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Contractor Report ARQED-CR-03001

RADIOLOGICAL CHARACTERIZATION OF BUILDING 611B DEPLETED URANIUM FIRING RANGE CHARACTERIZATION

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June 2004

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**ARMAMENT RESEARCH, DEVELOPMENT AND
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Quality Engineering and System Assurance

Picatinny, New Jersey

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14. ABSTRACT Building 611B testing facility at the Armament Research, Development and Engineering Center (ARDEC), Picatinny, New Jersey was used for firing operations and ballistics testing of small scale depleted uranium (DU/U-238) and/or staballoy kinetic engery penetrators and storage from July 1979 to October 1984. Uranium-238 and its short-lived daughters are the only radionuclides of concern. Subsequent to the approval of the Guitierrez-APalmenberg, Inc. (GPI's) drafts of a Project work plan, health and safety plan, and quality assurance plan to ensure compliance with the Nuclear Regulatory Commission license conditions, all pertinent regulations and permits, the characterization survey ended after 24 days with the demobilization of GPI on 13 May 1997. This radiological characterization report provides the information needed to decommission and remediate the Building 611B testing facility, which has not been used for DU munitions testing since the end of 1984, so as to remove it from ARDEC's SUB-348 license and free release it from radiological control.					
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As a result of the effort by Gutierrez-Palmenberg, Inc. (GPI), Joseph Fabiano of the Armament Research, Development and Engineering Center (ARDEC), Picatinny, New Jersey and Mike Styvaert of the U.S. Army Field Support Command (FSC), formerly the Industrial Operations Command (IOC), Rock Island, Illinois, the "Building 611B Testing Facility" consisting of building 611B, its accessory structures, and associated grounds underwent a characterization study to determine the concentration and distribution of depleted uranium (DU) in accordance with the work description of contract DAAA90-95-G-0017. The intention is to eventually have the Testing Facility not only decommissioned and remediated, but also to have it removed from ARDEC's SUB-348 license and free release it from the Nuclear Regulatory Commission and radiological control.

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CHARACTERIZATION SUMMARY

The Building 611B Testing Facility at the Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, New Jersey site was used for firing operations, ballistics testing of small scale depleted uranium (DU/U-238), staballoy (metal alloy made from high-density DU with other non-radioactive metals) kinetic energy penetrators for armor-piercing munitions and storage of armor plate and project related supplies from July 1979 to October 1984.

Gutierrez-Palmenberg, Inc. (GPI) performed this characterization study under contract to the U.S. Army Fire Support Command (FSC) formerly the Industrial Operations Command (IOC). A Project Work Plan, Health and Safety Plan (HASP), and Quality Assurance Plan (QA) were prepared and approved to ensure compliance with ARDEC's Nuclear Regulatory Commission (NRC) license conditions and appropriate regulations.

Most of the identified radioactive materials removed from the testing facility prior to the characterization were identified, inventoried, double bagged, and temporarily stored, in a secure and posted Military Communication Trailer (app A), which was used as an outside storage shelter. This ensured an accurate evaluation of the items pending classification by a broker that would be designated to remove, re-classify, re-identify, and re-package all the radioactive items into approved Department of Transportation containers to await on-post transfer, license-to-license transfer, and/or ultimate off-post Department of Defense (DoD) authorized disposal.

Routine air sampling taken by GPI during the characterization study indicated no external exposure to personnel and no detectable releases of radioactive materials either beyond the affected area or to the environment.

Various activities and levels of fixed and/or removable (loose) radioactive surface contamination were identified in the following places at the testing facility and described under the sections/components portions of this report:

- Base of the stairs and dirt under the wooden steps leading into the foyer
- Foyer (app B)
- Instrumentation room (app C)
- Non-DU firing range (app D)
- Depleted uranium/staballoy munition testing range tunnel (app E)
- Depleted uranium target room (app F)
- Inside storage room (app G)
- Multi-stage high efficiency particulate air (HEPA) filtration/ventilation bank (app H)

- Underground storage tank [(UST) (not available prior to decommissioning)]
- Outside, open, storage, platform/deck [also known as the gazebo (app I)]
- Building 611B associated grounds (app J)

Extensive soil sampling was conducted on the grounds outside the building in areas where it was reasonable to expect that radioactive material may have migrated from the various components making up the testing facility as a result of the storage of radioactive material on the outside, open, storage platform; tracking contamination from an affected area; and/or release of airborne contaminants from the HEPA filtration/ventilation system because of the unanticipated fire(s), which occurred within it.

Recommendations for remediation of the testing facility are included in this report.

There were no injuries to personnel during the characterization study.

There were no spills of hazardous or radioactive material during the characterization study.

SCOPE OF WORK

ARDEC is located in Dover, New Jersey. As a part of its mission, the arsenal designs, constructs, and tests weapon systems for the United States Army. This project, contract DAAA90-95-G-0017, a DU radiological characterization study of the Building 611B testing facility was completed by GPI in May 1997.

SITE AND CHARACTERIZATION METHODS

Building 611B was originally constructed in 1929 for use as a test range for firing artillery rounds until approximately 1959 when the east-west firing range tunnel was added to the existing non-DU firing range along with other structures for the testing of DU (U-238), staballoy kinetic energy, armor piercing projectiles, and the storage of armor plate and other project related supplies. In its original configuration, the north-south non-DU firing range was stated to be 373 ft 9 in. long. The DU/staballoy munition firing range tunnel is 40 ft long and intersects with the original non-DU firing range at approximately its midpoint. The only areas, surfaces, and/or components of radiological concern at the testing facility are those contaminated with and/or made of DU. On-site personnel have indicated that only the east-west tunnel was used for DU munitions testing.

Depleted uranium is used in munitions by the United States armed forces to enhance the energy level of a projectile. The DU used at the Building 611B testing facility was limited to firing small scale DU and/or staballoy kinetic energy, armor piercing, penetrators. They were loaded into the gun barrel located in the non-DU firing range and fired through a rectangular hole in the circular steel, dividing, wall/door at an armor target set-up on a stand in the target room. The target room, located at the west end of the DU/staballoy munitions firing range tunnel, was ventilated during firing by a HEPA filtration/ventilation system that discharged after four stages of filtration.

Over the years there was migration of DU from various sections/components of the building 611B testing facility. Affected and non-affected interior and exterior surfaces were gridded. Data which was collected from systematic/random direct measurements and smears, ambient air samples, and soil samples were organized and evaluated to determine the concentration and distribution of the fixed and/or transferable (removable, loose) contamination at the testing facility.

Reason for Remediation

The building 611B testing facility is no longer used for the testing of either DU or non-DU munitions. The operator's log (app K) contains the chronological history of the testing conducted in building 611B. This characterization report will provide the information needed to remediate and decommission the testing facility, remove it from ARDEC's SUB-348 NRC license, and free it from radiological control.

Management Approach

Gutierrez-Palmenberg, Inc. certified unexploded ordnance (UXO) expert sub-contractor personnel from Scientech, Inc. swept the surfaces of the testing facility for UXO and marked the unexploded surficial ordnance, which were found on the grounds to the east and north of the building for disposition by the ARDEC Explosive Ordnance and Technology Division (app L) prior to any characterization by GPI.

In areas where surface contamination was above the limits specified in the NRC Regulatory Guide 1.86 [section 5 (app M)], GPI established controls as required by GPI's NRC license number 27-29103-01 and ARDEC and GPI's radiation work permit and procedures, respectively. Areas where the soil activity exceeded 35 pCi/g (picocuries per gram) above background, a level identified in the Federal Register, 23 October 1981, V: 46, N:205, p 52081 and the State of New Jersey Department of Environmental Protection as the soil remediation level for DU are identified in this report. It is a commonly accepted level of remediation for DU in soil and accepted by the NRC.

All GPI crew personnel wore dosimetry. Personnel received no reportable radiation dose during the characterization of the testing facility.

GPI employees completed the on-site project work with on-site direction provided by the Project Manager, Thomas J. O'Dou, CHP (app. N) and the contract/interface project engineer, Joseph A. Fabiano.

Site Description

The building 611B testing facility at ARDEC is located on a large hill, which slopes about 10 to 20% and is littered with spent munition shells to an entry road that is below the grade of the building 611B testing facility. The road pavement leads to an outside, open storage area platform and outdoor storage shelters to the north and east of the "T" shaped building.

Type and Location of the Facility

The DU testing facility, located on the side of a large hill, is a scaled down version of a full size weapons range. The east-west DU (U-238)/staballoy firing range tunnel was added to the existing non-DU firing range, along with other structures for the testing of DU (U-238) staballoy kinetic energy, armor piercing projectiles, and storage in approximately 1959. It was not activated until July 1979 at which time it continued through October 1984 after which it was no longer used for either DU or non-DU munitions testing. No records were available to determine its use between 1959 and 1979, if indeed it was used. A characterization study to determine the concentration and distribution of DU and U-238 at the testing facility began in April 1997 in accordance with the work description of contract DAAA90-95-G-0017 with the intention of eventually having the testing facility decommissioned and re-mediated so as to remove it from ARDEC's NRC SUB-348 license and free release it from the NRC and radiological control. The testing facility characterization was completed in May 1997.

Ownership

ARDEC (Picatinny Arsenal) is owned by the United States Army.

Building 611B Testing Facility

The building 611B testing facility of approximately 40,000 ft² is bounded by a fence, brook, and entry road. It contains building 611B, accessory structures, and associated grounds that provided containment for the firing, testing, and storage of munitions.

