	6.4×10^{-5}
	1200-1540, 5/25/53	4.3×10^{-5}
	Average concentration for sampling period†	1.6×10^{-4}
Caliente	0745-0930, 5/25/53	Background
	0930-1230, 5/25/53	5.4×10^{-4}
	1230-1430, 5/25/53	9.8×10^{-6}
	1430-1730, 5/25/53	5.6×10^{-4}
	1730-2130, 5/25/53	Background
	2130-0830, 5/25/53	Background

*The air concentration at this location for the given sampling period was found actually to be 6.58×10^{-3} $\mu c/M^3$, but decay investigations show the material collected to be of Shot Harry origin. Thus, from Shot Grable there was no increase over the background prior to this shot.

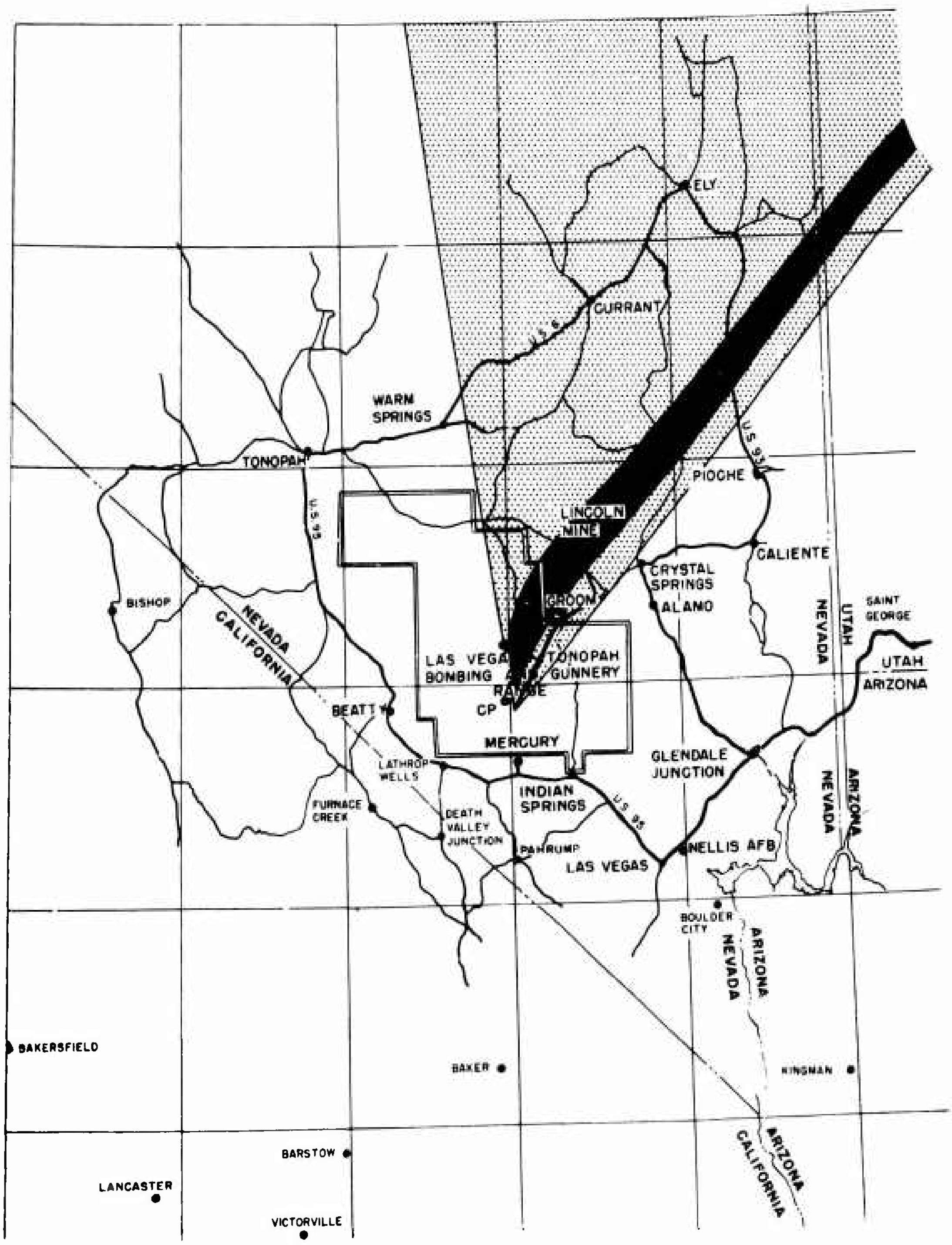
†Generator failure prevented further sampling.

Location	Time of sample	Results, $\mu c/M^3$
Panaca	0730-0930, 5/25/53	4.8×10^{-3}
	0930-1130, 5/25/53	6.7×10^{-4}
	1130-1330, 5/25/53	1.9×10^{-4}
	1330-1530, 5/25/53	1.0×10^{-4}
	1530-1730, 5/25/53	4.1×10^{-5}
	1730-2130, 5/25/53	2.6×10^{-5}
	2130-0830, 5/25 to 5/26/53	7.4×10^{-6}
	Average concentration for sampling period	4.8×10^{-4}
Pioche	0730-0930, 5/25/53	3.4×10^{-3}
	0930-1130, 5/25/53	3.4×10^{-5}
	1130-1400, 5/25/53	3.6×10^{-5}
	1400-1600, 5/25/53	4.3×10^{-5}
	1600-1800, 5/25/53	1.8×10^{-5}
	1800-2215, 5/25/53	6.7×10^{-6}
	2215-0830, 5/25 to 5/26/53	3.4×10^{-6}
	Average concentration for sampling period	3.0×10^{-4}
Milford, Utah	0915-1115, 5/25/53	5.3×10^{-3}
	1115-1315, 5/25/53	1.5×10^{-3}
	1315-1515, 5/25/53	6.4×10^{-4}
	1515-1715, 5/25/53	3.9×10^{-4}
	Average concentration for sampling period	2.0×10^{-3}
Ely	0730-0930, 5/25/53	Background
	0930-1230, 5/25/53	2.8×10^{-3}
	1230-1445, 5/25/53	2.7×10^{-3}
	1445-1730, 5/25/53	1.1×10^{-4}
	1730-2130, 5/25/53	7.4×10^{-5}
	2130-0005, 5/25 to 5/26/53	Background
	0005-0830, 5/25 to 5/26/53	Background
	Average concentration for sampling period	6.2×10^{-4}
	0930-1345, 5/25/53	MMD = 0.88 μ
Currant	0730-0930, 5/25/53	Background
	0930-1230, 5/25/53	1.0×10^{-3}
	1235-1635, 5/25/53	6.3×10^{-3}
	1655-2005, 5/25/53	1.1×10^{-3}
	Average concentration for sampling period†	2.6×10^{-3}
	0930-1230, 5/25/53	MMD = 1.70 μ
	1300-1630, 5/25/53	MMD = 1.83 μ
Warm Springs	0730-0830, 5/25 to 5/26/53	Background
Tonopah	0730-0830, 5/25 to 5/26/53	Background

Location	Time of sample	Results, $\mu c/M^3$
Beatty	0730-0830, 5/25 to 5/26/53	Background
Groom Mine	0730-0930, 5/25/53	3.9×10^{-3}
	0930-1030, 5/25/53	9.3×10^{-2}
	1030-1230, 5/25/53	3.1×10^{-3}
	1230-1530, 5/25/53	7.6×10^{-4}
	1530-1730, 5/25/53	2.6×10^{-4}
	1730-2130, 5/25/53	6.2×10^{-5}
	2130-0130, 5/25 to 5/26/53	1.2×10^{-5}
	0130-0830, 5/26/53	6.0×10^{-6}
	Average concentration for the sampling period	4.6×10^{-3}
	0930-1030, 5/25/53	MMD = 0.47 μ
	1045-1345, 5/25/53	MMD = 1.1 μ
	1350-1730, 5/25/53	MMD = 1.5 μ
Lincoln Mine	0730-0930, 5/25/53	Background
	0930-1015, 5/25/53	1.4×10^{-1}
	1015-1030, 5/25/53	1.2×10^{-1}
	1045-1100, 5/25/53	2.2×10^{-2}
	1100-1115, 5/25/53	3.4×10^{-2}
	1115-1130, 5/25/53	2.6×10^{-2}
	1130-1200, 5/25/53	1.5×10^{-2}
	1200-1300, 5/25/53	5.2×10^{-3}
	1300-1700, 5/25/53	1.0×10^{-3}
	1700-2130, 5/25/53	1.0×10^{-4}
	2130-0830, 5/25 to 5/26/53	7.6×10^{-5}
	Average concentration for sampling period	7.8×10^{-3}
	0900-1140, 5/25/53	MMD = 1.85 μ
	1150-1630, 5/25/53	MMD = 1.18 μ
	1700-2130, 5/25/53	MMD = 2.15 μ

Inclosure 4

RADIATION INTENSITY AT TIME OF FALL-OUT, SHOT GRABLE



■, 2.0 to 20.0 mr/hr. ░, 0.2 to 2.0 mr/hr. Heavy lines indicate the monitor runs.

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Inclosure 5

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at collection time, μc/liter
5/25/53	1630	Lake Mead, recreation area	1.5×10^{-2}
5/25/53	1800	Upper Pahranagat Lake	1.5×10^{-2}
5/25/53	1615	Lower Canyon Lake	3.3×10^{-3}
5/26/53	1000	Crystal Spring	Instrument background
5/26/53	1000	Lincoln Mine washroom tap	Instrument background
5/26/53	1000	Groom Mine kitchen tap	2.1×10^{-3}
5/25/53	1230	Wahwah Springs at Frisco Pass near Milford, Utah	Instrument background
5/25/53	1530	Milford, Utah, Service Station tap	1.8×10^{-3}
5/25/53	1815	Minersville, Utah, community reservoir	3.2×10^{-3}

Inclosure 6

DATA FOR CLOUD TRACKING AIRCRAFT B-29 (COOK BOOK 1)

Position*	Time	Altitude	Direction of cloud	T1B meter readings, mr/hr	Remarks
B-44	0841	22,000	N	98	Rosie NE of A/C.
C-43	0846	22,000	W	115	
B-43	0853	22,000	SE	210	
E-40	0859	22,000	SW	100	
E-41	0906	22,000	N	190	
G-39	0912	22,000	W	95	
G-38	0922	18,000	NE	13	
I-38	0922	22,000	SE	120	
J-36	0934	22,000	NE	135	Rosie beginning to dissipate.
I-36	0939	22,000	SW	45	
K-35	0946	22,000	NE	460	
L-31	0952	22,000		90	
M-32	0956	22,000	SW	160	
N-33	1008	22,000	NE	420	
P-31	1014	22,000	W	185	
Q-31	1022	22,000		220	Main Rosie not visible at this altitude.
Q-30	1026	22,000		125	Background 80.
R-30	1032	22,000		140	Main Rosie not visible.
T-26	1052	22,000		145	
Y-23	1059	22,000		150	
U-24	1105	22,000		120	
U-25	1112	22,000		800	
X-22	1120	18,000		270	
Y-21	1132	22,000		200	
Z-21	1142	22,000		80	
Y-20	1150	22,000		220	
Z-20	1155	22,000		1,500	
AA-20	1200	22,000		90	
AC-18	1210	22,000		130	Background 40.
AA-18	1215	22,000		800	Background 50.

Position*	Time	Altitude	Direction of cloud	T1B meter readings, mr/hr	Remarks
AD-17	1225	22,000		450	
AE-15	1235	22,000		130	Background 40.
AG-15	1242	22,000		60	Background 35.
AG-14	1250	21,000		80	Background 30.
AI-12					
AJ-11	1305	21,000			Background 20.

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

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Inclosure 7

DATA FOR CLOUD TRACKING AIRCRAFT B-29 (COOK BOOK 2)

Position*	Time	Altitude	Direction of cloud	T1B meter readings, mr/hr	Remarks
B-44	0846	18,000	NE	30	
C-42	0852	18,000	Above and NE	32	
E-41	0900	18,000	SE	16	
G-39	0906	18,000	SW	5	Background count.
G-40	0911	18,000	Above and SW	24	
H-38	0921	18,000	Above and NE	17	
I-36	0928	18,000	Above and S	27	
K-36	0934	18,000	Low and SW	19	
J-33	0938	18,000	S	7	
K-34	0943	18,000	Above	28	Maximum reading under Rosie.
M-32	0957	18,000	Above and SW	16	
O-31	1006	18,000	Above	13	
Q-32	1010	18,000	NW	8	Background count.
P-29	1018	18,000	Above	12	Rosie dissipated at this altitude.
R-29	1026	18,000	Unknown	11	
T-38	1031	18,000	Unknown	8	Background count.
U-24	1107	18,000	Unknown	7	Background count.
T-25	1110	18,000	Unknown	32	
U-23	1121	18,000	Unknown	34	
W-23	1130	18,000	Unknown	22	
Y-21	1138	18,000	Unknown	22	
V-20	1142	18,000	Unknown	7	Background count.
Y-20	1153	18,000	Unknown	29	
AA-19	1203	18,000	Unknown	25	
AB-18	1210	18,000	Unknown	26	

Position*	Time	Altitude	Direction of cloud	T1B meter readings, mr/hr	Remarks
AE-16	1235	18,000	Unknown	17	
AG-16	1246	18,000	Unknown	15	