Building 611B

The building 611B testing facility includes the following sections/components:

- Porch – includes the cement base at the bottom of wooden steps, wooden side rails, and wooden double doors, with windowpanes leading onto a platform, which leads into a foyer
- Foyer – wood frame structure on a concrete foundation with double doors with windowpanes leading to the loading area, instrumentation room, and a single steel door leading into the non-DU firing range. The floor is covered with vinyl tile possibly containing asbestos. The roof/ceiling is wood and fiberboard. It is 4 ft x 8 ft with a height of approximately 8 ft.
- Instrumentation Room – wood frame structure on a concrete foundation approximately 8.5 ft x 14.5 ft and slopes from 7 to 9 ft in height. The floor is covered with vinyl tile. The walls are concrete block and plaster. The roof is wood and fiberboard. This room is furnished with a small, dedicated, hand sink, which discharged via a plastic drain pipe, the only plumbing in the building, to the underground storage tank (UST)/sump located on the exterior, in the ground, to the south of this room. The room was used as an office

space and operations center for monitoring the ballistic firing and testing of small scale kinetic DU/staballoy, kinetic energy, armor piercing projectiles in the DU firing range tunnel.

- Non-DU firing range – primarily concrete block and concrete with a north end wall and sloping concrete sidewalls that support a corrugated steel roof. The range is approximately 6 ft wide by 58 ft long, which includes a concrete ramp that slopes at the north, catch box end, approximately 3 ft above the normal floor level. The height of the concrete wall is 5 ft at the entrance and 11 ft above normal floor level at the five-sided, steel, bullet catch box, north end of this range. The floor is covered with vinyl tile. It is perpendicular to and intersects with the east/west DU firing range tunnel. It is separated from an uncovered accessory structure to its north by the catch box that is snuggled up against a concrete wall. Although a gas gun had been designed for use in firing DU projectiles, site personnel have stated that DU rounds were never fired in the non-DU firing range.
- Depleted uranium/staballoy range tunnel – made up of four of five sections of reinforced concrete pipes, 8 ft in diameter with a wall thickness of 8.5 in. and a thick flat poured concrete floor making up this east-west tunnel. The DU firing range tunnel and target room are contiguous and consist of five sections of pipe laid end to end to make a total length of 40 ft. They are connected to each other from east to west with patching mortar/concrete and adhesive mixture/rubber sealant. The approximately 4 ft wide flat floor is poured concrete, covered with vinyl tile as in the non-DU firing range, instrumentation room and foyer except for the underside of a large steel gun mount weighing approximately 2.2 tons and located on the south side of the midline of this range. The gun mount is held above the concrete floor by wooden blocks and extends through a circular steel wall/door interface into the target room. A gun barrel fastened to the stand was loaded with small scale DU/staballoy, armor piercing, penetrators, which were shot through a rectangular opening in the circular steel wall/door interface at a target in the target room. This one holed, circular steel wall/door, divides the DU firing range tunnel from the target room. The door portion opens to permit the operator to set up the target and can be closed when firing at the target. This range also has a series of x-ray pulsers for in-flight measurements.
- Depleted uranium target room – this western most section of the concrete pipe tunnel is the end or the last of five sections of concrete pipe. It is doubly reinforced and interfaces with the inside storage room on the west, and with the DU firing range tunnel on the east. It is separated from the inside storage room by a circular concrete wall with a central rectangular opening sandwiched between two steel plates. The steel plate on the inside storage room side has an adjustable window whereas the one on the target room side is a rectangular plate, which acts as a backstop for shrapnel and/or projectiles fired at the target. The circular steel wall/door on the east is approximately ¼-in. thick and divides the target room from the DU firing range tunnel. The steel frame of this section of the concrete pipe tunnel consists of 2-in. angle iron and support hardware attaching it to the concrete sidewalls, steel front and

back walls. At the top of this pipe is a caged lighting fixture, a trouble light connected to an outlet in the DU firing range tunnel and an unscreened open paracentric 6-in. ventilation duct extending down through a penetration into the room above the target positioned on the gun stand/table. It is connected to the HEPA ventilation system atop the roof/deck of the inside storage room. The portion of the gun mount extending into this section is used for holding the armor plate targets impacted by small scale, DU/staballoy, kinetic energy, armor piercing projectiles.

- Inside storage room – rectangular steel paneled/wooden structure located at the west end of the five 8-ft in diameter, 8.5-in. thick walled sections of reinforced concrete pipe making up the target room and DU firing range tunnel. It has a wood framed ceiling, cement floor, and metal roof/deck with a parapet used as a deck/platform for the HEPA filtration/ventilation bank connected by ducts to the target room. The walls of this room are constructed of ½-in. steel plate panels. It interfaces on the east with the target room by means of a thick reinforced circular concrete wall with a central rectangular opening sandwiched between two specially configured steel plates. The steel plate on the east side of the inside storage room on the backside of the circular concrete wall has an adjustable window, whereas the one on the target room side is a one piece rectangular plate panel acting as a backstop for shrapnel and/or projectiles fired at the target. The steel plates are bolted together through the opening in the concrete wall. At the opposite (back) west wall end of this room there is a thick full length block of steel and a smaller thick square block piggy backed onto the steel plate panel making up the back wall. They would be in a projectiles path and act as backstops.

Building 611B Accessory Structures

- Uncovered accessory structure – sloping dirt ramp approximately 6 ft by 25 ft. It is heavily contaminated with metal and vegetation. It is bounded on the south, east, and west by cement walls. The south end is separated from the north end of the non-DU firing range by a concrete wall and five-sided catch box snuggled up against it on the north end wall of the non-DU firing range.
- Underground storage tank and fill pipe – 500-gal fiberglass tank located underground on the exterior south side of the instrumentation room. It is connected with dedicated plumbing to the dedicated washbasin/sink located on the north side of the instrumentation room. Its fill pipe, used for testing the water in the tank, extends up above the outside ground surface to the south of the instrumentation room.
- Outside open storage platform/deck (gazebo) – 12 ft by 6 ft platform/deck that has seriously degraded over the years is completely constructed of wood with a composite shingle roof supported by four (4 x 4) posts, wood side rails and no side panels. Several pieces of metal shims and targets were found on the flat wooden deck and the ground surface adjacent to this structure.

- Outside storage shelters – two modular and portable outside storage steel framed shelters are military communications trailers located on the outside and adjacent to the south side of the instrumentation room inside the boundary of the wetland.
- HEPA filtration/ventilation bank – multi-stage high efficiency particulate air (HEPA) filtration/ventilation bank positioned atop the inside storage area roof deck (app H). It contains four stages of filtration before discharging to the outside. A 6-in. duct extends from the HEPA bank out over the inside storage room roof and down, into the target room, through a penetration at the top center of the fifth and last section of the concrete pipe.

Building 611B Associated Grounds

- Associated grounds – The associated grounds are within a partially “enclosed” 40,000 ft² field, which consists of a paved entry way below the grade of the building to the south; an area on both sides of Bear Swamp Brook, which has a maximum width of a few feet and a flow rate of as much as 20 gal/min, to the east; and a fenced-in area to the north and west, which slopes down 10 to 20% towards the building located on the side of the hill. The unpaved areas are for the most part littered with spent munition shells and metal.

Operating History

The building 611B testing facility was designed for testing munitions and contained only non-radioactive munitions until approximately 1959 when the east-west testing range tunnel was built for small scale DU/staballoy munitions testing. From 1959 to 1979, there are no records available to substantiate the use/non-use of the facility. During operation, the safety measures taken to control the dispersion of radioactive material during impact were inadequate to ensure the proper engineered confinement of aerosolized and non-aerosolized DU. Discussions with personnel at the site revealed that some activities at the facility caused releases of material to the immediate area. The safeguards, however, appear to have been sufficiently effective to ensure consistently low exposures to personnel.

- One of the most important sources of release from a control standpoint was during operation of the HEPA system during firing. Thermally hot particulates of DU burned through the HEPA filtration/ventilation system causing ignition, excessive collection of particulates at the last stage of filtration, and the potential for the incomplete removal and uncontrolled emission of contaminants from this system. This was indicated by at least one reported fire in the HEPA filtration/ventilation bank. There was no monitoring of the exhaust ventilation for radioactive material. The direction of airflow from the HEPA system was toward the back (west) of the inside storage room, while its platform roof slopes toward the front of the room. Precipitation may have played a part in causing transfer of contaminants from the HEPA platform/roof/deck to the ground surface below.

- During firing, transferable/loose contaminants migrating from the target room to the inside of the building accumulated in some of the expansion joints between the poured concrete floor and walls, the seams between the floor tiles, and other locations outside the target room.
- The most significant migration of transferable/loose contaminants from the facility appears to have occurred by individuals tracking contaminants from the building to the inside storage room and vice versa. This was observed by detection of activity at the base of the stairs; in the soil under the stairs leading into the foyer; and on the ground in front of the entryway leading into the inside storage room, which possibly could have washed away and dispersed into the surrounding area.
- Also of significance, although not quantifiable, personnel reported that they observed a build up of pressure in the target room and the escape of particulates and dust into the DU/staballoy firing range tunnel and non-DU firing range through the fissures, penetrations, and openings between the circular concrete wall and steel plates, which divide the target room from the inside storage room. The firing events were described by ARDEC personnel as an explosion of material in the DU target room, which caused doors and steel hatched windows lining the east side wall of the non-DU firing range and window panes in the access doors leading into the foyer and loading area to either be stressed or to open during a firing. These comments caused us to take soil samples directly outside the hatched windows to determine the extent of contamination of the outside area.

Licensing

This characterization survey to identify DU(U-238) and its short-lived daughter products, the only radionuclides of concern, was conducted under the licensing authority [License number 27-29104-01, (app O)] held by GPL and granted by the United States NRC, which licenses and exerts its regulatory rules over this site in one with the New Jersey Department of Environmental Protection.

A Memorandum of Agreement was signed by GPI and the ARDEC Radiation Safety Officer (RSO) in order to facilitate cooperation of radiation protection aspects of their characterization survey protocol (app. P).

The total DU activity at the testing facility is conservatively estimated to be less than 1 mCi as determined from the characterization.

The average activity of DU in the $1.46\text{E}6\text{ cm}^2$ (centimeters squared) ($10 * \pi * 50 * 12^2 * 2.54^2$) contaminated area in the DU firing range tunnel is approximately 10,000-dpm (disintegrations per minute)/ 100 cm^2 , equal to $1.5\text{E}8\text{ dpm}$ or $6.6\text{E}7\text{ pCi}$ (picocuries) or $66\text{ }\mu\text{Ci}$ (microcuries).

The activity in the non-DU firing range is estimated to be less than 10% of the DU firing range tunnel; i.e., $6.6\text{ }\mu\text{Ci}$.

The average activity of DU in the 4.4E6 cm² contaminated area of the HEPA ventilation system is estimated to be 20,000 dpm/100 cm², equal to 8.9E6 dpm/100 cm² or 8.9E⁶ dpm or 4E6 pCi or 4 μCi.

Characterization Process

Data was collected during the characterization survey by direct measurement of emissions from fixed contamination of the affected surfaces using count rate meters (Geiger Muller counters) and/or exposure rate meters (ionization chambers), and by collecting and analyzing filter disc samples from either the air samples used or the cloth smears used to manually wipe the potentially contaminated surfaces for transferable/loose contaminants. The latter two were counted using a laboratory grade low level alpha/beta counting system. Direct measurements and smear analysis provided an indication of the total fixed and/or removable (loose) level of contamination on the various surfaces monitored.

Waste-disposal Practices

Waste generation during the characterization of the facility was limited to protective/anti-contamination clothing, dusts from vacuuming, and contaminated items removed from inside and outside of the sections/components of the facility including wiring, metal targets, metal plate, metal tools, metal gun stands, and decontamination materials. As much as practical of the identified radioactive materials removed from the facility for decontamination or disposal was inventoried, double bagged, or placed in metal containers and controlled for temporary storage in one of the two outside steel storage shelters/military communication trailers (app A), which were posted and secured as appropriate. This will remain stored until a broker designated by the U.S. Army Field Support Command can re-identify, decontaminate if possible, and re-package all the radioactive material originating from this characterization survey and future decommissioning/remediation actions into Department of Transportation (DOT) approved containers [e.g., 7.5 ft³ 55-gal drums, 95 ft³ B-25 boxes, or 675 ft³ (25 yd³) intermodals] properly surveyed, weighed, labeled, and manifested prior to on-post transfer, license-to-license transfer, and/or ultimate off-post DoD authorized disposal.

As practical, protective clothing and equipment waste generated during this project were frisked for release as clean waste to ensure that waste volume was minimized. More than 540 ft³ (20 yd³) of clean material was released from the site for a coordinated turnover to the appropriate organization at Picatinny for processing.

SURVEY INSTRUMENTS AND TECHNIQUES

The surveys completed during the characterization study involved detection of beta and gamma radiation with portable and semi-portable instruments in order to control and adequately determine the radiation levels due to fixed and/or loose contamination incident to the testing of DU/staballoy munitions, to evaluate the site for compliance, and provide the background information needed to remediate and decommission the facility, remove it from ARDEC's SUB-348 NRC license, and free it from radiological control.

NOTE: Although ^{238}U is an alpha emitter, the most important radiations emitted from a characterization standpoint are beta and gamma emissions from the ^{234}Th , $^{234\text{m}}\text{Pa}$, and ^{234}Pa daughter products. Radon and radon daughters are not a concern from the DU remaining from testing of scaled down DU/staballoy projectiles because the half-life of ^{234}U is sufficiently long to prevent substantial creation of radium and its daughters, and the relative time since the separation of DU from natural uranium is not significant compared to the half-life of ^{234}U (2.5E5 yrs).

Instruments on-site for this evaluation were designed for control of radioactive material and for characterization of the levels of fixed and removable contamination on surfaces.

- Ludlum Model 3 rate meters with Model 44-9 probes (GM pancake)
- Ludlum Model 19 with 1-in. by 1-in. internal sodium iodide detectors
- Ludlum Model 2221 rate meter/scaler with 44-89 probe (alpha/beta scintillation)
- Ludlum Model 2224 rate meter/scaler with 44-89 probe (alpha/beta scintillation)

INITIAL CONDITIONS

Prior to characterization of the testing facility, the initial physical and radiological conditions are described in the following paragraphs.

Initial Physical Conditions

The physical structure of building 611B, which contains materials and equipment to conduct firing operations and ballistic tests, is deteriorating. Even with signs of deterioration, such as the roof leakage and presence of carpenter ants in the instrumentation room, the structure is sufficiently sound to allow work.

The outside, open, storage platform/deck is a deteriorating wood frame structure that has been affected by the harsh weather of New Jersey and is not safe for routine use.

The two outside military communications shelters/trailers are metal and solid.

The grounds on the north and east sides of building 611B are littered with outdated potential UXO. This ordnance was marked and identified by UXO certified personnel for removal and disposition by the local Explosive Ordnance Disposal (EOD) and Technical Division.

Initial Radiological Conditions

Fixed and/or loose surface contamination due to alpha/beta/gamma radiation exists primarily in the HEPA filtration system, the DU target room, and the DU firing range tunnel. All other areas were essentially free of either fixed or removable/loose surface contamination or showed activities near the established limits.

The highest activities identified throughout building 611B were in the DU target room and DU/staballoy firing range tunnel. Activities in other sections of the building were spotty and found primarily during the characterization when equipment and materials were removed from the building.

The materials, equipment, and furniture in the non-contaminated areas of building 611B were found to be relatively free of surface contamination associated with the ballistics testing of small scale DU/staballoy, kinetic penetrator, armor piercing operations. Most of these items were released from the facility as clean after being surveyed. Those materials found to be contaminated were packaged, identified, and handled as described under the heading of Waste Disposal Practices previously discussed.

CHARACTERIZATION

Work Site Preparation

Prior to initiating the characterization study, the building 611B testing facility, was surveyed by certified UXO experts for the presence of UXO, which may have been present as a result of past operations at the facility. The UXO report from that survey is included with this publication at appendix L.

All of the GPI workers involved with the project reviewed and discussed the Project Work Plan, HASP, QA plan, scope of work, and radiological requirements for control of the work prior to beginning project related activities.

Air Sampling

Low volume (2 cfm) air sampling pumps were placed in the work area of the DU/staballoy firing range tunnel and outside building 611B to collect a background airborne radiological air sample on filter discs for comparison purposes. The work area air sampler was relocated within the different work areas to obtain representative breathing zone airborne samples.

There was never any indication of airborne radioactive particulates during the work. Respiratory protection devices were not used for this characterization work.

Characterization Surveys

Physical characterization efforts began on 14 April 1997. All loose material/debris removed from the floor area as well as the loose wiring systems and signal wires disconnected from the x-ray systems in the DU/staballoy firing range tunnel were inventoried, packaged, and

handled as described under the heading of Waste Disposal Practices. Large, heavy items were moved as practical to the non-DU firing range to reduce background dose rates in the areas being characterized. Recommended remediation methods are discussed later in this report.

A compilation of the radiological and explosive survey data for each area of the site is included in appendices A through J, L, and Q through T.

Foyer

Dust and soil in the seams between the floor tiles include DU particulates from the firing operations. Samples of the tile and paint from the walls were taken and analyzed for asbestos and lead, respectively, by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.

Instrumentation Room

There are four areas of radiological concern in this room:

- The floor and walls near the location of the sink had two small areas of activity. The sink was removed, packaged, and handled as described under the heading of Waste Disposal Practices.
- The seams between the vinyl floor tile had transferable/loose contaminants with dust, soil, and DU particulates from the DU/staballoy firing operations. Samples of the floor tile and paint from the walls were taken and analyzed for asbestos and lead, respectively, by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.
- Grid SC2 (app C) had a high reading due to the presence of the stem piece for the drain to the UST. It was left in place because a small amount of building removal is required to remove this item
- Penetrations on the west wall (interfacing to the non-DU tunnel) there into the non-DU firing range that have flat horizontal surfaces were found to be collecting points for loose contamination.

Non-DU Firing Range

Depleted uranium projectile fragments and/or transferable contaminants from the DU/staballoy firing operations were found with dust, soil, and/or DU particulates that collected on or in:

- Horizontal surfaces such as electrical conduit, electrical boxes, electrical conduit raceways, lights, and around the crevices between the structural concrete and steel plates making up the five-sided open catch box or on the floor under various DU operations-related hardware.

- Seams between the vinyl floor tile. Samples of the floor tile and paint from the walls were analyzed for asbestos and lead, respectively by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.
- Expansion joints around the concrete slope at the catch box north end of the non-DU firing range.

A large drum present in the bullet catch box is filled with sand. Although there were no readings on the drum that indicate the presence of activity above natural background, the drum will have to be emptied during the remediation phase.

Depleted Uranium Firing Range Tunnel

Collecting points for the DU projectile fragments and/or transferable/loose contaminants (e.g., dust, soil and/or DU particulates) from the DU/staballoy firing operations in this section were the:

- Seals connecting the sections of pipe making up the DU firing range tunnel that have deteriorated and have been patched over.
- Floor surfaces at the interface with the wall, other wall and floor surfaces and the lighting and electrical fixtures.
- Seams between the vinyl floor tile. Samples of the floor tile and paint from the walls were analyzed for asbestos and lead, respectively by a New Jersey certified laboratory through the base Industrial Hygienist. The results of his evaluation are pending.
- Inside un-tiled floor under the large steel gun mount. It is anticipated that this inaccessible area is the "hiding place" for several small-scale DU projectile fragments.
- One-holed circular steel door/wall dividing the DU firing range tunnel from the target room that will require removal for decontamination or disposal as radioactive waste.