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 8

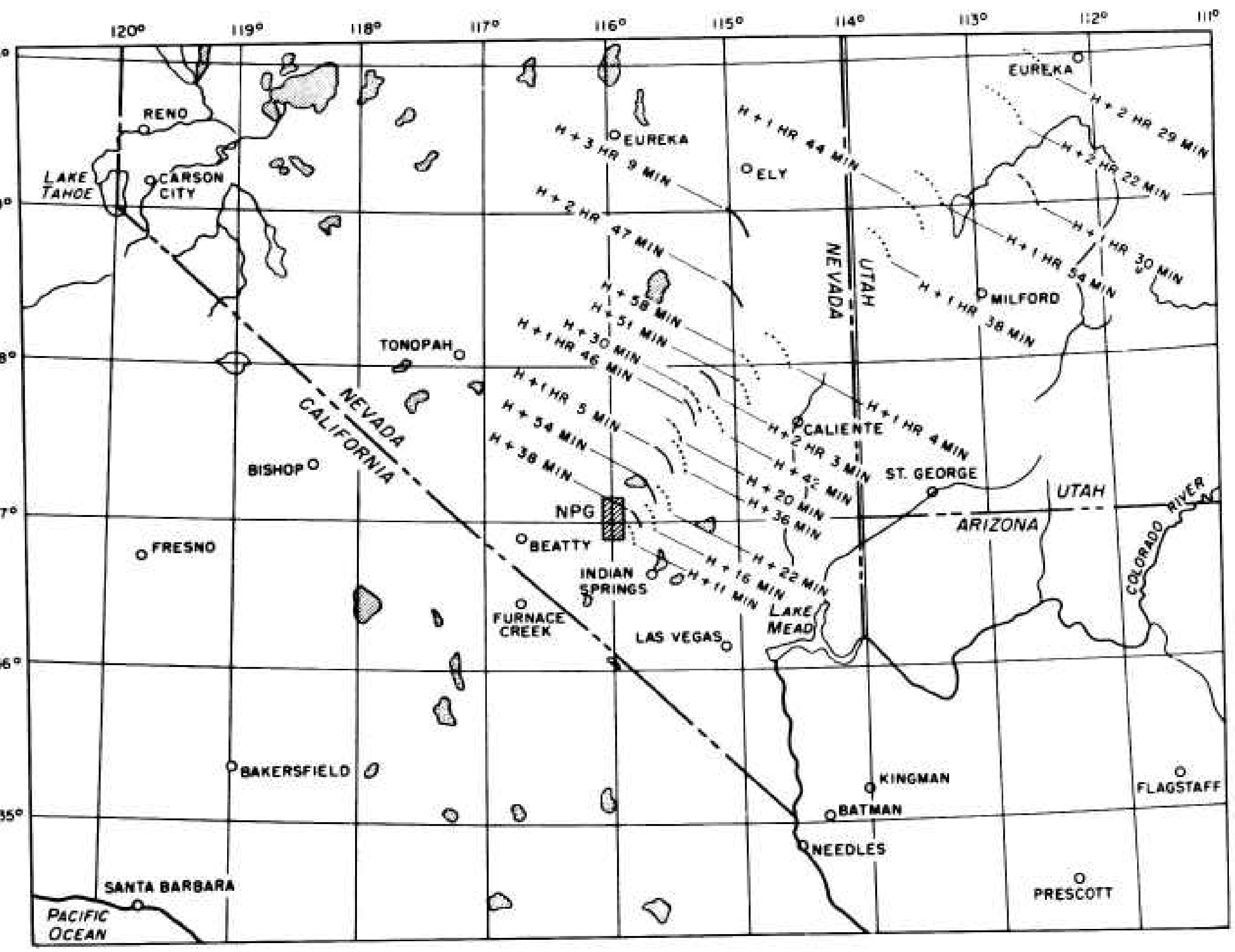
DATA FOR CLOUD TRACKING AIRCRAFT B-25 (COOK BOOK 3)

Position*	Time	Altitude	Direction of cloud	Meter readings, mr/hr MX-5	T1B	Remarks
B-44	0858	12,000	N	5	5	High 600; background 0.
B-43	0908	12,000	S	5	7	High 2 r; background 2 mr/hr.
C-42	0924	12,000	WNW	3	5	High 3 mr; background 5 mr/hr.
D-41	0935	12,000	W	Off scale	5	High 300; background 3 mr/hr.
B-39	0951	12,000	S	12	7	High 32; background 1 mr/hr.
E-38	1016	12,000	W	8	0	Rosie is quite large and spread out at this altitude.
E-38	1033	12,000	N	7	10	High 76; background 2.
F-33	1056	12,000	W	7	6	High 20; background 1.5 mr/hr.
D-33	1102	12,000	S	8	7	High 22; background 1.5 mr/hr.
D-34	1117	12,000	E	Off scale, erratic	8	High 65; background 2 mr/hr.
E-31	1133	12,000	S	Off scale, erratic	7	High 150; background 2 mr/hr.
G-31	1139	12,000		Off scale, erratic	8	High 22; background 2 mr/hr.
D-31	1148	12,000		Off scale, erratic	8	High 120; background 2 mr/hr.

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 9

ACTUAL CLOUD TRACK, SHOT GRABLE



———, 10,000 ft msl. ········, 20,000 ft msl. - - - - - -, 40,000 ft msl.

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Inclosure 10

PREDICTED CLOUD TRAJECTORY, 1900, 24 MAY 1953

———, 10,000 ft msl. ...., 20,000 ft msl. -------, 30,000 ft msl. _._._._, 40,000 ft msl.

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Inclosure 11

DATA FOR TERRAIN SURVEY AIRCRAFT HELICOPTER (FIRE FLY)

Position*	Time	Altitude above ground, ft	T1B meter readings, mr/hr
N-$\frac{1}{2}$31			0
D-32			0
Q-$\frac{3}{4}$ 32	0857	20	10
R-32	0857	20	1,000
R-$\frac{1}{4}$32	0858	20	10,000
$\frac{1}{2}$R-$\frac{1}{2}$32	0858	20	40,000
R-33.5	0905	20	10
R-$\frac{1}{8}$ 33	0803	20	100
R-$\frac{1}{2}$32	0907	200	30,000
Over GZ	1045	500	17,000

*The coordinates are those listed in Incl. 19, Chap. 3

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Inclosure 12

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr	
			MX-5	T1B
A-½45/46	1145	500	0	0
A-45	1148	500	0.05	0
Frenchman Flat	1150	500	Off scale	400
½A/B-44	1151	500	0.7	0.6
½A/B-43	1155	500	0.05	0
C-41	1205	500	1.5	1.5
C-40	1210	500	0.7	0.7
C-39	1215	500	0.1	0
D-39	1219	500	0.4	0.4
D-40	1224	500	0.1	0
D-41	1231	500	0.2	0.2
E-42	1239	500	0.1	0
F-43	1245	500	0.2	0.2
E-44	1251	500	0.05	0
E-45	1257	500	0.06	0

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 13

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	T1B	"Scint"	C-1 air foil
D-½45	1237	1000	0.03	0	0	
E-45	1241	800	0.05	0	0	
F-44	1247	1000	0.06	0	0	0.15
F-43	1251	2000	0.05	0	0	
F-42	1255	2000	0.03	0.1	0	
F-41	1258	3000	0.04	0	0	
F-40	1302	3000	0.07	0	0	
F-39	1304	3000	0.05	0	0	
F-38	1309	3000	0.03	0	0	0.4
F-37	1312	2000	0.05	0	0	
F-36	1315	2000	0.03	0	0	
F-35	1319	2000	0.04	0	0	
F-34	1223	2000	0.03	0	0	
G-34	1325	1500	0.05	0	0	
H-34	1329	3000	0.04	0	0	
I-34	1332	3500	0.06	0	0	0.6
J-34	1335	3000	0.08	0	0	

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Chapter 12

SHOT CLIMAX*

12.1 INTRODUCTION

The eleventh shot of the Upshot-Knothole series, Climax, was detonated at about 1300 ft above the ground in Test Area T-7-3 in Yucca Flat at the Nevada Proving Grounds at 0415 PDT, 4 June 1953, after a three day delay. The winds were light and variable at the time of detonation. The low level cloud spread slowly in the southeast quadrant out to a distance of approximately 75 miles, became scattered, and was dispersed by 1000. Fall-out was light. The maximum ground contamination recorded was 12 mr/hr on Highway 93, ten miles west of Glendale, Nev. The On-Site survey was completed by 0525 and R (general recovery) hour announced at 0532. Mercury Highway was opened to traffic at 0515.

12.2 ON-SITE OPERATIONS

12.2.1 The initial ground survey reports began at 0435, and the survey was completed by 0525. No difficulty was encountered in making the initial survey. The initial survey and subsequent surveys are shown in Incl. 1.

12.2.2 Two dry runs for the initial survey teams were conducted prior to D-day. On D – 4 a complete survey of Yucca Flat was made to determine radiation levels before the shot in Test Area T-7-3 (Incl. 2). Surveys were also conducted in the Frenchman Flat area.

12.2.3 One hundred thirty-six (136) parties were processed in Yucca Flat. Approximately 1,230 film badges were processed. Vehicle decontamination processed fourteen (14) vehicles and many items of heavy test equipment.

12.3 OFF-SITE OPERATIONS

12.3.1 The changes in the anticipated fall-out pattern from Shot Climax are delineated in the weather maps provided by the Air Weather Service Unit attached to the Nevada Proving Grounds (Section II, WT-705). The complexities of plotting such a fall-out pattern are well illustrated by the post analysis (Section II, WT-705), which shows the variability in speed and direction of the wind field in the 200 mile region for about the first nine hours following the detonation.

12.3.2 Little fall-out was detected within the 200 mile zone. Levels slightly above normal background were recorded at Glendale Junction, Overton, and vicinity. With the exception of this area, the exact amount of contamination resulting from this shot was masked by that residual occurring from previous detonations. A documentation of the ground monitoring results is given in Incl. 3.

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*Period covered, 31 May to 6 June.

12.3.3 In addition to the Overton area noted above, significant airborne activity was detected at the CP, Indian Springs, Alamo, Caliente, Pioche, and Groom Mine, indicating a wide dispersal of the cloud as would be anticipated from the prevailing wind pattern. There was still detectable airborne activity to be found in St. George, Utah, as a result of Shot Harry. The air sampling results are presented in Incl. 4.

12.3.4 The pictorial presentation of the fall-out pattern is shown in Incl. 5.

12.3.5 The results of water samples analyzed for fission product activity following this shot are given in Incl. 6.

12.4 AIR PARTICIPATION

12.4.1 All air space within a 70 mile radius of the Nevada Proving Grounds was closed at all altitudes from 0345 to 0800. The air space above 25,000 ft msl bounded by a line from the Nevada Proving Grounds to Delta, Utah, to Grand Junction, Colo., to Akomita, N. Mex., to Truth or Consequences, N. Mex., to Needles, Ariz., to the Nevada Proving Grounds was closed from 0500 to 1500. At 0630 this notice was modified to read all air space above 25,000 ft msl in the area bounded by a line from Nevada Proving Grounds direct to Prescott, Ariz., to Hanksville, Utah, to Delta, Utah, and back to the Proving Grounds. An aircraft warning circle was declared for all air space within 150 miles of Las Vegas, Nev.

12.4.2 The cloud reached a maximum altitude of 42,700 ft msl as reported by sampler aircraft. The B-29 cloud trackers were able to track the cloud at 18,000 and 22,000 ft msl for a distance of about 100 miles from the Nevada Proving Grounds in the southeast quadrant. Cloud dispersion and low wind velocities made cloud identification and tracking very difficult. The B-25 cloud tracker was able to track the cloud at 12,000 ft msl for a distance of approximately 30 miles southeast of the Nevada Proving Grounds. The data and plot from these aircraft are shown in Incls. 7, 8, 9, and 10. The predicted cloud track is shown in Incl. 11.

12.4.3 The helicopter was not used in the close-in survey on this shot owing to mechanical difficulties just prior to shot time.

12.4.4 The L-20 departed on its portion of the low level terrain survey at 0715. The data are attached as Incl. 12. The C-47 was off at 0815. The data for this flight are attached as Incl. 13. Only insignificant fall-out was indicated, and no fall-out plot is included.

12.5 LOGISTICS AND SUPPLY

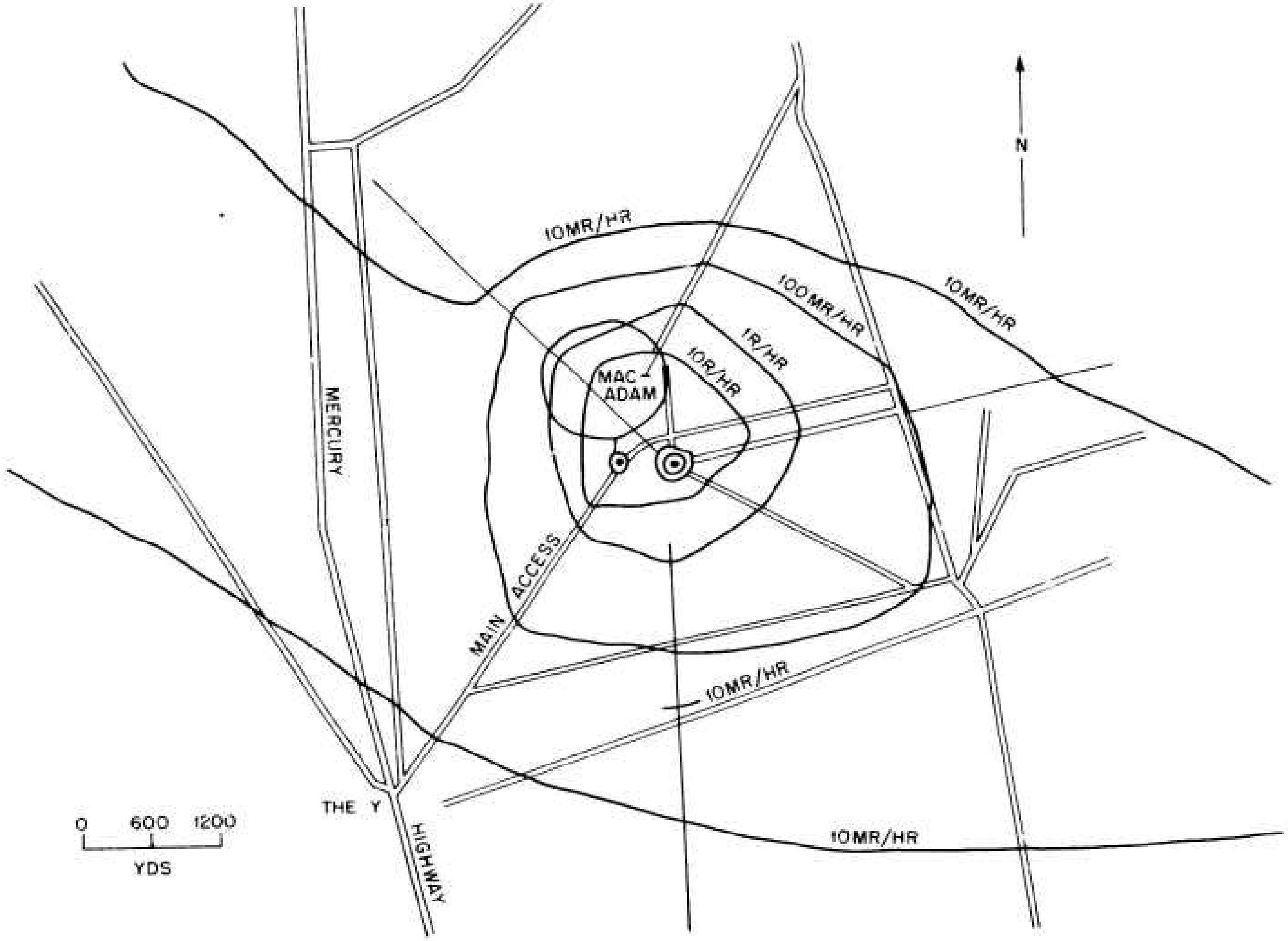
For this period, the Supply Section issued 61 protective caps, 93 pairs of shoe covers, 97 coveralls, 53 respirators, 87 pairs of cotton gloves, 1 pair of clear goggles, and 5 pairs of high intensity goggles. The laundry serviced 65 protective caps, 100 pairs of shoe covers, 442 coveralls, 237 respirators, 85 pairs of cotton gloves, and 60 towels.