Depleted Uranium Target Room

The areas of radiological concern in this room are:

- Openings due to the absence of seals between the circular steel wall/door that divide the target room from the DU firing range tunnel, and the concrete frame of the pipe and openings has allowed for dispersal of DU particulates and dust during firing into the DU firing range tunnel.
- All of the DU target room's infrastructures and infrastructure interfaces that are contaminated with DU.

- The space between the gun mount and floor that is a hiding place for projectile fragments.
- The two exposed, un-paneled circular concrete sidewalls that show signs of severe degradation due to the impact of projectiles and target fragments.
- The steel plate on the target room side in front of the circular concrete wall that has several penetrations including some made by scaled down projectiles.
- All metal frames and hardware that will be packaged, inventoried, and handled under the heading of Waste Disposal Practices.
- The open end of the 4-in. diameter duct extending into the target room that was taped to confine any of the transferable/loose contamination from the inside of the exteriorly mounted HEPA ventilation system. The latter showed more activity than any other location during the characterization study.

Inside Storage Area

Transferable contaminants (e.g., projectile fragments and dust) migrated into the inside storage room through the unsealed adjustable window on the east end of this room and were found in the wall and settled on the horizontal faces of the steel blocks attached to the back/west wall.

Materials stored in the inside storage room were found to be contaminated (app S). These contaminating radioactive materials probably caused DU contamination of some of the floor surfaces and subsequently some of the shoes of personnel accessing the room. Personnel traffic then resulted in the limited migration of the DU into the soil directly outside the room.

Underground Storage Tank (UST)

The cover of the UST fill pipe was removed for evaluation of the tank contents. A frisk survey of the threads on the inside of the pipe indicated the presence of activity above background (approximately 100 counts per minute). This potentially indicates that an overflow of the tank occurred in the past. Soil samples in the area indicate that most of the released contaminate was removed or dispersed from the area.

Samples of the silt and soil that collected in the tank over the years also indicates the presence of DU activity with count rates of 50 to 100 counts per minute above background. It is not anticipated that the water, when sampled, would provide any indication of radiologicals associated with the operations conducted at the testing facility. However, since a smear sample of the inside of the tank did indicate the presence of removable contamination, the tank should be considered for removal during the remediation of the facility.

Outside Open Storage Platform

The structure was monitored to determine the level of radiation and radioactive contamination. Due to the weakness of the structure, the raised, horizontal, wooden, flat surfaced deck could not be removed without compromising its integrity. Many pieces of wood under the platform will require removal and survey for release during the remediation phase.

- Materials stored on this platform caused minor contamination of its wooden, flat surfaced deck. This flat surface floor was painted during the characterization to fix the activity in place until the affected piece of plywood deck could be removed and disposed of as low activity radioactive waste. That deck was not removed because the stability of the entire platform would be seriously compromised by the lack of a deck. It is not considered likely that activity above limits is present beneath the deck.
- All contaminated materials found were inventoried, packaged, and handled as described under the heading of Waste Disposal Practices.

Outside Storage Shelters

No remediation effort is required for these two shelters/trailers. The one used to store the packaged radioactive material removed from the building 611B testing facility prior to the site characterization survey is properly secured and posted while the other remains empty and padlocked.

Building 611B Associated Grounds

Fifty soil samples were collected in several areas to demonstrate the likely migration of radioactive materials from building 611B and accessory structures. Levels of DU activity in the surface soil range from levels consistent with background to as much as approximately 107 pCi/g. Of all the samples, four exceeded the remediation level of 35 pCi/g with the soil under the stairs leading into the foyer with the highest concentration of DU activity. Seven samples have detectable DU activity between background and the remediation level, and the remainders are consistent with background. The contaminated soil with DU transferable contaminants in this area along with the contaminated soil in other areas will have to be excavated until the area samples show activities below the action level. Contaminated soil is packaged, and handled as described under the heading of Waste Disposal Practices. Refer to the sample results table (app. S)

RADIOACTIVE WASTE STREAM INFORMATION

Type of Waste and Packaging

All contaminated materials found were inventoried, packaged, and handled as described under the heading of Waste Disposal Practices. No liquids requiring treatment or disposal were generated in this phase of the work. No sampling for the presence of hazardous materials was done at the site.

Disposal Information

The approximate volume of waste generated thus far is 256 ft³ (excluding soil volume and other radioactive materials or low activity mixed radioactive materials resulting from any future decommissioning remediation action). The final burial volume from this phase of the decontamination may be less if metal processing to remove DU activity from item surfaces is pursued. Hazardous materials discovered at the site were provided to the on-post Industrial Hygienist for disposition.

RECOMMENDED REMEDIATION STRATEGIES

Remediation Methods

Experienced personnel should accomplish decontamination of the concrete surfaces of the structure in the DU firing range tunnel and target room using scabbling techniques. It is anticipated that scabbling to a depth of 1 cm (2 in.) will be adequate to remove the activity from the concrete surface.

Decontamination of other surfaces, such as the tile and floor will be completed by removal of the tile and cleaning the exposed surfaces. If lead or asbestos containing materials (ACM) or other hazardous materials are identified from the samples taken from the floor, then standard industry control measures for ACM or the other hazardous materials must be identified in the remediation work plan and used to prevent unnecessary exposure to the material.

No new work processes will be attempted during the remediation phase of this project.

Recommended Work Breakdown

Remediation of the foyer would require removal of the floor tile and mastic. No other decontamination appears necessary for this area.

Remediation of the instrumentation room should consist of removal of the sink drain, floor tile, and mastic, decontamination of the affected walls and penetrations.

Remediation of the non-DU firing range will require removal of all contaminated components, removal of the floor tile and mastic, scabbling of the wall surfaces with fixed contamination paying special attention to the horizontal surfaces on top of the concrete walls, removal of contaminated concrete from cracks and the wall to floor joints, and dismantling and removal of the large steel catch box positioned against the north wall end of the non-DU firing range.

Remediation of the DU firing range tunnel will require removal of all contaminated components, removal of the floor tile and mastic, scabbling of all wall surfaces with fixed contamination, removal of contaminated concrete from cracks and the wall to floor joints, removal of the gun mount (possibly decontamination and cutting it into pieces before removal), and removal of the circular steel wall/door separating the DU firing range from the DU target room.

Remediation of the DU target room will require removal of all steel components, scabbling of the concrete floor surface, scabbling of all wall surfaces, removal of the contaminated concrete from cracks and the wall to floor joints, decontamination or removal of the circular concrete wall with its anchored front and back steel plates.

Remediation of the inside storage room will require removal of all contaminated components, removal or decontamination of contaminated steel structures such as metal wall panels and backstops, scabbling of all contaminated concrete wall and floor surfaces with fixed contamination, removal of contaminated concrete from the cracks and the wall to floor joints, and removal of the contaminated circular concrete wall with its anchored front and back steel plates.

Remediation of the outside, open, storage platform will simply require removal of contaminated flat wooden decking. The plywood and floor joists can be removed, but it may be necessary for the structure to be demolished after removal or new structural members be placed to prevent the structure from accidentally falling.

No remediation is required for the two steel frame military communications trailers adjacent to building 611B, of which one is being used as a temporary outside storage shelter for the low activity radioactive materials removed from the facility.

Waste Minimization During Remediation

Waste generation for the remediation of the building 611B testing facility will be limited to protective clothing, dusts from vacuuming and scabbling, soil, HEPA filters, old packaging for contaminated materials, the UST transferable contamination (if it is cleaned), and metal and wood materials used for targets and construction materials. The contaminant is mainly limited to the DU target room, DU firing range tunnel, HEPA filtration/ventilation bank, and contaminated components throughout the facility; i.e. Building 611B, accessory structures, and associated grounds. Waste generated will be handled, inventoried, and packaged as described under the heading of Waste Disposal Practices and temporarily stored in or outside of building B312, the Radioactive Materials Storage and Handling Facility awaiting ultimate disposal.

As practical, protective clothing and equipment wastes that are generated during this project will be frisked for release as clean waste to ensure that waste volume is minimized.

The Radiation Protection Office designee will stage clean materials at the site in a designated clean area for removal.

CONCLUSIONS

As a result of the effort by Gutierrez-Palmenberg, Inc., Joe Fabiano of the Army Armament Research, Development and Engineering Center (ARDEC), Picatinny, New Jersey and Mike Styvaert of the Army Field Support Command, formerly the Industrial Operations Command, the Building 611B Testing Facility at ARDEC has been characterized for the presence of depleted uranium in accordance with the work description of contract DAAA09-95-G-0017.

APPENDIX A
LOW ACTIVITY RADIOACTIVE MATERIAL INVENTORY
(STORAGE)

ARDEC Picatinny Arsenal
Building 611B Characterization
Radioactive Material Inventory

Notes

1. Packages are double bagged and stored in the portable storage area labeled #2
2. Dose rates on packages are based on contact readings with a gamma radiation detector and are uR/hour.
3. Bag weight is reported in pounds based on estimates from workers.

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Radioactive Material Inventory

Bag #	Contents	Weight (Pounds)	Dose Rate μ R/hour
1	hose and light covers	10	10
2	misc. paper products 2 pieces steel stock misc. rubber pushers small piece of hose sink drain 2 spools of wire pair of shoes pair of gloves	15	15
3	sink	10	7
4	plastic floor mat garbage can gloves paper	10	7
5	9 X ray tubes	3	18
6	garbage can ammo box with misc. parts	20	7
7	4' angle iron	5	7
8	2' X 2' plywood	8	7
9	1' X 2.5' metal shelf	10	7
10	2' X 2' plywood	8	7
11	2' X 6.5' plywood	10	8
12	4 2" X 6' PVC pipe	10	7
13	bag of trash	10	7
14	2 large c-clamps	15	7
15	2 large c-clamps	15	7
16	3 pieces of wood	20	28
17	3 x ray guns	15	7

Bag #	Contents	Weight (Pounds)	Dose Rate μR/hour
18	4 c-clamps tape dispenser level 1 glove	20	7
19	tool box misc. tools	15	7
20	trash	10	8
21	1 file 3 small c-clamps misc. scrap metal	20	7
22	25 pieces of plywood	20	8
23	misc. tools scrap metal steel plate	50	8
24	ammo box	25	8
25	2 large c-clamps	15	7
26	nuts and bolts lead x ray letters brush magnet	26	9
27	steel plate c-clamp	45	8
28	steel plate	50	8
29	gun breach nuts and bolts counter weights	30	7
30	trash	10	7
31	wire	15	7
32	wire	15	8
33	wire	15	8
34	wire	10	7

Bag #	Contents	Weight (Pounds)	Dose Rate μ R/hour
35	wire	10	7
36	wire	15	7
37	wire and trash	10	7
38	wire	20	7
39	wire	12	7
40	wire	5	8
41	wire	15	7
42	wire	15	7
43	3 steel plates targets	75	7
44	steel plates targets	60	8
45	steel plates targets	75	7
46	6 x ray guns	30	19
47	4 x ray guns	20	13
48	4 x ray guns	20	12
49	steel plate (target)	60	7
50	box steel	15	7
51	wood	20	9
52	misc. scrap steel	10	7
53	steel plates (targets)	70	7
54	misc steel (scrap)	40	18
55	trash	25	7
56	bottom of cabinet	10	7
57	cabinet sides (2)	40	8
58	steel angle iron	10	8

Bag #	Contents	Weight (Pounds)	Dose Rate μ R/hour
59	steel angle iron	10	8
60	steel	100	7
61	stock steel bars	40	7
62	wood table top	15	8
63	5 2x6x7	20	7
64	wood	8	16
65	steel plate	50	11
66	angle iron	10	7
67	steel plate	25	7
68	thin steel plate	2	10
69	misc steel	2	48
70	ammo box misc items	30	8
71	plexi glass	10	8
72	bag of trash	10	9
73	wood	1	7
74	ammo can	35	7
75	ammo can	30	7
76	ammo can	20	9
77	ammo can	15	8
78	ammo can	15	8
79	steel stock	30	7
80	1 4"x 30"x 1" steel	25	7
81	1 4"x 30" x 1" steel	25	12
82	2 4"x 12" x 1" steel	25	7
83	plywood 20"x 10' x 3/4"	20	7

Bag #	Contents	Weight (Pounds)	Dose Rate μR/hour
84	plywood 20"x 5' x 3/4"	10	7
85	steel 1/2" x 6" x 12"	5	7
86	steel 2" x 6" x 6"	20	40
87	steel 2" x 8" x 8"	30	50
88	steel 2" x 8" x 8"	30	7
89	steel 2" x 10" x 10"	40	30
90	steel 2" x 8" x 8"	30	8
91	steel 2" x 8" x 8"	30	7
92	rubber floor mats	40	7
93	½ target mounts	100	10
94	½ target mounts	80	15
95	18" X 12" X 1/4" steel	5	7
96	trash	3	8
97	wood	10	8
98	aluminum plates	40	8
99	fan	10	7
100	2 ammo box wood box	40	8
101	ammo box wood box	30	7
102	pipe	10	8
103	steel pipe 18" x 3/4"	5	7
104	ammo box shims and bolts	10	7
105	2" x 2" x 6' channel	30	7
106	plywood 20" X 30" X ½	5	7
107	wood box nuts and bolts	40	8

Bag #	Contents	Weight (Pounds)	Dose Rate μ R/hour
108	trash	20	6
109	trash	40	6
110	trash	40	6
111	plate steel	170	7
112	trash	10	11
113	plexi glass	10	6
114	steel plate	30	6
115	bag of trash	10	8
116	trash	20	7

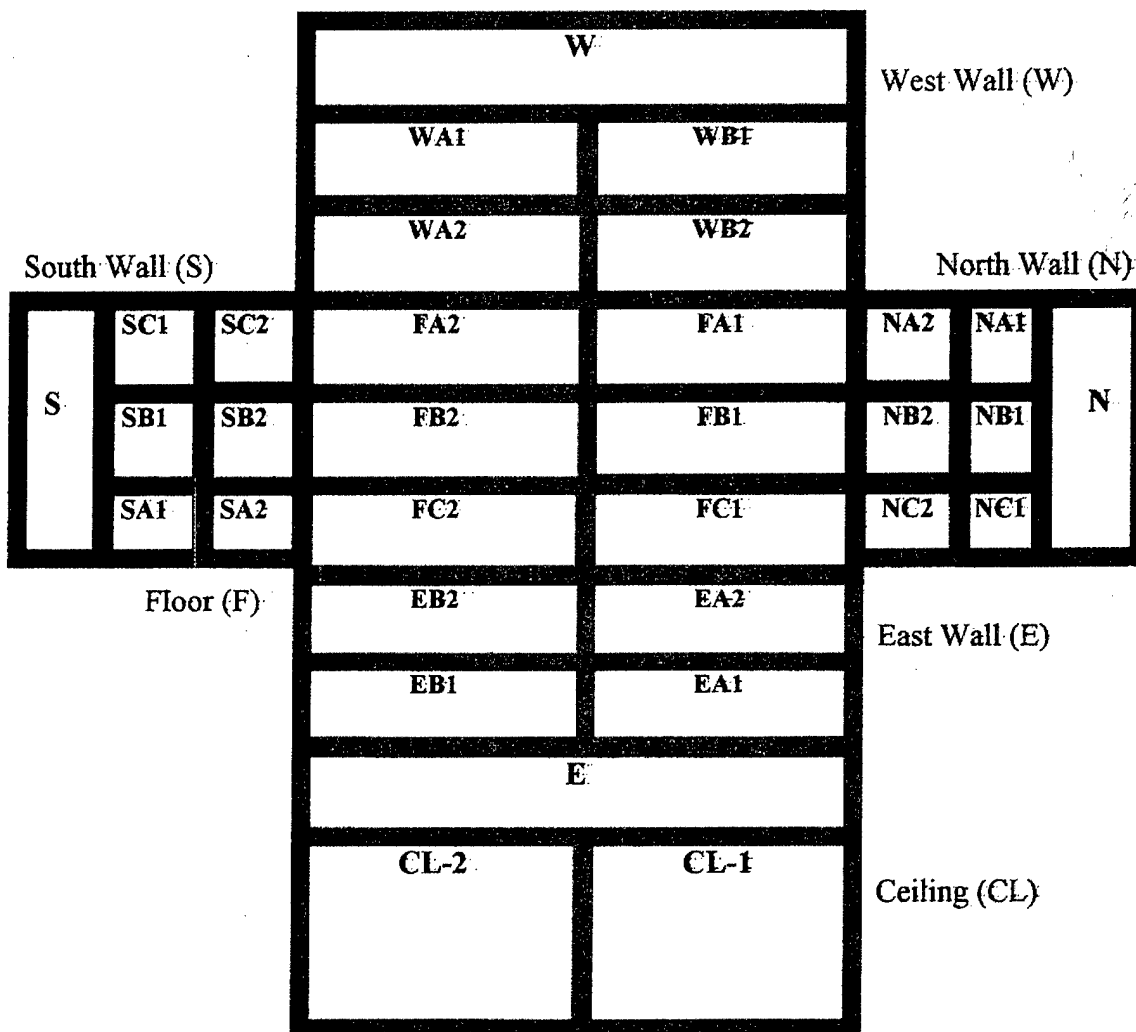
APPENDIX B
ANALYSIS OF DATA FOR BUILDING 611B FOYER

ARDEC Picatinny Arsenal
Building 611B Characterization
611B Foyer

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

Table FR-1..

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-024 Large Probe
 Location: 611B Foyer - Unaffected area

Detection efficiency = 0.17 c/d
 Background = 300 cpm

Estimated activity based on efficiency and background stated above
 dpm/100 square cm

	1	2
N	300	
E	307	
S	303	
W	300	
Ceiling	300	300

	1	2
N	0	
E	41	
S	18	
W		
Ceiling	0	0

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-024 Large Probe
 Location: 611B Foyer West wall

Detection efficiency = 0.17 d/d
 Background = 300 cpm

Gross Instrument Response (cpm)		Estimated activity based on efficiency and background stated above - dpm/100 square cm	
1	2	1	2
A 300	300	0	0
300	300	0	0
300	300	0	0
300	300	0	0
300	300	0	0

Note: Readings less than background (300 cpm) were recorded as 300 cpm

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPL-S-024 Large Probe
 Location: 611B Foyer - North wall

Detection efficiency = 0.17 c/d
 Background = 300 cpm

Gross Instrument response (cpm)		Estimated activity based on efficiency and background stated above dpm/100 square cm	
1	2	1	2
A	310 300 323 325 354	59 0 135 147 318	
B	330 300 344 300 315	176 0 259 0 88	
	361 300 347 371 300	359 0 276 418 0	
C	300 300 308 328 338	0 0 47 165 224	
	311 300 300 309 324	65 0 0 53 141	
	307 300 300 300 318	41 0 0 0 106	

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

Location: 611B Foyer - Floor

300 cpm

- dptm/100 square cm

	Gross Instrument response (cpm)		- dpm/100 square cm	
	1	2	1	2
A	100 220 200	110 300 250 300 180	0 1200 1000	0 2000 1500 1000
B	200 70 80	300 180 120	0 300 400	0 500 200
C	70	120 150	300	500 10 200 500

38

= particake probe GM response (cpm) detection efficiency ~ 10%, results approximated as dpm/probe area