12.6 GENERAL

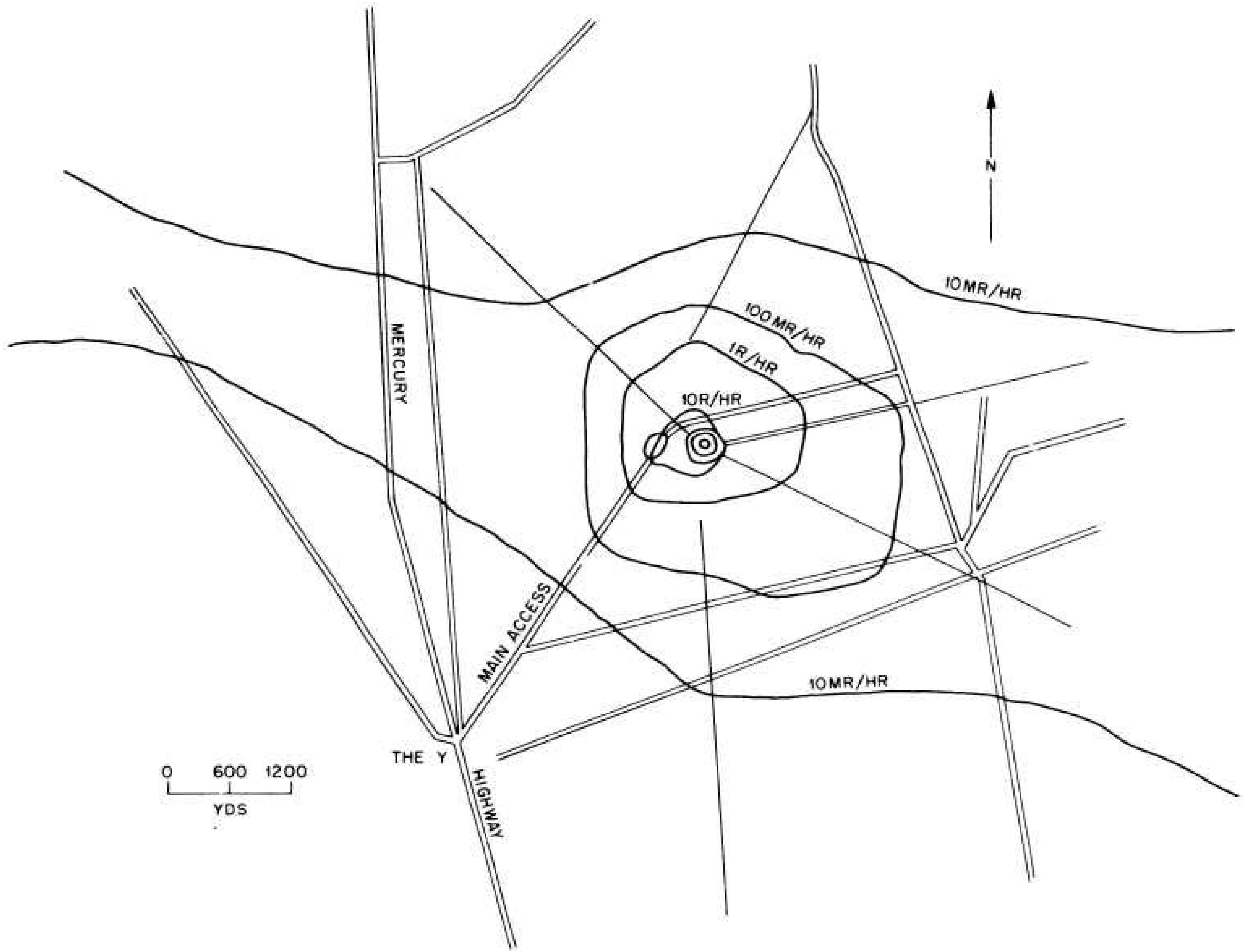
This shot produced only minor radiological problems. The upper portion of the cloud passed over St. George, Utah; but no radiation levels above background were detected on the surface at this location. As a result of the rapid initial survey and the small number of projects taking part in the test, the On-Site Operations encountered no problems of importance. The extent of residual radioactivity in the test area was somewhat greater than anticipated but did not appreciably affect the data of the Off-Site monitors.

Inclosure 1

SURVEYS OF TEST AREA 7-3, SHOT CLIMAX



Initial survey, 0500, 4 June 1953.



Resurvey, 0800, 5 June 1953.

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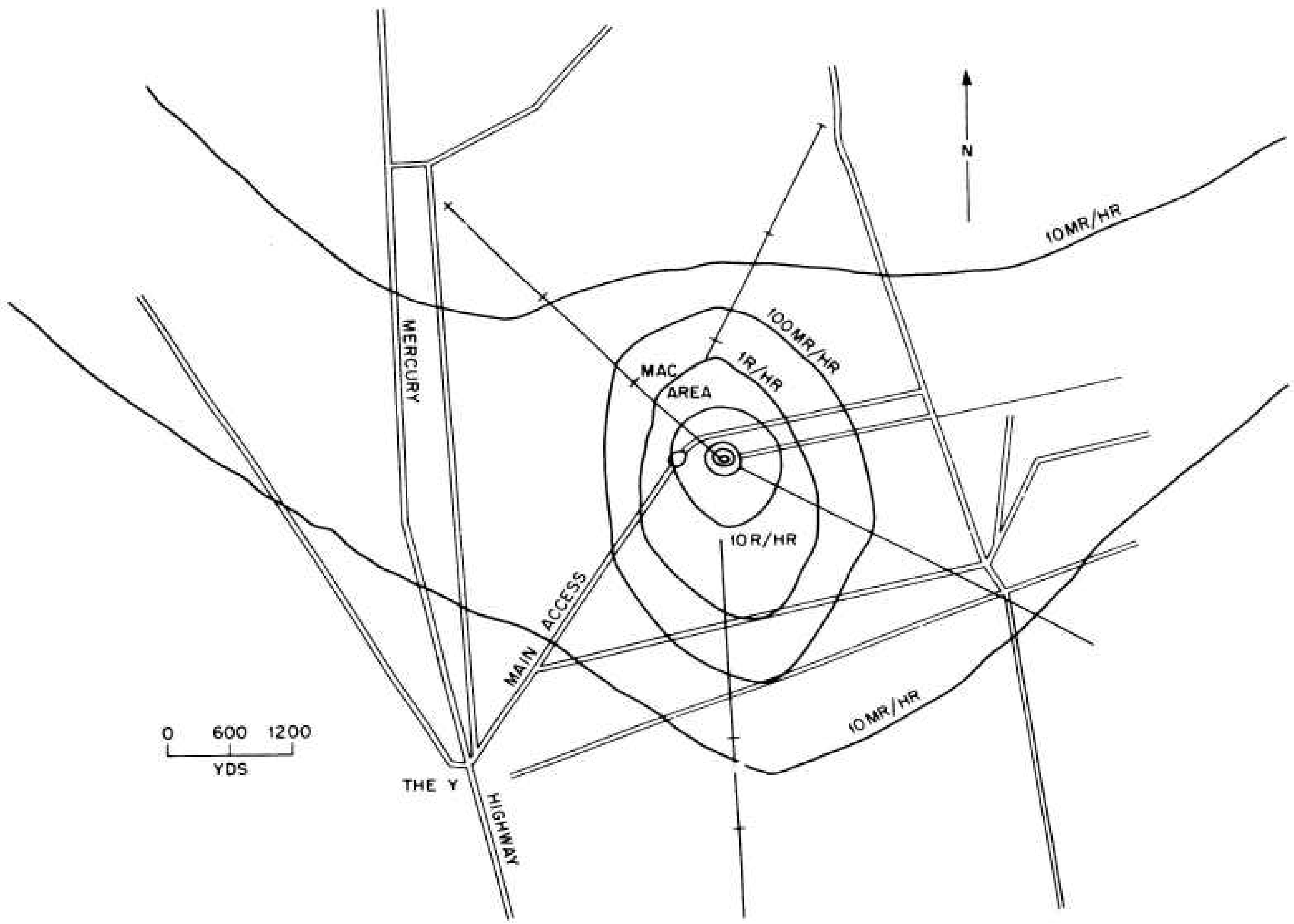
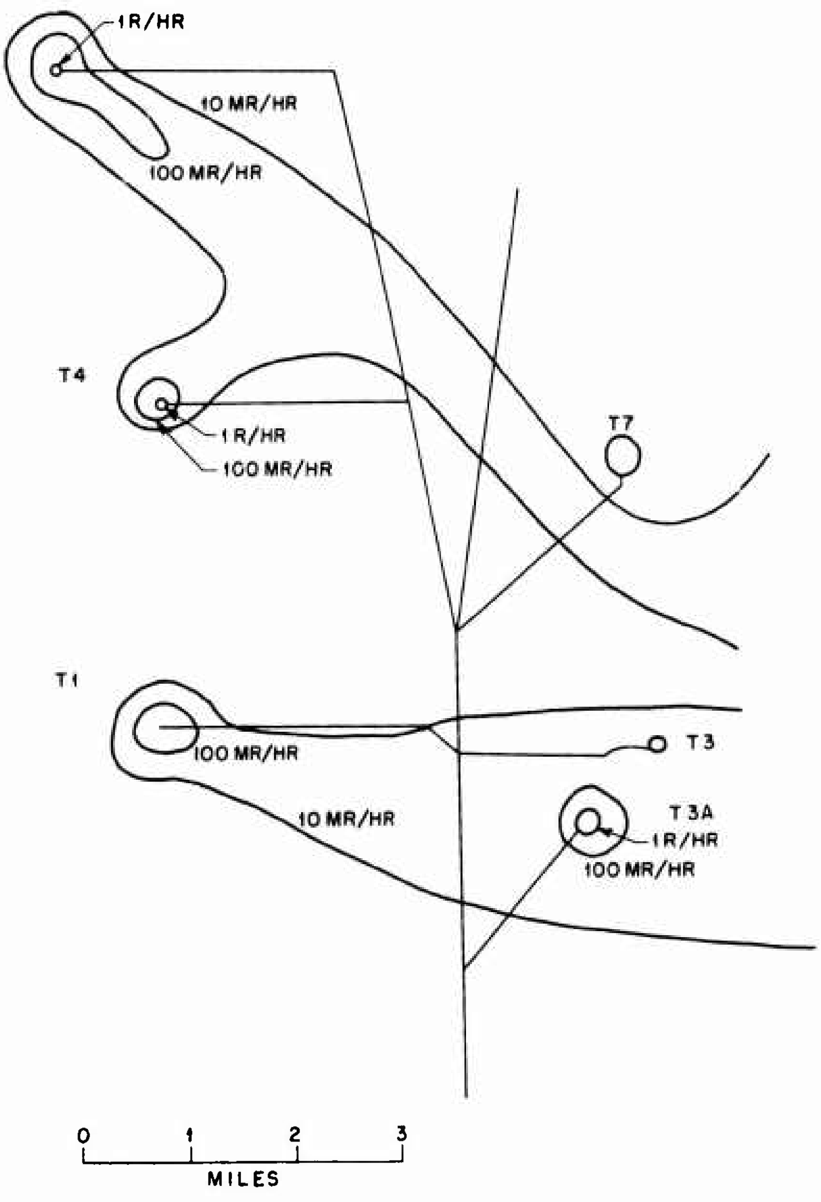


Resurvey, 4 June 1953.

Inclosure 2

YUCCA FLAT RADIOLOGICAL SITUATION, 31 MAY 1953



Resurvey, all areas, 31 May 1953.

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Inclosure 3

GROUND MONITORING DATA, SHOT CLIMAX

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Carter	H + 0:45 to 11:10	Mercury	Background		
Melton	H + 1:00 to 1:30	Mercury to Indian Springs	Background		
Melton	H + 1:30 to 11:45	Indian Springs	Background		
MacMurray	H + 4:00 to 4:55	Indian Springs to Las Vegas	Background		
MacMurray	H + 6:55 to 7:50	Las Vegas to Indian Springs	Background		
Jordan	H + 1:00 to 24:00	Las Vegas	Background		
Jordan	H + 15:30	Boulder City	Background		
Frazier	H + 15:35	Boulder City	Background		
Frazier	H + 15:35 to 16:56	Boulder City to Kingman, Ariz.	Background		
Jordan	H + 2:15 to 2:35	Las Vegas to Nellis AFB	Background		
Jordan	H + 11:00 to 11:25	Nellis AFB to Las Vegas	Background		
Rowe	H + 7:20	35 miles SW of Glendale on U. S. Hwy 93	0.2	7	Fall-out occurring
Jordan	H + 11:00	35 miles SW of Glendale on U. S. Hwy 93	Background	7	
Rowe	H + 7:15	30 miles SW of Glendale on U. S. Hwy 93	0.3	7	Fall-out occurring
Jordan	H + 10:45	30 miles SW of Glendale on U. S. Hwy 93	Background	7	
Williams	H + 27:25	30 miles SW of Glendale on U. S. Hwy 93	0.3	7	1.5
Rowe	H + 7:08	25 miles SW of Glendale on U. S. Hwy 93	1.6	7	Fall-out occurring
Jordan	H + 10:48	25 miles SW of Glendale on U. S. Hwy 93	0.07	7	0.1

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Jordan	H + 10:47	24 miles SW of Glendale on U. S. Hwy 93	0.08	7	0.1
Jordan	H + 10:42	22 miles SW of Glendale on U. S. Hwy 93	0.3	7	0.5
Rowe	H + 7:02	20 miles SW of Glendale on U. S. Hwy 93	3.9	7	Fall-out occurring
Jordan	H + 10:38	20 miles SW of Glendale on U. S. Hwy 93	0.7	7	1.1
Williams	H + 27:05	20 miles SW of Glendale on U. S. Hwy 93	0.4	7	1.9
Jordan	H + 10:31	17 miles SW of Glendale on U. S. Hwy 93	0.8	7	1.3
Shipman	H + 10:35	17 miles SW of Glendale on U. S. Hwy 93	2.0	7	3.0
Rowe	H + 6:55	15 miles SW of Glendale on U. S. Hwy 93	11.0	7	Fall-out occurring
Jordan	H + 10:28	15 miles SW of Glendale on U. S. Hwy 93	0.9	7	1.5
Jordan	H + 10:25	14 miles SW of Glendale on U. S. Hwy 93	1.6	7	2.5
Shipman	H + 10:30	12 miles SW of Glendale on U. S. Hwy 93	5.0	7	3.0
Rowe	H + 6:45	10 miles SW of Glendale on U. S. Hwy 93	11.0	7	Fall-out occurring
Williams	H + 26:40	10 miles SW of Glendale on U. S. Hwy 93	0.5	7	2.5
Shipman	H + 10:25	7 miles SW of Glendale on U. S. Hwy 93	1.8	7	2.6
Rowe	H + 6:35	5 miles SW of Glendale on U. S. Hwy 93	2.7	7	Fall-out occurring