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

APPENDIX C
ANALYSIS OF DATA FOR INSTRUMENTATION ROOM

ARDEC Picatinny Arsenal
Building 611B Characterization
Instrumentation Room

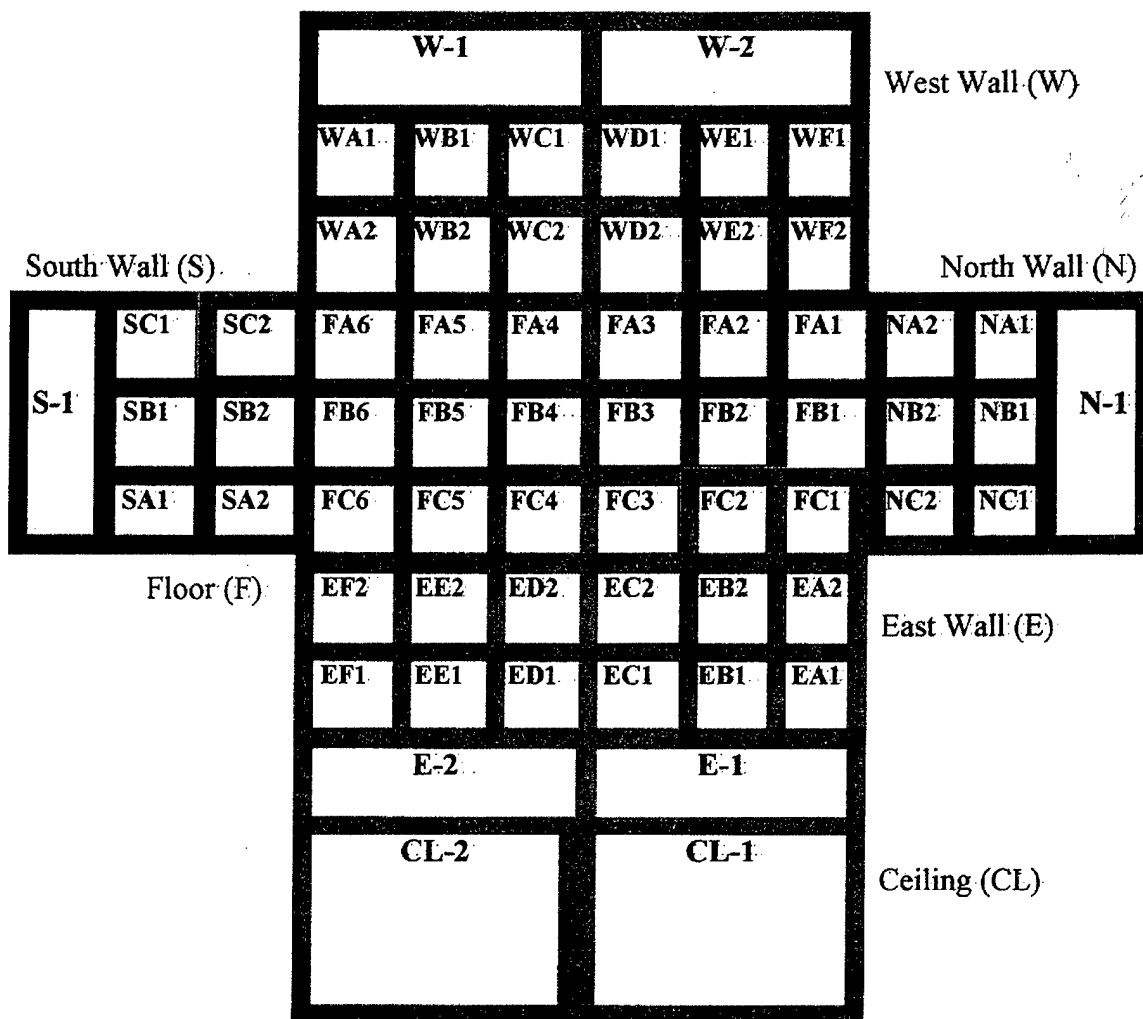
Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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ARDEC Picatinny Arsenal

Instrument Room Grid Layout



 = less than 1000 dpm/100 square cm

 = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

 = greater than 5000 dpm/100 square cm

Table IR-1

Location: 611B Instrument Room Unaffected Areas (Upper walls & Ceiling)

Estimated activity based on efficiency and background stated above
- dpm/100 square cm

_____ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-022 Large Probe

Location: 611B Instrument Room Floor

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (cpm)

	1	2	3	4	5	6
A	440	478	451	434	448	422
	403	482	460	450	424	489
	458	447	397	413	445	447
B	447	658	360	376	393	360
	433	336	353	370	389	336
	409	489	357	341	367	344
C	484	558	478	520	401	403
		530	504	494	421	385
	442	603	458	470	421	417
		462	407	397	349	386
						401

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1	2	3	4	5	6
A	824	1047	888	788	871	718
	606	1071	941	882	729	1112
	929	865	571	665	853	865
B	865	2106	353	447	547	353
	782	212	312	412	524	212
	641	1112	335	241	394	259
C	1082	1518	1047	1294	594	606
		1353	1200	1141	712	500
	835	1782	929	1000	712	506
		953	629	571		524
						594

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-023 Large Probe

Location: 611B Instrument Room North Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (CPM)

	1	2
A	443	452 425 407
	432	418 421 435
	416	423
B	464	401 406
	413	420 414 408
		400 405 403 404
C	440	417 397 446 395
	431	452 443 426 433

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1	2
A	841	894 735 629
	776	694 712 794 747
	682	724 647
B	965	594 624
	665	706 671 635
		588 618 612
C	824	688 571 859 559
	771	894 841 741 588 782

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-027 Large Probe

Location: 611B Instrument Room West Wall

Detection efficier 0.17 c/d
Background = 300 qpm

Estimated activity based on efficiency and background stated
- dpm/100 square cm

	Gross Instrument response (CPM)					
	1	2	3	4	5	6
A	300	300	300	300	300	300
B	402	420	405	327	417	
	445	305	364			
C	323	300	331	547	502	
	410	456	408	439	467	
D	418	426	413	450	422	
	414	480	402	477	394	
E	487	409	390	405	398	
	358	417		377		
F	432	430	427	363	352	
	427	371	368	385	413	
	398	384	384	342	390	
		380		423	401	

	Estimated activity based on efficiency and background stated - dpm/100 square cm					
	1	2	3	4	5	6
A	0	0	0	0	0	0
B	600	706	618	159	688	
	853	29	376			
C	135	182	818	1453	1188	
	647	918	635	882	718	
D	694	665	1041	553		
	671	1059	600	618		
E	1100	641	529	576		
	341	688				
F	776	800	306	453		
	747	747	371	306		
		418	400	500		
	494	494	247	665		
	576	471	724	529		
				594		

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-026 Large Probe

Location: 611B Instrument Room South Wall

Detection efficiency = 0.17 c/d
Background = 300 cpm

Gross Instrument response (CPM)

	1	2
A	373	337 394 346
	381	371
B	352	365 378 399
	343	300
	256	365 367
C	270	402 300
	377	476
	352	495
	384	457 4713

Estimated activity based on efficiency and background stated above - dpm/100 square cm

	1	2
A	429	218 553 271
	476	418
B	306	382 459 582
	253	329 0
	-259	382 394
C	-176	600 0
	453	588 1035
	306	635 1147
	494	1335 924 25959

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

APPENDIX D

ANALYSIS OF DATA FOR NON-DU FIRING RANGE

ARDEC Picatinny Arsenal
Building 611B Characterization
Non-DU Firing Range

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

ARDEC - Picatinny Arsenal

Non-DU Tunnel Grid Layout

West wall					Floor		East wall					Ceiling *
4	3	L	2	1	1	2	1	2	L	3	4	5
A	A		A	A	A	A	A	A		A	A	A
B	B		B	B	B	B	B	B		B	B	B
C	C		C	C	C	C	C	C		C	C	C
D	D		D	D	D	D	D	D		D	D	D
E	E		E	E	E	E	E	E		E	E	E
F	F		F	F	F	F	F	F		F	F	F
G	G		G	G	G	G	G	G		G	G	G
H	H		H	H	H	H	H	H		H	H	H
I	I		DU Tunnel		I	I	I	I		I	I	I
J	J		J	J	J	J	J	J		J	J	J
K	K		K	K	K	K	K	K		K	K	K
L	L		L	L	L	L	L	L		L	L	L
M	M		M	M	M	M	M	M		M	M	M
N	N		N	N	N	N	N	N		N	N	N
O	O		O	O	O	O	O	O		O	O	O
P	P		P	P	P	P	P	P		P	P	P
Q			Catch Box Location								Q	Q
R											R	R

Grids 4 on the West and East walls are also a part of the ceiling.
L = Ledge on West and East walls.

 = less than 1000 dpm/100 square cm

 = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

 = greater than 5000 dpm/100 square cm

Table NDU-1.