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Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Shipman	H + 10:20	2 miles SW of Glendale on U. S. Hwy 93	0.7	7	1.1
Williams	H + 1:00 to 6:00	Glendale Junction	Background	7	
Rowe	H + 6:30	Glendale Junction	1.3	7	Fall-out occurring
Williams	H + 7:45	Glendale Junction	0.7	7	0.8
Williams	H + 9:45	Glendale Junction	1.0	7	1.4
Stevens	H + 36:25	Glendale Junction	0.3	7	2.2
Paganini	H + 2:48	Crystal	0.3	7	Before fall-out
Paganini	H + 14:58	Crystal	1.4	7	3.4
Paganini	H + 14:53	4 miles SE of Crystal on Nevada Hwy 40	0.8	7	1.6
Paganini	H + 12:55	8 miles SE of Crystal on Nevada Hwy 40	0.15	7:30	Before fall-out
Paganini	H + 14:45	9 miles SE of Crystal on Nevada Hwy 40	1.0	7:30	2.4
Paganini	H + 3:02	12 miles SE of Crystal on Nevada Hwy 40	0.5	7:30	Before fall-out
Paganini	H + 14:36	14 miles SE of Crystal on Nevada Hwy 40	0.9	7:30	2.2
Paganini	H + 14:28	19 miles SE of Crystal on Nevada Hwy 40	1.5	7:30	3.5
Paganini	H + 3:14	21 miles SE of Crystal on Nevada Hwy 40	Background	7:30	Before fall-out
Paganini	H + 3:25	Intersection of Nevada Hwys 12 and 40	Background	7:30	Before fall-out
Paganini	H + 14:11	Intersection of Nevada Hwys 12 and 40	1.5	7:30	3.4
Paganini	H + 1:00 to 6:15	Overton	Background	7:30	
Paganini	H + 7:15	Overton	4.0	7:30	Fall-out occurring
Paganini	H + 9:45	Overton	5.0	7:30	7.1

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Williams	H + 11:45	Overton	2.0	7:30	3.8
Paganini	H + 11:45	Overton	5.0	7:30	9.0
Paganini	H + 13:45	Overton	4.0	7:30	8.5
Paganini	H + 8:04	Junction of Nevada Hwy 12 and U. S. Hwy 91	0.7	7:30	0.8
Paganini	H + 8:12	8 miles NE of Glendale on U. S. Hwy 91	0.6		Probably residual from previous shots
Williams	H + 4:45	10 miles NE of Glendale on U. S. Hwy 91	0.5		Probably residual from previous shots
Paganini	H + 8:19	13 miles NE of Glendale on U. S. Hwy 91	0.6		Probably residual from previous shots
Paganini	H + 8:25	18 miles NE of Glendale on U. S. Hwy 91	0.5		Probably residual from previous shots
Williams	H + 5:10	20 miles NE of Glendale on U. S. Hwy 91	0.1		Probably residual from previous shots
Paganini	H + 8:32	23 miles NE of Glendale on U. S. Hwy 91	1.0		Probably residual from previous shots
Williams	H + 5:20	25 miles NE of Glendale on U. S. Hwy 91	0.5		Probably residual from previous shots
Paganini	H + 8:37	28 miles NE of Glendale on U. S. Hwy 91	0.9		Probably residual from previous shots

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Paganini	H + 8:40	Bunkerville	0.9		Probably residual from previous shots
Platz	H + 26:27	Bunkerville	0.5		Probably residual from previous shots
Platz	H + 26:22	Mesquite	0.2		Probably residual from previous shots
Platz	H + 25:26	Santa Clara	0.3		Probably residual from previous shots
Platz	H + 1:00 to 24:00	St. George	0.3 to 0.5		Probably residual from previous shots
Williams	H + 6:40	10 miles N of Glendale on U. S. Hwy 93	0.2		Probably residual from previous shots
Stevens	H + 36:05	10 miles N of Glendale on U. S. Hwy 93	0.2		Probably residual from previous shots
Williams	H + 6:50	20 miles N of Glendale on U. S. Hwy 93	0.3		Probably residual from previous shots
Stevens	H + 35:50	20 miles N of Glendale on U. S. Hwy 93	1.3		Probably residual from previous shots
Williams	H + 6:55	25 miles N of Glendale on U. S. Hwy 93	0.3		Probably residual from previous shots

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Stevens	H + 35:43	25 miles N of Glendale on U. S. Hwy 93	0.5		Probably residual from previous shots
Stevens	H + 35:35	30 miles N of Glendale on U. S. Hwy 93	0.7		Probably residual from previous shots
Smithson	H + 12:51	33 miles N of Glendale on U. S. Hwy 93	1.0		Probably residual from previous shots
Stevens	H + 35:25	35 miles N of Glendale on U. S. Hwy 93	1.4		Probably residual from previous shots
Smithson	H + 12:38	40 miles N of Glendale on U. S. Hwy 93	0.4		Probably residual from previous shots
Stevens	H + 35:22	40 miles N of Glendale on U. S. Hwy 93	0.6		Probably residual from previous shots
Stevens	H + 35:13	45 miles N of Glendale on U. S. Hwy 93	0.15		Probably residual from previous shots
Stevens	H + 35:05	50 miles N of Glendale on U. S. Hwy 93	1.7		Probably residual from previous shots
Smithson	H + 12:15	52 miles N of Glendale on U. S. Hwy 93	0.10		Probably residual from previous shots
Stevens	H + 34:55	55 miles N of Glendale on U. S. Hwy 93	0.08		Probably residual from previous shots

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Smithson	H + 11:53	Alamo	Background		
Stevens	H + 34:40	Alamo	Background		
Smithson	H + 11:25 to 11:53	Hiko to Crystal Springs to Alamo	Background		
Stevens	H + 34:20	Crystal Springs	Background		
Weathersbee	H + 1:00 to 24:00	Groom Mine	Background		
Rossano	H + 1:10 to 16:00	Lincoln Mine	0.1		Residual from previous shots
Rossano	H + 30:00 to 31:00	Lincoln Mine to Groom Mine	Background		
Stevens	H + 29:05 to 32:10	Ely to Pioche	Background		
Jensen	H + 27:15 to 28:20	Crystal Springs to Caliente	Background		
Jensen	H + 25:00 to 25:45	Caliente to Pioche	Background		
Jensen	H + 1:00 to 8:45	Pioche	Background		
Jensen	H + 9:00	Pioche	0.06		
Jensen	H + 9:15 to 10:30	Pioche	0.1		
Jensen	H + 11:45	Pioche	Background		
Fetz	H + 0:00 to 26:00	Ely	Background		
Stevens	H + 7:00	Preston	Background		
Stevens	H + 7:08	Lund	Background		
Stevens	H + 3:45 to 15:30	Currant	Background		
Stevens	H + 4:45 to 5:35	Currant to 26 miles SW on U. S. Hwy 6	Background		
Stevens	H + 14:00 to 15:30	Currant to 26 miles SW on U. S. Hwy 6	Background		
Stevens	H + 6:10 to 7:00	Currant to junction of Hwys 6 and 38	Background		
Forsythe	H + 0:00 to 18:00	Warm Springs	Background		
Forsythe	H + 7:45 to 8:45	Warm Springs to 30 miles NE on U. S. Hwy 6	Background		
Forsythe	H + 14:00 to 15:00	Warm Springs to Tonopah	Background		
Larsen	H + 0:00 to 24:00	Tonopah	Background		

Name of monitor	Time from H-hour	Location	Level, mr/hr	Assumed time of fall-out from H-hour	Calculated intensity at time of fall-out, mr/hr
Larsen	H + 34:00 to 36:30	Tonopah to Beatty	Background		
Claborn	H + 1:00 to 24:00	Beatty	Background		
Lawrence	H + 1:22 to 3:33	Mercury to Beatty	Background		
Claborn	H + 27:45 to 29:15	Beatty to Mercury	Background		
Lawrence	H + 4:15 to 5:12	Beatty to Lathrop Wells	Background		
Lawrence	H + 5:12 to 5:50	Lathrop Wells to Death Valley Junction	Background		
Lawrence	H + 5:50 to 6:15	Death Valley Junction to Ash Meadows	Background		
Lawrence	H + 7:35 to 8:25	Ash Meadows to Pahrump	Background		
Lawrence	H + 9:15 to 10:25	Pahrump to Mercury	Background		

Inclosure 4

AIR SAMPLING RESULTS

Location	Time of sample	Result, μ/M^3
Shot Area (10 mr line)	0505-0515, 6/4/53	5.9×10^{-2}
CP	0315-0515, 6/4/53	3.0×10^{-4}
	0515-0545, 6/4/53	6.7×10^{-4}
	0545-0630, 6/4/53	1.7×10^{-3}
	0630-0730, 6/4/53	6.9×10^{-2}
	0730-0915, 6/4/53	2.9×10^{-3}
	1115-1315, 6/4/53	7.8×10^{-4}
	1315-1715, 6/4/53	9.7×10^{-5}
	1715-2115, 6/4/53	Background
	2115-0615, 6/4 to 6/5/53	Background
	Average concentration for sampling period	6.9×10^{-4}
	0555-0730, 6/4/53	MMD = 7.6 μ
	1115-1315, 6/4/53	MMD = 0.04 μ
Mercury	0200-0525, 6/4 to 6/5/53	Background
Indian Springs AFB	0120-0550, 6/4/53	Background
	0550-0615, 6/4/53	Background
	0615-0915, 6/4/53	1.6×10^{-4}
	0915-1115, 6/4/53	3.2×10^{-3}
	1115-1315, 6/4/53	3.3×10^{-4}
	1315-1715, 6/4/53	1.3×10^{-5}
	1715-2105, 6/4/53	Background
	2110-0420, 6/4 to 6/5/53	Background
	Average concentration for sampling period	2.9×10^{-4}
Boulder City	0915-1800, 6/4/53	Background
Las Vegas	0305-0500, 6/4 to 6/5/53	Background
Nellis AFB	0330-(power failure at some time after 1630)	Background
Glendale Junction	0315-0515, 6/4/53	Background
	0515-0715, 6/4/53	Background
	0715-0915, 6/4/53	Background
	0915-1215, 6/4/53	Background
	1215-1515, 6/4/53	8.0×10^{-4}
	1815-0415, 6/4 to 6/5/53	2.4×10^{-4}
	Average concentration for sampling period	2.3×10^{-4}
Overton	0800-1000, 6/4/53	5.0×10^{-4}
	1000-1200, 6/4/53	9.3×10^{-2}
	1200-1250, 6/4/53	1.4×10^{-1}
	1250-1350, 6/4/53	7.9×10^{-2}
	1350-1750, 6/4/53	2.0×10^{-2}

Location	Time of sample	Result, μ/M^3
Overton	Average concentration for sampling period	4.8×10^{-2}
	0805-1200, 6/4/53	MMD = 4.73 μ
	1210-1400, 6/4/53	MMD = 2.80 μ
	1410-1800, 6/4/53	MMD = 3.00 μ
St. George, Utah	0330-0415, 6/4 to 6/5/53	Background*
	1315-2115, 6/4/53	MMD = 0.74 μ
	2115-0415, 6/4 to 6/5/53	MMD = 0.35 μ
Alamo	0300-0525, 6/4/53	Background
	0525-0845, 6/4/53	Background
	0845-1045, 6/4/53	Background
	1045-1345, 6/4/53	1.1×10^{-3}
	1345-1800, 6/4/53	2.2×10^{-4}
	1800-2100, 6/4/53	5.4×10^{-6}
	2100-0430, 6/4 to 6/5/53	Background
	Average concentration for sampling period	1.8×10^{-4}
Crystal Springs	0315-0530, 6/4 to 6/5/53	Background
Caliente	0315-0515, 6/4/53	Background
	0515-0815, 6/4/53	Background
	0815-1015, 6/4/53	Background
	1015-1045, 6/4/53	Background
	1315-1715, 6/4/53	3.7×10^{-4}
	1715-2115, 6/4/53	1.8×10^{-4}
	2115-0545, 6/4 to 6/5/53	6.9×10^{-5}
	Average concentration for sampling period	1.9×10^{-4}
Pioche	0315-0515, 6/4/53	Background
	0515-0815, 6/4/53	Background
	0815-1015, 6/4/53	Background
	1015-1315, 6/4/53	2.1×10^{-3}
	1315-1515, 6/4/53	4.1×10^{-3}
	1515-1715, 6/4/53	3.3×10^{-3}
	1715-2115, 6/4/53	6.1×10^{-5}
	2115-0415, 6/4 to 6/5/53	Background
	Average concentration for sampling period	8.4×10^{-4}
Ely	0315-2000, 6/4/53	Background
Currant	0315-2000, 6/4/53	Background
Warm Springs	0515-2115, 6/4/53	Background
Tonopah	0315-0415, 6/4 to 6/5/53	Background
Beatty	0315-0415, 6/4 to 6/5/53	Background

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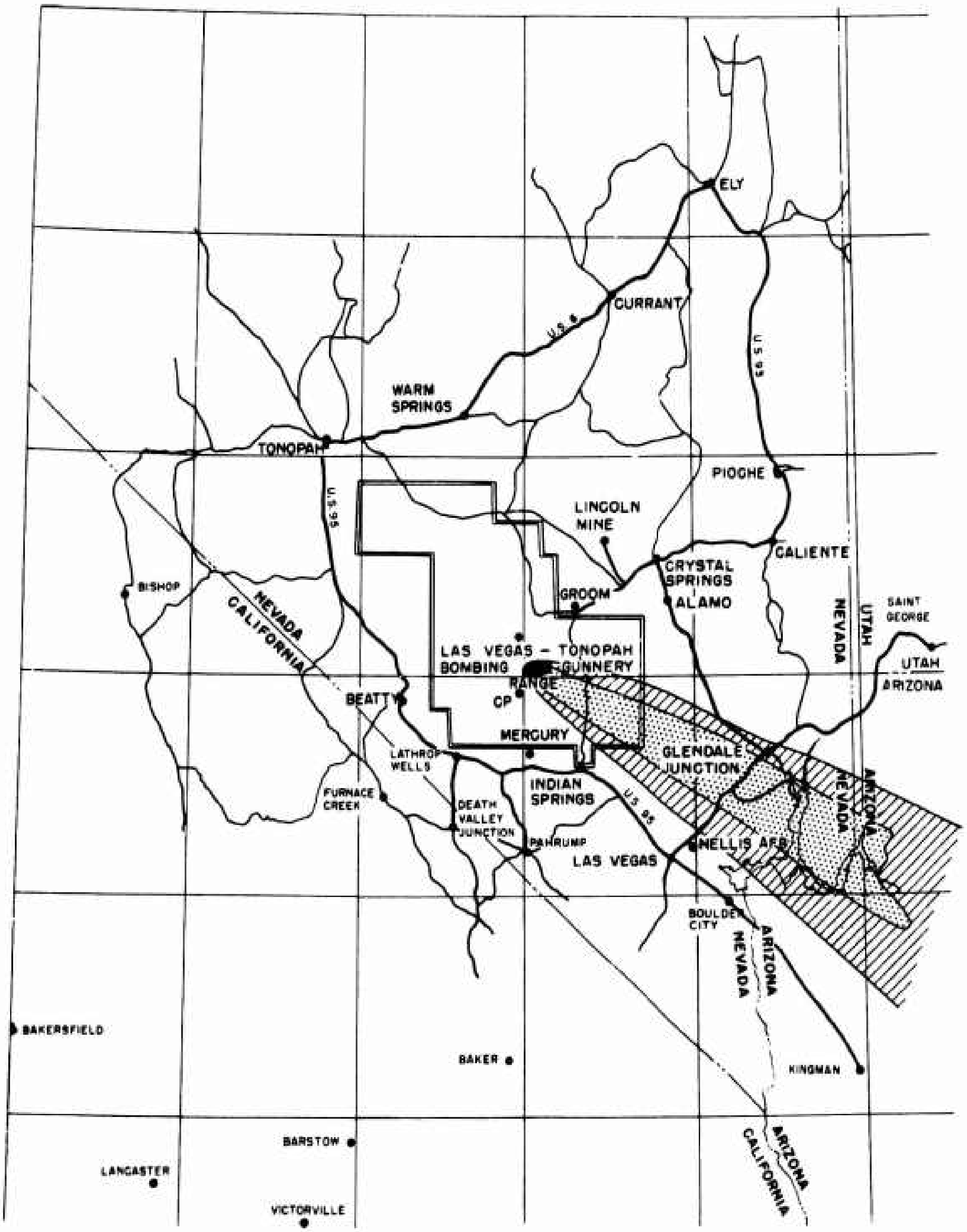
Location	Time of sample	Result, μ/M^3
Groom Mine	0315-0515, 6/4/53	5.6×10^{-4}
	0515-0715, 6/4/53	4.1×10^{-5}
	0715-0930, 6/4/53	3.3×10^{-5}
	0930-1130, 6/4/53	2.1×10^{-4}
	1130-1330, 6/4/53	3.7×10^{-4}
	1330-1730, 6/4/53	1.3×10^{-4}
	1730-2130, 6/4/53	6.7×10^{-5}
	2130-0415, 6/4 to 6/5/53	Background
	Average concentration for sampling period	1.3×10^{-4}
Lincoln Mine	0315-0415, 6/4 to 6/5/53	Background

* The air concentration at this location for the given sampling period was found to be actually 7.1×10^{-4} μ/M^3, but decay investigations and background sampling prior to Shot Climax show the material collected to be of Shot Harry origin.

Inclosure 5

RADIATION INTENSITY AT T[illegible] FALL-OUT, SHOT CLIMAX



Radiation intensity at time of fall-out: Heavy lines indicate the roads monitored. [solid black], 100 mr/hr and up. [stippled], 2 to 20 mr/hr. [hatched], 0.2 to 2 mr/hr.

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Inclosure 6

WATER SAMPLE RESULTS

Date of collection	Time of collection	Location	Activity at collection time, μc/liter
6/4/53	1730	Overton tap	2.22×10^{-2}
6/4/53	1740	Pahranagat Lake	Counter background
6/4/53	1830	Crystal Springs	Counter background
6/5/53	1000	Groom Mine	Counter background
6/4/53	1945	Lake Mead recreational area	Counter background
6/4/53	1620	Overton Beach	1.72×10^{-2}
6/5/53	1100	Lincoln Mine tap	Counter background

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Inclosure 7

DATA FOR CLOUD TRACKING AIRCRAFT B-29 (COOK BOOK 1)

Position*	Time	Altitude	Direction of cloud	T1B meter, mr/hr	Remarks
A-44	0444	22,000	E	20	
A-43	0449	22,000	SE	25	
B-45	0457	22,000	NW	18	
C-44	0511	22,000	N	14	Background 4.
C-43	0525	22,000	Directly above		Negative fall-out from main Rosie.
C-45	0530	22,000	NE	38	Maximum reading in this area.
C-46	0550	22,000	NE	46	Rosie scattered over large area.
D-44	0603	22,000	Above		
D-46	0607	22,000	Scattered	46	
D-47	0611	22,000	Scattered above	38	
E-46	0614	22,000	Scattered NE	35	
E-45	0624	22,000	N	80	
E-47	0649	22,000	N	75	
F-47	0651	22,000	N	65	
G-46	0716	22,000	NNE	90	Face of Rosie SW.
F-48	0720	22,000	NW	60	
G-48	0729	22,000	NW	55	
G-49	0733	22,000	N	42	
H-46	0751	22,000	NW	50	
G-47	0800	22,000	Above	110	Maximum reading this area. Background 27.
H-47	0802	22,000	Not visible		
H-48	0805	22,000	Not visible		
H-49	0808	22,000	Not visible		
I-47	0814	22,000	Not visible		
I-48	0816	22,000	Not visible		
I-49	0820	22,000	Not visible		
I-50	0823	22,000	Not visible		
H-50 to F-50	0827	22,000	Unknown		

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 8

DATA FOR CLOUD TRACKING AIRCRAFT B-29 (COOK BOOK 2)

Position*	Time	Altitude	Direction of cloud	T1B meter, mr/hr	Remarks
A-43	0444	18,000	NE	9	
B-43	0457	18,000	Above and SE	180	
B-44	0508	18,000	NE and above	16	
B-43	0516	18,000	Above and SE	120	
E-45	0523	18,000	Left and above	0.1	
C-45	0531	18,000	Above and E	11	
C-44	0540	18,000	N and above	18	
B-43	0546	18,000	E and above	22	
C-45	0556	18,000	NE and above	10	
D-44	0608	18,000	S and above	30	Rosie is in several parts.
D-45	0612	18,000	Above	18	
D-47	0621	18,000	NW	4	
D-44	0636	18,000	Above and E	28	
D-43	0644	18,000	W and above	22	
D-44	0657	18,000	NE and above	18	
E-42	0706	18,000	Above	44	
D-43	0716	18,000	SE	18	
D-45	0723	18,000	E	2	
G-43	0726	18,000	Unknown	20	
G-46	0749	18,000	Unknown	33	
H-46	0800	18,000	NW	17	Unable to positively identify Rosie.
I-46	0815	18,000	Unknown	31	
G-45	0833	18,000	Unknown	4	

*The coordinates used are the same as those shown in Incl. 9, Chap. 2.

Inclosure 9

DATA FOR CLOUD TRACKING AIRCRAFT B-25 (COOK BOOK 3)

Position*	Time	Altitude	Direction of cloud	T1B meter, mr/hr
A-44	0524	12,000	E	1
A-43	0538	12,000	E	2.0
B-43	0545	12,000	E	6
	0608	12,000	E	2
D-41	0635	12,000	E	0.8
E-44	0703	12,000	E	0.4
B-43	0708	12,000	E	1.3
A to M 41 to 49	0805	12,000	E	Background

* The coordinates used are the same as those shown in Incl. 9, Chap. 2.

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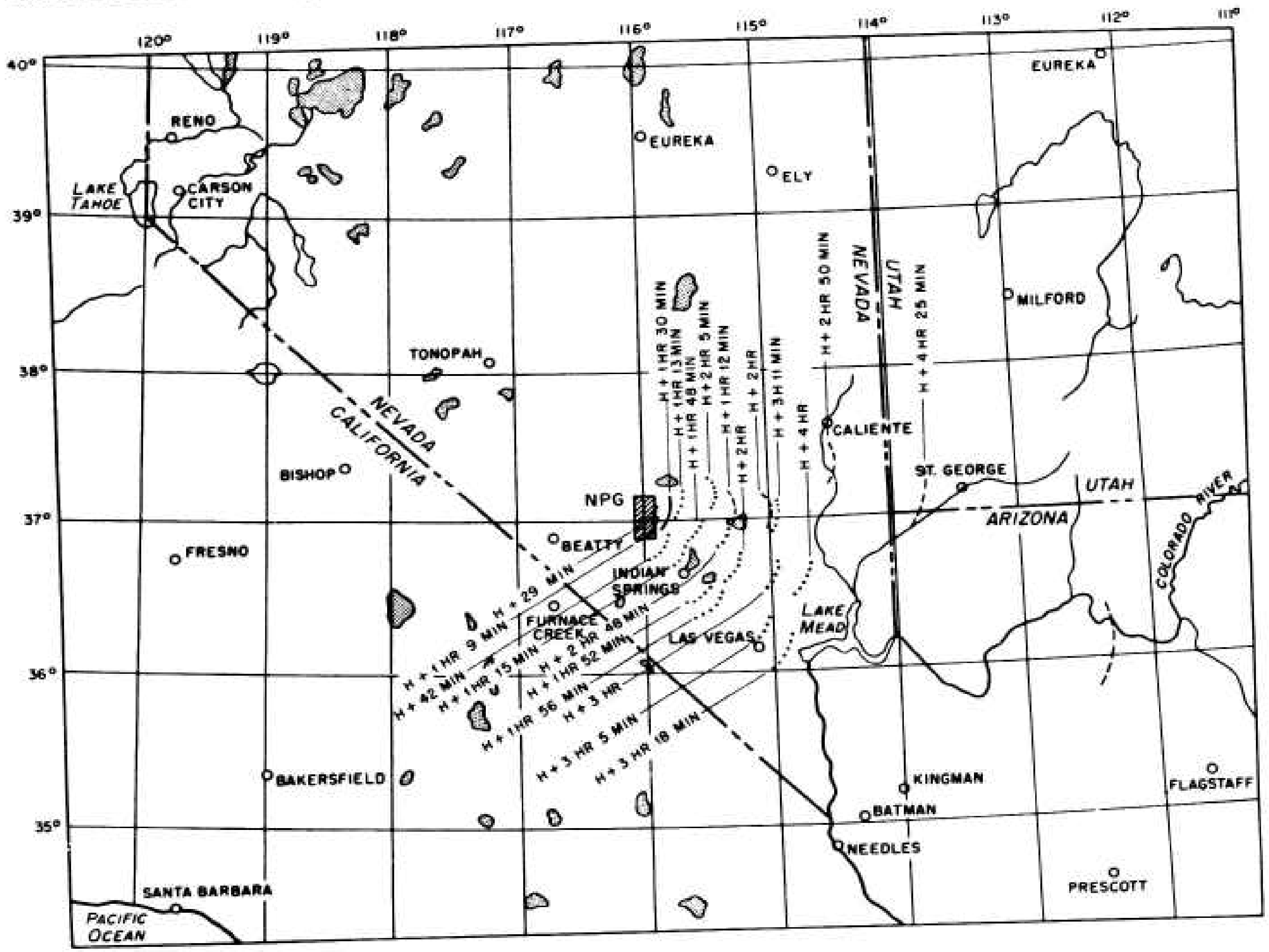
Inclosure 10

ACTUAL CLOUD TRACK, SHOT CLIMAX



——, 12,000 ft msl. ...., 18,000 ft msl. - - - - -, 35,000 to 40,000 ft msl.

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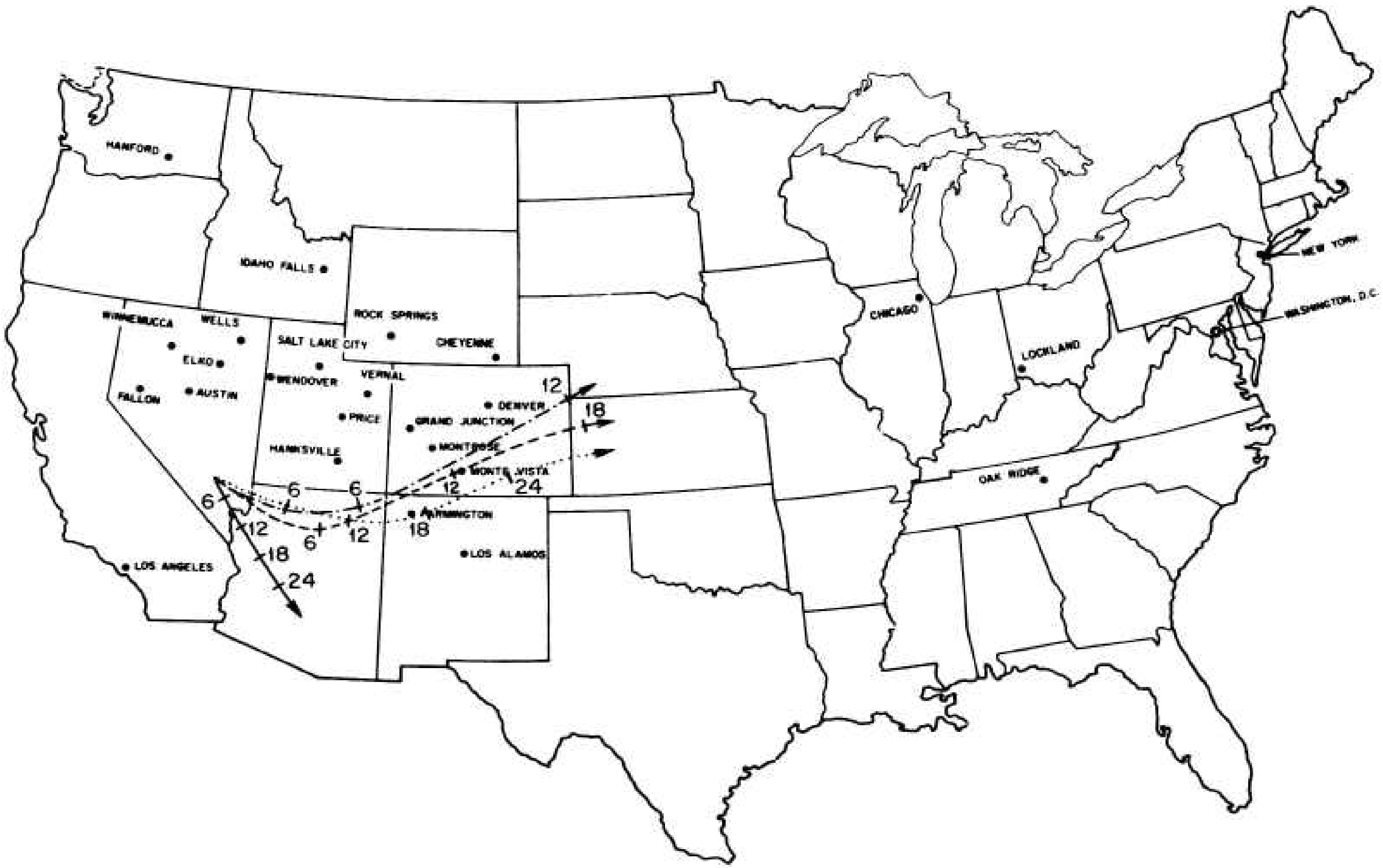
Inclosure 11

PREDICTED CLOUD TRAJECTORY, 0415, 4 JUNE 1953



——, 10,000 ft msl. ...., 20,000 ft msl. -------, 30,000 ft msl. –·–·–·–, 40,000 ft msl.

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Inclosure 12

DATA FOR TERRAIN SURVEY AIRCRAFT L-20 (EVER READY)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr		Calculated ground intensity	Infinite dose
			MX-5	T1B		
ZC-45	0742	500	0	0		
ZE-44	0752	500	0	0		
ZD-43	0757	500	Background	0		
ZC-42	0802	500	Background	0		
ZB-41	0808	500	0	0		
ZA-41	0811	500	0	0		
A-41	0816	500	0	0		
B-41	0824	500	0	0		
B-42	0827	500	0	0		
B-43	0832	500	Background	0		
B-44	0835	500	0	0		
B-45	0840	500	0	0		
C-45	0842	500	0	0		
C-44	0846	500	Background	0		
C-43	0850	500	1	1.2	12	370
C-42	0857	500	0.2	0.2	2	65
C-41	0901	500	Background	0		
D-41	0904	500	0	0		
E-42	0909	500	Background	0		
E-43	0912	500	0.2	0.2	2	60
D-44	0920	500	Background	0		
D-45	0926	500	Background	0		
D-46	0930	500	Background	0		

*The coordinates used are those listed in Incl. 9, Chap. 2.