ROEC Pictorial Aerial		Detection efficiency =		0.17 cdi																			
Survey Number: GPH-B-068 Ledge Probe		Background =		200 cpm																			
Location: Inside Non-DU Tunnel East Wall Ledge																							
Instrument Response (CPM)																							
3	A	247	245	248	236	240	203	246	247	250	247	245	247	478	713	576	504	690	510	520	H	1352	853
Activity Concentration (dpm/100 square cm)																							
3	A	276	285	283	212	235	547	271	278	294	278	265	278	1835	3018	2212	1788	2882	1824	1882	H	6776	3841
= less than 1000 dpm/100 square cm																							
= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm																							
= greater than 5000 dpm/100 square cm																							
Instrument Response (CPM)																							
3	I	1451	1459	1561	1351	1147	2137	1139	1803	1687	1717	1274	1245	1487	1810	2042	1549	2563	2223	1580	F	1328	1243
Activity Concentration (dpm/100 square cm)																							
3	I	7399	7406	8594	6771	5571	11394	5524	9429	8747	8924	6318	6147	7571	9471	10835	7935	13841	11900	8178	P	6824	6135
Instrument Response (CPM)																							
3	Q	2029	1928	1788	1755	1904																	
Activity Concentration (dpm/100 square cm)																							
3	Q	10759	10165	9341	9147	10024																	

RDC Facility/Aerial
 Survey Number: GPS-073 Large Probe
 Location: Ceiling of Non-DU Tunnel

Detection efficiency = 0.17 db
 Background = 200 cpm

West Wall Ceiling

Instrument Response (CPM)												
A	B	C	D	E	F	G	H					
247	251	280	251	246	257	224	223					
Activity Concentration (dpm/100 square cm)												
A	B	C	D	E	F	G	H					
276	300	353	300	271	335	141	135					
Instrument Response (CPM)												
I	J	K	L	M	N	O	P	Q	R			
215	235	237	222	197	207	227	179	227	211			
Activity Concentration (dpm/100 square cm)												
I	J	K	L	M	N	O	P	Q	R			
88	208	216	129	-18	41	159	-124	159	65			

East Wall Ceiling

Instrument Response (CPM)												
A	B	C	D	E	F	G	H					
270	278	275	272	265	273	255	256					
Activity Concentration (dpm/100 square cm)												
A	B	C	D	E	F	G	H					
412	459	441	424	392	429	324	329					
Instrument Response (CPM)												
I	J	K	L	M	N	O	P	Q	R			
235	256	219	230	199	218	228	272	235	210			
Activity Concentration (dpm/100 square cm)												
I	J	K	L	M	N	O	P	Q	R			
206	329	112	229	.6	106	165	424	208	59			

■ = less than 1000 dpm/100 square cm
 ■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm
 ■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-069 Large Probe
 Location: Non-DJ Tunnel Ceiling

Detection efficiency = 0.17 c/d
 Background = 200 cpm

Instrument Response (CPM)				
J	K	L	M	N
5	242	211	225	227

Activity Concentration (dpm/100 square cm)				
J	K	L	M	N
5	247	65	147	159

Instrument Response (CPM)			
O	P	Q	R
5	225	223	209
			221

Activity Concentration (dpm/100 square cm)			
O	P	Q	R
5	147	135	53
			124

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-050 Large Probe
 Location: Non-DU Tunnel South Wall

0.17 c/d
 170 cpm

Detection efficiency =
 Background =

Instrument Response (CPM)	
A	B
1	368 210 224 413
	212 200
2	369 226 216 356
	350 204 206 328
	202 192
3	366 191 211 388
	323 318 349 309
	290 343
	356 298 300 290

Activity Concentration (dpm/100 square cm)	
A	B
1	368 210 224 413
	212 200
2	369 226 216 356
	350 204 206 328
	202 192
3	366 191 211 388
	323 318 349 309
	290 343
	356 298 300 290

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPT-S-031 Large Probe
Location: Non-DU Tunnel Floor

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)																	
	A	B	C	D	E	F	G	H									
1	338	320	613	1009	912	400	317	410	488	300	497	334	366	559	528	796	964
2	512	316	713	317	305	523	300	317	305	440		503	300	359	417	720	
	327	394	1038	340	300	330	364	370	453	444		332	671	428	771	520	
	586	989			360	450	387	427	449	562	538	509	360	480	698		
					300	334	355	312						376	703	537	

Activity Concentration (dpm/100 square cm)																								
	A	B	C	D	E	F	G	H																
1	224	110	1841	4171	3600	588	100	129	118	641	100	647	4218	1106	0	1159	200	388	2341	1524	1341	2918	2471	1294
2	1247	94	2429	100	29	1312	1112	1782	0	100	28	824	1194	0	1159	200	388	2341	1524	1341	2918	2471	1294	
	159	553	4341	235	0	176	182	276	378	412	900	847	1400	188	2182	1059	2341	1394						
	4053	500	218	353	882	78	0	200	324	71	876	1541	1229	353	447	2371	1394							

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

Instrument Response (CPM)																					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P					
1	636	551	569	721	790	1482	488	583	1540	1042	3771	1296	1459	1388	1160	1474	1271	1198	1262	604	873
	1320	418	2387	577	682	577	682	598	680	756	1480	756	1480	2175	1528	1309	1024	1152	1458	1404	1247
2	702	616	530	535	535	457	845	3098	1696	1337	1696	1337	1435	1384	1738	1473	1514	855	777	1323	1444
	480	508	697	1545	663	646	458	561	676	6570	974	2219	1093	2214	1194	1489	1590	1185	1439	1289	1444

Activity Concentration (dpm/100 square cm)																							
	I	J	K	L	M	N	O	P															
1	1976	6000	1476	1582	2476	2882	6953	1106	1665	7294	4365	20418	5859	6818	6400	5059	6947	6906	5712	5282	5659	1788	3371
2	3506		684	12276	1629	2247		1753	2235	2882	6941		2882	6941	11029	7224	5935	4259	5012	6812	6494	5571	
	2365		1859	1353	1382	924		3206	16459	8212	6100		6676	6376	6876	6376	8459	6900	7141	3265	2806		
	941				7324		929			36882		4665		4665			6994		7376	6018			
			1224	2335		2135	2035	4595	2242	3665	11288		11259	5259	7588	5206			6700	5818	6729		

ORDEC Regulatory Approval
Survey Number: CPH-8-003 Light Probe
Location: Inside NW-OU Tunnel East Wall

Detection efficiency =
Background = 0.17 cph
200 cpm

Instrument Response (CPM)											
A	B	C	D	E	F	G	H	I	J	K	L
376	343	314	387	391	340	395	391	424	382	452	406
377	378	390	318	300	300	320	394	425	662	370	399
380	390	390	300	310	300	312	386	391	427	397	414
401	414	370	434	417	463	419	467	447	472	407	417
240	265	237	296	231	304	243	228	222	249	256	240
333	320	380	332	332	367	309	342	352	402	252	438

Activity Concentration (dpm/100 square cm)											
A	B	C	D	E	F	G	H	I	J	K	L
1035	841	671	1124	824	1124	1318	1482	1212	14018	1365	1000
1041	1047	1118	694	598	598	1224	706	1141	1324	2718	2459
941	1059	1059	588	765	588	1000	665	1094	1124	1335	1259
1182	1259	1000	1376	1276	1547	1453	1471	2547	1106	1600	1169
236	382	218	565	182	612	559	41	165	1818	1276	1218
782	335	706	1059	982	700	835	529	135	129	288	329

Instrument Response (CPM)

A	B	C	D	E	F	G	H	I	J	K	L
422	384	370	391	331	544	488	382	373	390	432	346
409	436	421	474	405	503	504	652	619	407	587	436
344	408	426	441	447	447	438	386	470	450	432	1076
382	320	391	444	426	463	404	417	633	602	436	436
242	250	313	297	241	241	268	375	300	324	318	267
504	372	463	418	272	423	421	435	472	489	467	373

Activity Concentration (dpm/100 square cm)

A	B	C	D	E	F	G	H	I	J	K	L
1306	1388	1141	1000	1124	2024	1753	1071	1018	1118	1385	859
1229	1300	1612	1224	1206	1782	1882	1788	2659	1218	2276	1388
847	706	1224	1329	1418	1453	1200	1400	1094	1188	1365	5153
1071	1124	1435	1329	1329	1547	1276	1276	2547	1488	1365	1388
247	294	686	571	241	241	400	1029	1029	2418	818	935
1788	1012	1547	1282	1312	1371	1300	1382	1600	600	694	1018

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: DPL-S-087 Light Probe
 Location: Inside Non-DU Tunnel West Wall Ledge

Detection efficiency = 0.17 dd
 Background = 170 cpm

Indirect Response (CPM)																	
A	B	C	D	E	F	G	H	I									
2	532	543	640	413	739	573	511	500	529	550	724	624	647	595	989	1006	1112

Indirect Response (CPM)																										
	J	K	L	M	N	O	P	Q	R																	
2	961	899	1079	721	681	1288	2037	1280	1624	1373	1018	850	789	1460	1699	990	1126	1197	1426	1366	1110	991	1736	1514	1501	1382

Activity Concentration (cpm/100 square cm)																	
A	B	C	D	E	F	G	H										
2	2129	2184	2765	1429	3347	2371	2006	1941	2112	2235	3259	2871	2806	3088	4818	4918	5541

	J	K	L	M	N	O	P	Q	R																	
Activity Concentration (cpm/100 square cm)	4653	4288	5347	3241	3065	8459	10982	6529	8553	7076	4988	4000	3524	7588	8984	4824	5624	5041	7388	7035	5528	4829	9212	7906	7829	7129

- █ = less than 1000 cpm/100 square cm
- █ = greater than 1000 cpm/100 square cm and less than 5000 cpm/100 square cm
- █ = greater than 5000 cpm/100 square cm

	Instrument Response (CPLM)																	
	A	B	C	D	E	F	G											
1	446	457	414	354	360	365	308	407	439	503	472	445	478	486	454	482	475	472
	489	385	404	479	447	489	430	548	610	533	889	549	526					
2	849	523	523	584	600	593	555	647	647	440	503	618	465	487	425	446	465	534
	385		445	308	308	407	419	440	440	440	408	462	487					482
	428	345	399	395	360	407	397	434	434	454	532	468	464	464	407	464	464	453