Inclosure 13

DATA FOR TERRAIN SURVEY AIRCRAFT C-47 (RAG MOP)

Position*	Time	Altitude above ground, ft	Meter readings, mr/hr MX-5	Meter readings, mr/hr T1B	Calculated ground intensity	Infinite dose
E-45	0910	800	Background	0		
F-44	0918	300	0.4	0.4	2.4	78
F-43	0921	100	0.3	0	0.75	23
F-42	0927	200	Background	0		
F-41	0935	200	Background	0		
G-42	0940	200	Background	0		
G½H-43	0948	200	0.2	0	0.8	25
H-43	0955	300	Background	0		
H-42	0957	500	Background	0		
H-41	1000	300	Background	0		
H½I-42	1003	500	Background	0		
I-43	1006	500	Background	0		
I-44	1012	300	Background	0		
I-45	1018	300	Background	0		
I-46	1025	200	1	1.2	4.8	170
J-46	1031	300	0.2	0	1.2	40
J-45	1034	500	0.2	0	2.0	75
J½K-44	1042	150	0.2	0	0.6	22
J½K-43	1047	200	0.2	0	0.8	30
J½K-42	1049	200	Background	0		
K-42	1051	200	0.2	0	0.8	32
K-43	1053	200	0.2	0	0.8	32
K-44	1056	200	Background	0		
K-45	1059	100	0.3	0	0.75	30
K-46	1107	200	0.2	0	0.8	33
K-47	1111	200	0.2	0	0.8	34
K-48	1115	200	Background	0		
K-49	1120	200	0.2	0	0.8	35

*The coordinates used are those listed in Incl. 9, Chap. 2.

Chapter 13

ROLL-UP AND MISCELLANEOUS

13.1 INTRODUCTION

The Upshot-Knothole series of atomic tests has presented radiological safety problems which varied from almost nil, in the case of the high air burst, to the greatest problem ever presented at a continental test, in the case of the larger tower shots. Shot Simon is an example of the radiological contamination problem produced by a high yield tower shot. The infinite dose for this shot at 200 miles distance from ground zero was 5 r. Vehicles as far east as Glendale and Mesquite were found to be contaminated, in a few cases to a radiation intensity as high as 500 mr/hr. This required the establishment of roadblocks and decontamination stations in these areas to monitor and decontaminate vehicles.

13.2 ROLL-UP

13.2.1 The roll-up of the Rad-Safe Unit and preparation of the area for the interim period started directly after Climax and was completed by 12 June. All the personnel of the Off-Site Section departed by 9 June. On-Site was reduced to a skeleton crew by this time.

13.2.2 A final survey was run of all contaminated areas in Yucca Flat (Incl. 1), and signs and barricades were posted on all access roads. All debris in Frenchman Flat was monitored, and items over 10 mr/hr were marked and pointed out to salvage crews. The highest reading was 50 mr/hr.

13.2.3 Rosters were made up on the total gamma exposure of all personnel who had entered contaminated areas during the tests. The rosters were sent to AFSWP for all DOD personnel, with the film badges corresponding and accumulative dosage records. A roster of all other personnel was sent to the Director, Division of Biology and Medicine. In addition to the above, separate rosters were sent to individual military establishments and the home offices of agencies that had personnel participating.

13.3 LIFETIME GAMMA DOSES AT POPULATED AREAS

During this operation various small towns in the vicinity of the proving grounds were in the path of fall-out from the different shots in the series. A cumulative record was kept on each town (Incl. 2). The cumulative dosage was computed from outside readings and is based on integration of the $t^{-1.2}$ decay curve, with the exceptions of the Lincoln Mine and St. George, Utah, data which were measured under an intensity curve. As activity from fission products is known to fall off faster than $t^{-1.2}$ due to weathering and other factors and as intensity readings taken in shelters and homes were always much lower than those readings taken outside, it should not be considered that the persons at these locations received the full dosage listed. A figure of one-half or one-third of the reading given would be more nearly correct.

13.4 RECORD OF CATTLE IN THE FALL-OUT AREAS

Throughout the period of the tests, records were made by the Off-Site monitors and monitors in aerial terrain survey planes of the location of cattle they noticed in the fall-out area. This was done because of numerous problems that arose after the Tumbler-Snapper operation regarding cattle. The information is shown in Incl. 3.

13.5 UNUSUAL DOSIMETER-TO-FILM BADGE RATIO

13.5.1 The seventh shot of this series presented a problem in that there were 39 film badge exposures over the 3.9 r limit set by the Test Director. Monitors relied upon their T1B survey meters and pocket dosimeters in controlling their exposure and the exposure of personnel in their parties during surveys and recovery work. Questioning of these personnel and examination of dosimeter records indicated that according to their survey meter readings and pocket dosimeters they should not have been overexposed. Therefore an investigation was made of the incident.

13.5.2 In this investigation the following steps were taken:

1. Film badge processing was reviewed.
2. Film badge readings were reviewed.
3. Calibration curves were run on the 0-10 r dosimeters involved.
4. Statistics were prepared comparing the ratio of pocket dosimeter to film badge readings from previous shots and this shot.
5. Pocket dosimeters and film badges were placed in the field on D+2 and D+3 for this shot at the 1 and 2 r lines, and the ratio of the readings was studied.
6. The Project Officer, Project 6.8, was contacted and requested to furnish information on any unusual features he might have noted in the characteristic radiation from this shot.
7. An inquiry was made of the Test Director's Staff to determine if there were any unusual features in this gadget that might cause this.
8. An inquiry was made whether the findings from the chemical analysis of the atomic cloud might indicate a solution to this problem.

Steps 1 and 2 showed that the film badge processing and film badge readings were correct. The recalibration of the 0-10 r pocket dosimeters, step 3, showed that the dosimeters were accurate within their expected tolerance limits.

A review of the statistics gathered, step 4, showed that prior to the seventh shot the pocket dosimeters with few exceptions read generally higher than the film badges. The comparisons of the pocket dosimeter to film badge readings made in the field on D+2 and D+3 days showed approximately the same ratio. However, the ratio of the pocket dosimeter to film badge readings on D-day and D+1 for this shot was consistently lower than 1, and in many cases the film badge read more than twice as much as the dosimeter.

The Project Officer, Project 6.8, pointed out that the beta to gamma ratio was unusually high for this shot and that certain of his instruments indicated a hard beta component and that instruments that respond to low energy gamma radiation indicated higher readings than those indicated by the usual gamma survey meters.

Personnel on the staff of the Test Director indicated that there was nothing unusual in the features of this gadget that would cause a change in the characteristic radiation. This was supported by the chemical analysis.

13.5.3 Examination of the characteristic energy response curves of the pocket dosimeter and the standard film badge indicated that this effect could be caused either by an excess of low gamma energy or by an excess of hard beta. The hard beta would have little effect on the T1B and pocket dosimeter but could cause excessive X rays on the lead shield of the film badge. This would expose the film badge more than normal and cause it to read high.

13.5.4 The information available is not conclusive; however, the information indicates that these high readings are probably the result of a hard beta component in the radiation field the first two days after the seventh shot.

13.5.5 A possible solution for early detection of this condition is the immediate development of film badges worn by the initial survey monitors and a comparison of these readings and their dosimeters. This would have to be done immediately after each shot. This action would not solve the problem but would alert the Rad-Safe organization to the condition existing for that shot.

13.6 DECONTAMINATION SECTION

13.6.1 Much of the work of the vehicle decontamination section was not covered in detail in the narrative report on the various shots. In addition to the decontamination of vehicles and the items listed in the narrative reports in Chaps. 2 through 12, the vehicle decontamination section was called upon to perform numerous difficult and unusual decontaminations. A variety of animals used in the test operation, both dead and alive, were decontaminated during the operation prior to their turn-over to project personnel. Live animals were usually vacuumed and dusted. Dead animals were often washed with soap and water until readings were brought down to tolerable levels. After Shot Grable, 50 dead dogs were decontaminated. A great many items of USMC Petroleum Oil Lubricant equipment, with readings often as high as 20 r/hr, were decontaminated to acceptable levels. Three Navy LVT's that were to be shipped from the Proving Grounds by contract carrier were worked on for a period of approximately four days so they could meet the contracted shipment date. This later work was done at the temporary station set up in the Frenchman Flat area.

13.6.2 Other unusual decontamination activities included decontamination on the inside of tower cabs, which had been contaminated by prior shots, in Areas 3A and 2 in the Yucca Flat area. Throughout the test period, large quantities of scientific measuring devices and construction equipment were decontaminated. Electrical equipment and cameras presented a major problem as it was not possible to use steam and water on much of this equipment.

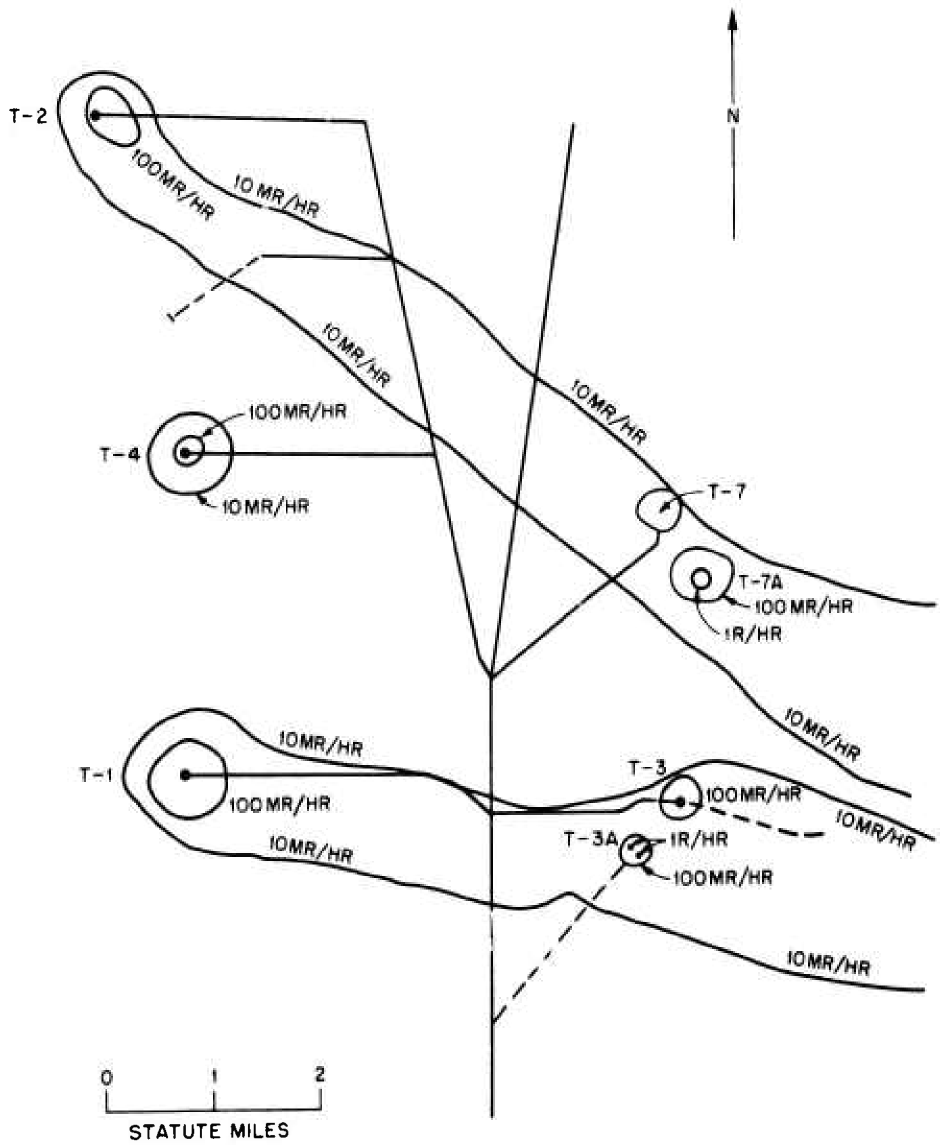
13.6.3 During Shot 8 and Shot 10 in the Frenchman Flat area, a decontamination station was set up which operated continuously for three days. During the period between Shot 6 and Shot 11, the vehicle check point at the intersection of the access road to the CP and Mercury Highway operated continuously. Lights were installed by the AEC for night work.

13.6.4 A routine check was made after each shot of vehicles parked in the Mercury motor pools. Throughout the test series only four vehicles were found to be contaminated over the tolerance limit. It was assumed that these vehicles had evaded the vehicle monitor check point.

13.6.5 Levels of contamination reached in the vicinity of the decontamination station could always be brought down to tolerance and did not present excessive exposures for the men.

Inclosure 1

YUCCA FLAT RADIOLOGICAL SITUATION, 8 JUNE 1953



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Inclosure 2

CUMULATIVE FALL-OUT RECORD

Population center	Approximate population	Infinite dose, r
Alamo		0
Bunkerville	202	5 to 8
Caliente	1000	0.15
Cedar City, Utah		0.5
Crystal	7	7.0
Crystal Springs	1200 (in valley)	0
Dry Lake	>35	0.6
Garnet, Nev.	16	0.2
Glendale	15	
Groom Mine	3	0.6
Hiko	6	0
Hurricane, Utah	1500	7.7
Lincoln Mine	270	3.5
Littlefield, Ariz.	50	1.8
Logandale	350	
Mesquite	600	2.1
Moapa Reservation	250	
Overton	600	
Overton Landing	150	0.01
Panaca	300 (plus schools)	0.25
Pioche	2000	0
Riverside Cabins	14	12 to 15
Rockville, Utah	300	6.0
St. George, Utah	5000	4.75

Inclosure 3

CATTLE IN FALL-OUT AREA

The following table has information on cattle noted by the monitors in the terrain survey aircraft. Infinite dose readings are based on readings taken from the aircraft in the vicinity of the cattle and should be considered as only approximate; and, as the cattle migrate from area to area, the readings should not be considered as the dosage received by the cattle. All bearings are from a point at 37°N 116°W, or the approximate center of the Proving Grounds.

Position	Time	No. of cattle	Infinite dose, mr
		25 April 53	
152 miles at 106°	1245	50	5000
107 miles on a bearing of 120°	1130	8	3700
122 miles on a bearing of 117°	1145	8	4000
78 miles on a bearing of 125°	1245	30	5000
149 miles on a bearing of 135°	1006	60	500
		24 March 53	
57.5 miles at 54°	0842	50	Background
51 miles at 64°	0842	15	Background
36 miles at 337°	0916	40	60
48.5 miles at 23°	0946	20	50
77.5 miles at 55°	1032	6 horses and 200 cows	Background
56.5 miles at 360°	1058	50	240
76.5 miles at 28°	1231	20	Background
67.5 miles at 8°	1243	6	1250
		19 May 53	
18 miles at 24°	0850	50	4500

The following table has information on cattle noted by the ground monitors. The infinite dose is based on intensity readings taken by the monitor in the area.

Date	Location	No. of cattle	Infinite dose, mr
24 March 53	Adaven-Sunnyside region	1500 to 2000 sheep	1000
18 April 53	Valley of Fire	150 cattle	3000 to 6000
25 April 53	Virgin River Valley	550 cattle	1500 to 6000
16 May 53	St. George and vicinity	7 herds of milk cows	3000 to 6000

Chapter 14

COMMENTS ON ORGANIZATION AND PERSONNEL

14.1 INTRODUCTION

The operational peculiarities confronted with each shot and the data obtained are included in the preceding chapters. This chapter contains comments on the general organization, changes to the organization, and a brief account on the functioning of each section in the Rad-Safe Unit, including the idea of a permanent Rad-Safe Support Unit for atomic tests.

14.2 ORGANIZATION

A reorganization of the Rad-Safe Unit was effected after the second shot, with the departure of the executive officer of the Support Unit who had been the On-Site Operations Officer, by appointing the Commanding Officer of the Rad-Safe Support Unit as On-Site Operations Officer. The Rad-Safe Officer and the Rad-Safe Control Officer assumed the responsibility for operational administration of the Rad-Safe Unit and consolidation of the journal for the Rad-Safe Unit Report. This centralized the operational control of the Rad-Safe Unit and put the Commanding Officer of the Rad-Safe Support Unit in a direct supervisory position with respect to the greater portion of his personnel. This reorganization resulted in the organization shown in Incl. 1. No major changes were made in the organization of the On-Site, Off-Site, Logistics and Supply, or Control sections with the exception that the helicopter used in the initial survey was taken from On-Site and placed under the Control Officer.

14.3 ON-SITE OPERATIONS

14.3.1 As covered in the first chapter, the 9778th TSU Rad-Safe Support Unit provided the bulk of the personnel for the Rad-Safe Unit, and in particular the On-Site Operations Section. During the greater part of the operation, the Commanding Officer of the Support Unit was also On-Site Operations Officer.

14.3.2 Owing to the length of this operation, it was necessary to rotate personnel from the various sections of the Rad-Safe Unit so as to prevent accumulation of excess dosages by the personnel of the monitoring section. This rotation of personnel, plus the arrival of new personnel, necessitated a continuous training program in monitoring techniques. This refresher program for monitors was conducted by the On-Site Section and included training in communication procedure.

14.3.3 With the addition of the eleventh shot, it was found necessary to request the Test Director to authorize an increase in the 3.9 r tolerance dosage for 22 monitors in the section to 4.5 r as a total dosage for the operation and the roll-up period.

14.3.4 The functions and responsibilities assigned to the On-Site Section in the Operation Order were adequate for this series of tests and were well performed by the section.

14.4 OFF-SITE OPERATIONS

14.4.1 The personnel of the Off-Site Section indicated in Incl. 2, Chap. 1, carried out their responsibilities in an outstanding manner, and much valuable data on Off-Site fall-out were obtained. Much of this success was due to the capability of the Off-Site operations officer and his excellent knowledge of his work and of the country within the 200 mile area of responsibility. Both the military and PHS personnel were dependable and carried out responsible assignments.

14.4.2 The functioning and data collected by the Off-Site Section not only indicate the completeness in which the Off-Site work was done, but also on first analysis appear to indicate the needlessness of fixed air sampling stations for the Rad-Safe organization at the Nevada Proving Grounds. As indicated in Annex H to the Rad-Safe Operation Order, fixed air sampling stations were arranged peripherally around the test site. As no significant airborne activity levels were detected without significant ground readings from gamma survey instruments, it appears that unless external gamma radiation as registered by survey meters becomes dangerously high, there will be no hazard from airborne activity. It is recommended that for future operations, the air sampling program be eliminated as a responsibility of the Off-Site Operations Section with the exception of the two or three mobile air sampling teams that were used during the present operation. It is felt that if these mobile air sampling teams are moved so as to collect samples directly in the fall-out path, a complete enough coverage can be made of the airborne activity in that area. When the other monitoring teams, previously located at fixed air sampling stations, are relieved of this responsibility for air sampling, they will be more mobile; and it is conceivable that many of them can be moved from their initial station to the fall-out area. This will facilitate a more thorough coverage of the fall-out area.

14.4.3 For personnel for this section for future operations, it is necessary to consider that associated with the immediate Rad-Safe problem is also a very important public relations problem. The Off-Site monitor not only records and reports radiation in his sector, but often takes emergency action for the Test Manager. He must be able to converse with local officials for the Test Manager. He has been asked to investigate and review complaints registered by persons in the area, and in a few cases has been ordered to suggest that personnel in large communities go inside, as a precautionary measure. Only persons who are both levelheaded and experienced in the Rad-Safe problem can be expected to perform this type of duty satisfactorily. This becomes even more apparent when cognizance is given to the fact that the off-site monitor is often on his own, for communication with him, by either radio or telephone, is not dependable.

14.4.4 Most of the equipment for the Off-Site Section was furnished by H Division, LASL. This equipment functioned well for the program outlined.

14.4.5 The Off-Site Section needs additional office and working space. This should be considered prior to another operation. A quonset in the Mercury area would be a solution.

14.5 CONTROL SECTION

14.5.1 The responsibilities assigned to the Control Section in the Rad-Safe Operation Order were carried out well. The idea of this section and the data it presented to test personnel aided much in controlling the Rad-Safe operation.

14.5.2 One of the principal duties of the control officer was to control and assign missions to the aircraft used by the Rad-Safe Unit. Cloud tracking and the delineation of fall-out are two examples. These two functions are treated separately herein with recommendation for future air participation.

14.5.3 Support for the cloud-tracking mission was obtained from the 4925th Task Group (Atomic). They, in turn, obtained the aircraft and crews on a shot-to-shot, loan basis from the Strategic Air Command. Crews, to a large extent, were rotated to spread the training among a greater number. This rotation diminished to some extent the efficiency of the cloud-tracking operation. This, in addition, required extra work on the part of permanent personnel in the form of continued briefings, etc. The aircraft commander in each case had performed the mission at least once before. This did not, however, always give a fully experienced commander in that his previous mission may have been either an air burst or a small tower shot, where little or no radiation was encountered at his altitude.

The method of tracking was designed to minimize the amount of radiation the crews were subjected to and at the same time define the limits of the cloud accurately. Errors in judgment of distance and speed, as well as in the time required for turn, in some cases brought the aircraft into high radiation fields. The aircraft, in some cases, became highly contaminated. However, basically, the method of tracking is sound, and no great improvements are suggested.

More continuity and stability can be obtained if the same crews fly this mission for each shot. If it is desired to train additional crews the extra crews should go along for the training and not to actually perform the mission. The crews chosen for the mission should arrive in sufficient time before the first shot to allow for a more adequate indoctrination training. This is desired in order to give the crews more knowledge of their mission and the hazards involved.

The problem of the proper altitudes and planes for cloud tracking should be considered. The position of the top of the cloud is easily determined by the sampler control aircraft, a B-50. The low level position of the stem of the cloud was covered by a B-25 at 12,000 ft. This is a desirable altitude as it assists greatly in approximating the position of the fall-out area. The position of the cloud from this low level altitude to the top of the cloud should be determined by one other aircraft, altitude depending upon the maximum height of the cloud. However, 25,000 to 30,000 ft msl is appropriate for clouds which do not rise higher than 45,000 ft msl. A B-29 was used for this intermediate altitude. A third aircraft would be needed in a reserve status to replace either of these two in case of mechanical failure, or to relieve either of the planes when it is necessary to track the cloud for an extended period. It is preferable that all three of these aircraft be of the same type, with the same altitude and range capabilities.

14.5.4 The terrain survey portion of air participation was divided into two separate functions, first, the close-in, or on-site, part which was performed by helicopter; and, second, the extended, or off-site, part which was performed by L 20 and C-47 type aircraft. Since there was some doubt as to the feasibility of delineation of the fall-out pattern by means of aircraft, preliminary fall-out plots for Shots Simon and Badger were made from air data alone. When these plots were later compared with the ground data from the Off-Site ground survey teams and data obtained by Program 27, it was observed that the correlation was excellent. However, there are several sources of errors, as might be expected in aerial surveys. In each case, action can be taken to minimize this error. One of the main errors is that of the determination, accurately, of the altitude above the terrain. An error of 100 or 200 ft from an altitude of 600 ft will produce a 50 per cent error. This error can be corrected, or eliminated, by the use of an accurately calibrated radio or radar altimeter. This type instrument is recommended as a requirement for the aircraft used on this type mission. Another error which is encountered in the terrain survey is in locating accurately the planes' positions. The maps used by the aircraft crews are 1:1,000,000 ratio aeronautical charts. These maps are known to be inaccurate as to terrain features. The scale of the map is not suitable for the pinpoint navigation necessary in this type survey. The new 1:250,000 aeronautical chart, when complete, would correct both of these faults. A final point of importance is the correlation of air to ground intensities. This is the determination of the ground intensity from the air intensity reading. To obviate this difficulty, several calibration flights were run during the current series of tests. The data are plotted from these calibration runs for a helicopter and a C-47 and are attached as Incl. 2. As one would expect, correlation is different for different locations in the plane. Two separate curves are inclosed for the C-47. One is a correlation curve with the survey meter in the cockpit, and the other is with the meter in the cargo compartment. The source of radiation was fall-out in the Yucca Flat area. This approximated an extended source as it covered at least two miles of fairly uniform contamination.

The T1B ion chamber instrument was found to be the most suitable survey meter for this type work. In the practical work at the Nevada Proving Grounds, detection of a ground contamination intensity of 10 mr/hr is an adequate lower limit. This would give an air reading at 500 ft above the ground of about 1 mr/hr. This intensity can be measured fairly accurately with the T1B field survey instrument. The more sensitive Geiger or scintillation type survey instruments seem to be of little advantage. In high fields, which are sometimes encountered, the MX-5 Geiger counter goes off scale, and the scintillation counter, the Scintelog obtained from NYOO, becomes so saturated that fast response at high intensity is not obtainable. At least two T1B's should be carried in the aircraft.

The C-1 air filter used on the C-47 was not of great value. The fall-out plot should be studied, and a sufficient delay in the take-off time should be made to assure that all fall-out has occurred and that no low contaminated patches of air remain in the valleys.

When fall-out has been heavy, an accurate survey can be made on D + 1 day, and it is recommended that the terrain survey be repeated on this day. Little, if any, is gained by a 360° survey, however, as no evidence exists that a significant fall-out can occur up-wind.

The extended off-site portion of the survey, in this series, was made by an L-20 (out to about 30 miles) and by a C-47 from this range out to a distance of 200 miles. The C-47 does not have the desired performance for the mountainous terrain. A B-25 or a plane of the Convair 340 type would be more efficient.

14.5.5 The monitors functioning in the air participation worked directly under the Control Officer. This group should be organized as a separate, small section of the Rad-Safe Unit.

14.5.6 During this operation, the helicopter was not used to its maximum capability as the helicopters used for the first part of this series were old and unsuitable. An H-19, which arrived near the end of the series, was a more desirable type. In addition to survey work, the H-19 can be utilized in project recoveries in heavily contaminated areas. This would minimize exposure for project personnel and monitors. Three H-19's would be adequate to accomplish both these missions. In addition to the above, an H-19 can be used to transfer Off-Site personnel from one point to another in emergency situations.

14.6 LOGISTICS AND SUPPLY

14.6.1 Supply of equipment for the Rad-Safe Unit was satisfactory with the exception, as pointed out in the first chapter, that vehicles arrived late and therefore radio communications could not be properly checked out prior to start of thè operation. Radio communication, both for On-Site and Off-Site, could not be depended upon at the beginning of the operation. Modification of the power supply, by the installation of separate 6-volt generators on the military vehicles after the second shot, and the installation of isoplane antennas on the On-Site $^3/_4$ ton vehicles after the fourth shot, improved On-Site communications considerably. The present radio communications for Off-Site, although much better than at the beginning of the operation, still cannot be depended upon.

14.6.2 There was a shortage of spare parts for the $^1/_4$-ton and $^3/_4$-ton military vehicles. This resulted in a hardship, as vehicles were sometimes deadlined when needed for operational work.

14.6.3 An additional laundry dryer is needed in the laundry room of the Rad-Safe Building to facilitate the processing of contaminated laundry. Although the washer is capable of processing laundry at a rate of 60 pounds per hour, the present dryer has a much lower capacity. This often caused a delay in the processing of contaminated clothing.

14.6.4 A modification of the basement of the Rad-Safe Building is in order. There is not enough working space for instrument repair personnel, instrument and battery storage, and Off-Site office and laboratory.

14.6.5 The Logistics and Supply Section as organized for this operation functioned well.

14.7 RAD-SAFE SUPPORT UNIT

14.7.1 The idea of a Rad-Safe Support Unit has proved its value for this operation. The majority of the personnel of the Rad-Safe Unit for the operation were assigned to the 9778th Rad-Safe Support Unit. In addition to the operational functions already pointed out, the Commanding Officer, through his administrative section, handled all the Unit's administration and the assignment of personnel to various sections of the Rad-Safe Unit, as well as provided organized recreation for all troops of the Rad-Safe Unit. The Supply Section of the Support Unit formed the Logistics and Supply Section of the Rad-Safe Unit.

14.7.2 Most of the personnel of the Support Unit were well qualified for their work, and it is believed that with the experience gained from this operation in the requirements for a test operation, a permanent unit of this nature, preferably with many of the present personnel, could meet all but a few special requirements of a Rad-Safe operation at the Nevada Proving Grounds.

14.7.3 Assuming that a permanent unit is designed with the purpose of meeting all the requirements at the Nevada Proving Grounds, the following are considered as key positions and should be filled by personnel having training in nuclear physics and radiation health physics equivalent to that given to army officers with the 7330 MOS qualification:

1. Off-Site Operations Officer and assistant.
2. On-Site Operations Officer and assistant.
3. Control Officer.

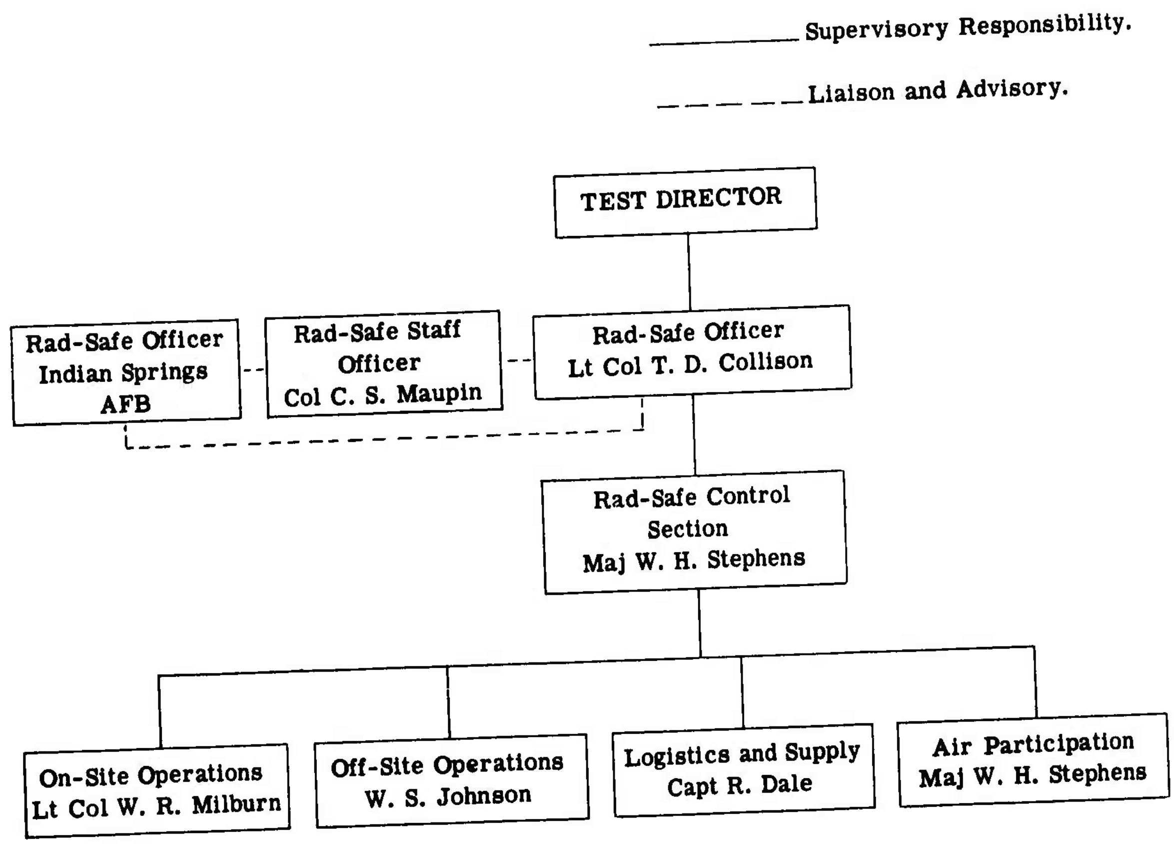
In addition to the above, all Off-Site monitors must be personnel with above average training and reliability. This is due to the unusual circumstances under which they must work and the decisions they must often make on their own. A review of the Off-Site activities with each shot substantiates this.

14.8 PERSONNEL

The Rad-Safe Unit consisted of personnel from the 9778th TSU Rad-Safe Support Unit and personnel furnished by the Air Force, Navy, Public Health Service, AFSWP, and LASL. During the pre-test period, an interim detachment of one officer and nine enlisted men was stationed at the proving grounds. On 15 February, an advance party consisting of personnel of the 9778th TSU Rad-Safe Support Unit and the Rad-Safe Officer, NPG, arrived at the proving grounds. This brought the total personnel strength, including the interim detachment, to 22. The main body of the Support Unit arrived on 1 March and brought the strength of the Unit to approximately 180 men. The arrival of augmentation personnel, Air Force, Navy, and Public Health Service, between 1 and 15 March, brought the strength of the Unit to 218, its maximum strength during the test period. Rotation and separation of personnel resulted in a fluctuation of the Unit's strength throughout the test period. However, the total strength of the Unit was steadily decreased after the ninth shot, as monitor personnel who had received their total permissible radiation dosage were returned to their home stations. On 6 June, the total number present was 98. By 15 June, the return of personnel had been completed with the exception of the three officers and the twenty enlisted men who were to remain during the interim period.

Inclosure 1

ORGANIZATION CHART



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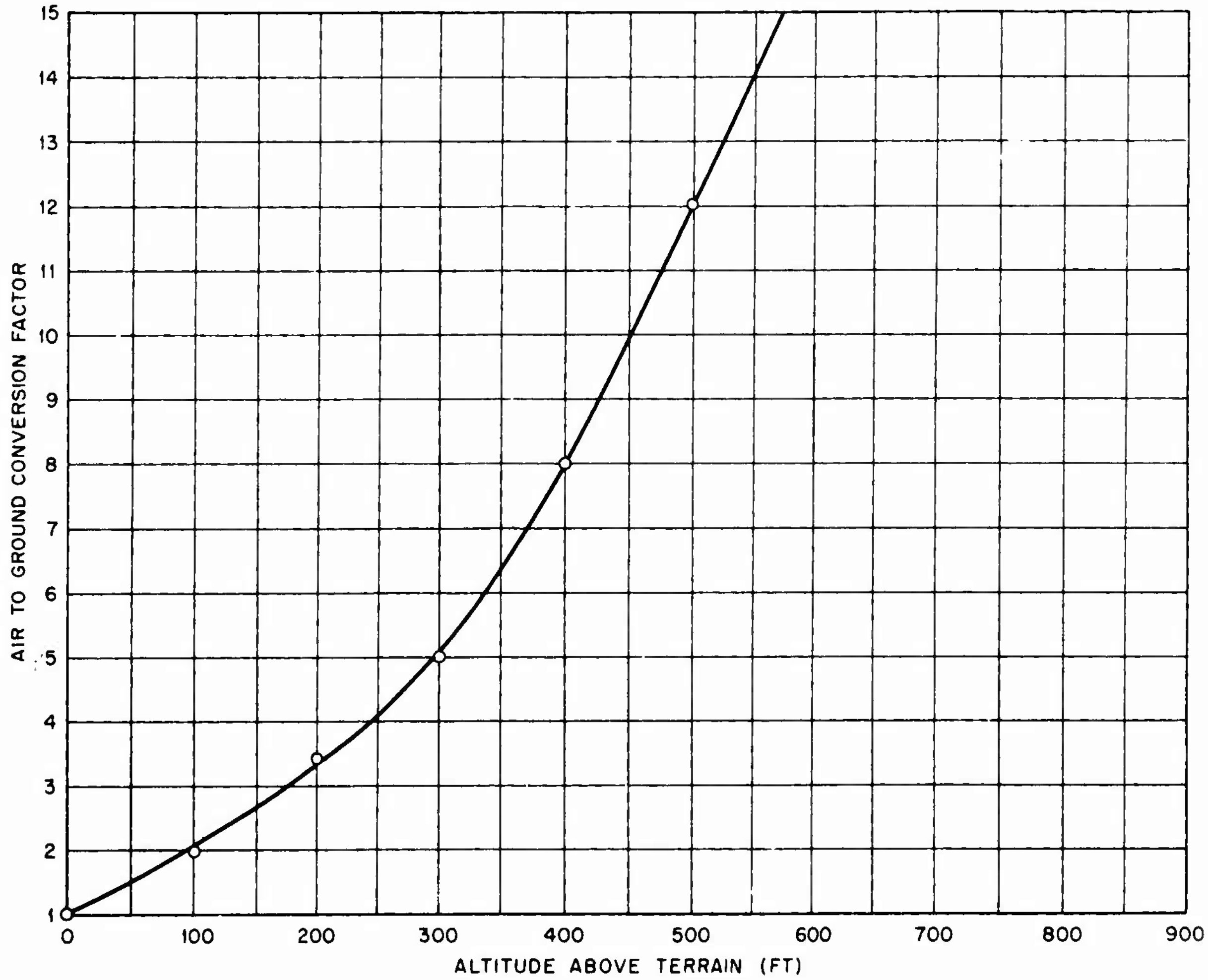
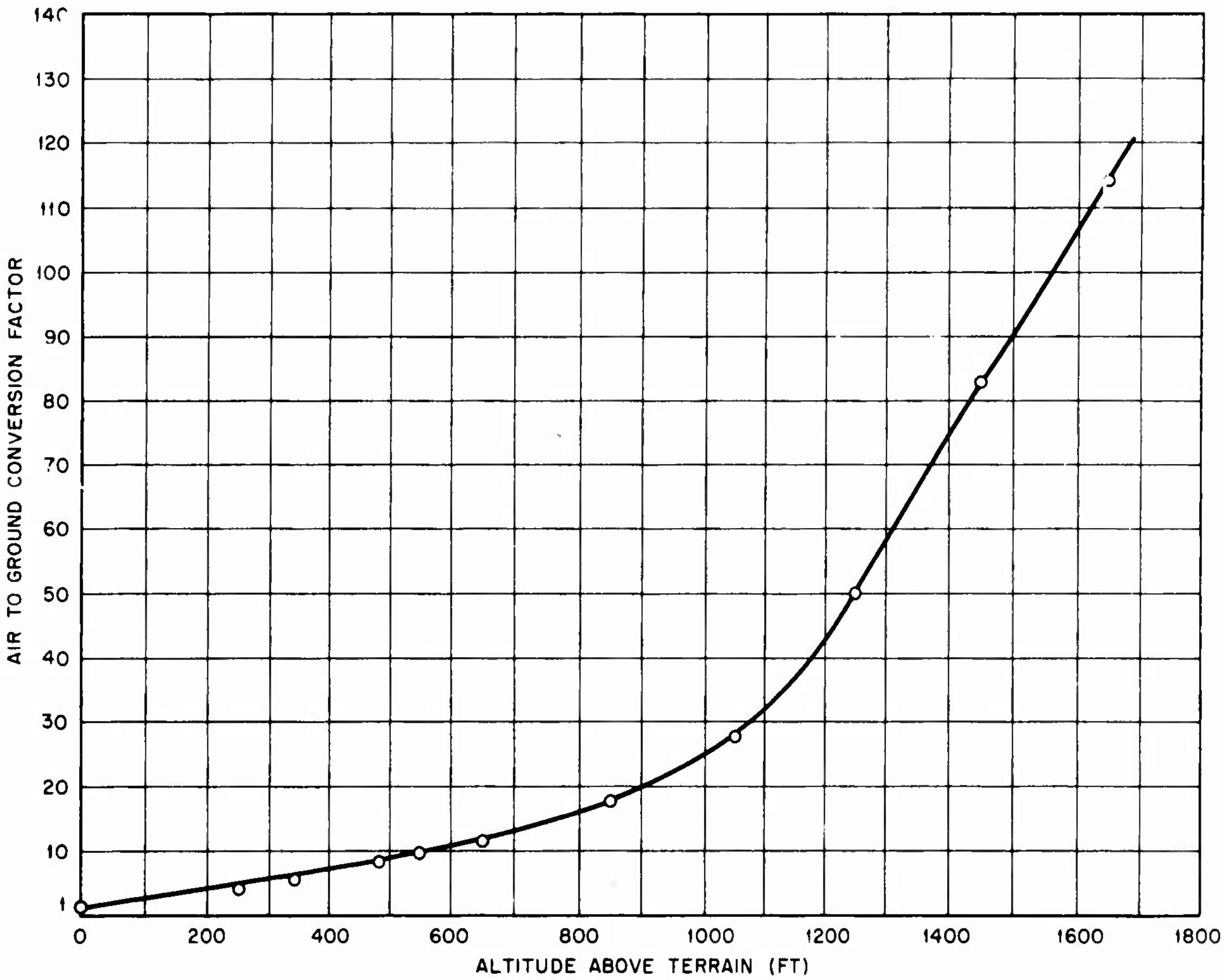
Inclosure 2

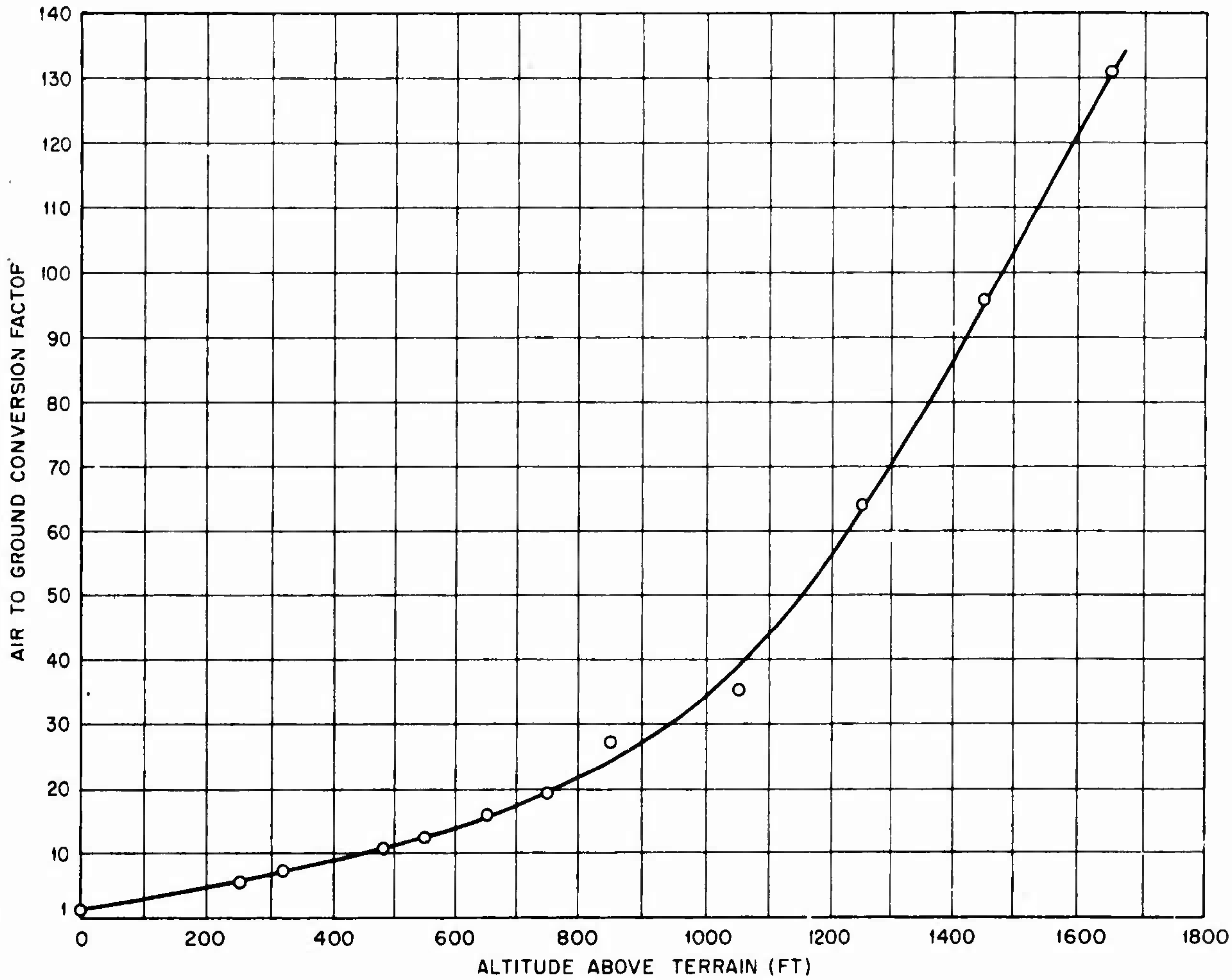
CORRELATION CURVES FOR AIR TO GROUND READINGS



Correlation curve for readings taken over ground zero of Shot Annie 17 days (3 April 1953) after shot (helicopter survey with T1B).



Curve for C-47 survey with T1B. Readings were taken in the cockpit (19 April 1953).



Curve for C -47 survey with T1B. Readings were taken in the cargo compartment (19 April 1953).

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