	A	B	C	D	E	F	G	H
	Activity Concentration (dpm/100 square cm)							
1	859	291	488	671	1053	788	1312	853
	1112	500	812	1312	853	388	353	47
2	2053	500	285	406	671	1053	788	1312
	859	291	488	671	1053	788	1312	853
3	1112	500	812	1312	853	388	353	47
4	2053	500	285	406	671	1053	788	1312
5	859	291	488	671	1053	788	1312	853
6	1112	500	812	1312	853	388	353	47
7	2053	500	285	406	671	1053	788	1312
8	859	291	488	671	1053	788	1312	853
9	1112	500	812	1312	853	388	353	47
10	2053	500	285	406	671	1053	788	1312
11	859	291	488	671	1053	788	1312	853
12	1112	500	812	1312	853	388	353	47
13	2053	500	285	406	671	1053	788	1312
14	859	291	488	671	1053	788	1312	853
15	1112	500	812	1312	853	388	353	47
16	2053	500	285	406	671	1053	788	1312
17	859	291	488	671	1053	788	1312	853
18	1112	500	812	1312	853	388	353	47
19	2053	500	285	406	671	1053	788	1312
20	859	291	488	671	1053	788	1312	853
21	1112	500	812	1312	853	388	353	47
22	2053	500	285	406	671	1053	788	1312
23	859	291	488	671	1053	788	1312	853
24	1112	500	812	1312	853	388	353	47
25	2053	500	285	406	671	1053	788	1312
26	859	291	488	671	1053	788	1312	853
27	1112	500	812	1312	853	388	353	47
28	2053	500	285	406	671	1053	788	1312
29	859	291	488	671	1053	788	1312	853
30	1112	500	812	1312	853	388	353	47
31	2053	500	285	406	671	1053	788	1312
32	859	291	488	671	1053	788	1312	853
33	1112	500	812	1312	853	388	353	47
34	2053	500	285	406	671	1053	788	1312
35	859	291	488	671	1053	788	1312	853
36	1112	500	812	1312	853	388	353	47
37	2053	500	285	406	671	1053	788	1312
38	859	291	488	671	1053	788	1312	853
39	1112	500	812	1312	853	388	353	47
40	2053	500	285	406	671	1053	788	1312
41	859	291	488	671	1053	788	1312	853
42	1112	500	812	1312	853	388	353	47
43	2053	500	285	406	671	1053	788	1312
44	859	291	488	671	1053	788	1312	853
45	1112	500	812	1312	853	388	353	47
46	2053	500	285	406	671	1053	788	1312
47	859	291	488	671	1053	788	1312	853
48	1112	500	812	1312	853	388	353	47
49	2053	500	285	406	671	1053	788	1312
50	859	291	488	671	1053	788	1312	853
51	1112	500	812	1312	853	388	353	47
52	2053	500	285	406	671	1053	788	1312
53	859	291	488	671	1053	788	1312	853
54	1112	500	812	1312	853	388	353	47
55	2053	500	285	406	671	1053	788	1312
56	859	291	488	671	1053	788	1312	853
57	1112	500	812	1312	853	388	353	47
58	2053	500	285	406	671	1053	788	1312
59	859	291	488	671	1053	788	1312	853
60	1112	500	812	1312	853	388	353	47
61	2053	500	285	406	671	1053	788	1312
62	859	291	488	671	1053	788	1312	853
63	1112	500	812	1312	853	388	353	47
64	2053	500	285	406	671	1053	788	1312
65	859	291	488	671	1053	788	1312	853
66	1112	500	812	1312	853	388	353	47
67	2053	500	285	406	671	1053	788	1312
68	859	291	488	671	1053	788	1312	853
69	1112	500	812	1312	853	388	353	47
70	2053	500	285	406	671	1053	788	1312
71	859	291	488	671	1053	788	1312	853
72	1112	500	812	1312	853	388	353	47
73	2053	500	285	406	671	1053	788	1312
74	859	291	488	671	1053	788	1312	853
75	1112	500	812	1312	853	388	353	47
76	2053	500	285	406	671	1053	788	1312
77	859	291	488	671	1053	788	1312	853
78	1112	500	812	1312	853	388	353	47
79	2053	500	285	406	671	1053	788	1312
80	859	291	488	671	1053	788	1312	853
81	1112	500	812	1312	853	388	353	47
82	2053	500	285	406	671	1053	788	1312
83	859	291	488	671	1053	788	1312	853
84	1112	500	812	1312	853	388	353	47
85	2053	500	285	406	671	1053	788	1312
86	859	291	488	671	1053	788	1312	853
87	1112	500	812	1312	853	388	353	47
88	2053	500	285	406	671	1053	788	1312
89	859	291	488	671	1053	788	1312	853
90	1112	500	812	1312	853	388	353	47
91	2053	500	285	406	671	1053	788	1312
92	859	291	488	671	1053	788	1312	853
93	1112	500	812	1312	853	388	353	47
94	2053	500	285	406	671	1053	788	1312
95	859	291	488	671	1053	788	1312	853
96	1112	500	812	1312	853	388	353	47
97	2053	500	285	406	671	1053	788	1312
98	859	291	488	671	1053	788	1312	853
99	1112	500	812	1312	853	388	353	47
100	2053	500	285	406	671	1053	788	1312

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

[illegible]

	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ
1			7038	478	1135	1671	1000	2100	900	706	847	568	688	559	653	700																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		

RDEC Facility Aerial
 survey Number: GPR-S-054 Large Probe
 location: Non-DU Tunnel West Wall

Detection efficiency =
 Background =

0.17 d/d
 300 cpm

Note that background varied in the area monitored.

200

Instrument Response (CPM)												
A	B	C	D	E	F	G	H	I	J	K	L	M
446	350	383	354	439	472	454	475	472				
457	385	404	414	407	481	488	482	475				
489	523	523	479	420	461	533	620	526				
649	523	523	564	647	503	425	448	549				
385	385	445	308	419	440	486	482	465				
426	345	389	366	434	532	488	487	484				
240	270	248	250	237	236	223	225	220				
238	238	238	250	241	237	226	225	224				
			250	250	230	235	235	224				

Activity Concentration (dpm/100 square cm)												
A	B	C	D	E	F	G	H	I	J	K	L	M
858	284	485	318	818	853	906	1071	1026				
924	500	612	671	708	947	988	1284	1426				
1112	1312	1312	1053	1459	1824	1371	2288	1465				
2053	500	853	1553	2041	1194	735	859	971				
763	285	426	398	788	1385	988	1158	965				
235	412	271	324	218	224	135	285	118				
229	224	224	284	294	218	118	147	141				
			235	253	176	153	206	145				

■ = less than 1000 dpm/100 square cm
 ■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm
 ■ = greater than 5000 dpm/100 square cm

Instrument Response (CPM)												
A	B	C	D	E	F	G	H	I	J	K	L	M
420	381	372	493	444	400	417	411	419				
354	395	403	465	401	509	683	527	632				
373	408	403	439	451	448	474	495	429				
				508	481	421	533	376				
220	224	222	412	439	405	421	419	426				
250	222	233	226	227	222	228	227	219				
515	489	293	568	402	358	412	406	458				

Activity Concentration (dpm/100 square cm)												
A	B	C	D	E	F	G	H	I	J	K	L	M
700	476	424	1071	900	588	688	671	700				
505	565	605	1800	708	659	529	871	1082				
908	718	608	1088	829	1124	1024	588	1076				
			788	1212	618	712	1371	447				
			2624	818	618	100	700	465				
			103	471	129	1247	199	1218				
118	141	194	2185	1800	928	1212	1318	1518				
1853	2224	1700	899	612	1188			982				

ARDEC Picatinny Arsenal

Survey Number: GPI-S-048 Large Probe

Location: Non-DU Tunnel Inside 611B Top of Catch Box

0.17 c/d
150 cpm

Detection efficiency =
Background =

Instrument Response (cpm)

A		B	
1	2106	2479	2421
		2098	2513
	2210	1839	2690
2	1994	2223	1515
		1924	1997
	2151	2392	2376
			2580
			1816
			2026
			2349

Activity (dpm/100 square cm)

A		B	
1	11506	13700	13359
		11459	13900
	12118	9935	14941
2	10847	12194	8029
		10435	10865
	11771	13188	13094
			12935
			14294
			9800
			11035

= less than 1000 dpm/100 square cm

= greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

= greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-049 Large Probe
 Location: Non-DU Catch Box East Wall
 0.17 c/d
 200 cpm

Detection efficiency =
 Background =

Instrument Response (CPM)	
A	B
1	232 250 185 220
	252 213
2	250 201 215 256
	252 201 254
	234 210
	241 255 221 223

Activity Concentration (dpm/100 square cm)	
A	B
1	188 294 -88 118
	306 76
2	294 6 88 329
	306 306 6 318
	200 59
	241 324 124 135

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-049 Large Probe

Location: Non-DU Catch Box West Wall

Detection efficiency =
Background =

0.17 c/d
200 cpm

Instrument Response (CPM)	
A	B
1	268 226 213 236
	239 216
2	212 246 216 242
	231 259 263 220
	266 225
	233 264 236 244

Activity Concentration (dpm/100 square cm)	
A	B
1	400 153 76 212
	229 94
2	71 271 94 247
	182 347 371 118
	388 147
	194 376 212 259

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-049 Large Probe

Location: Non-DU Catch Box North Wall

0.17 c/d
170 cpm

Detection efficiency =
Background =

Instrument Response (CPM)

	Instrument Response (CPM)			
	A	B	C	D
1	212	241	213	213
	212		225	
2	208	187	165	246
	213	252	214	221
		223	235	
	252	217	232	206

Activity Concentration (dpm/100 square cm)

	Activity Concentration (dpm/100 square cm)			
	A	B	C	D
1	247	418	253	253
	247		324	
2	224	100	-29	447
	253	482	259	300
		312	382	
	482	276	365	212

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-049 Large Probe

Location: Non-DU Catch Box Ceiling

0.17 d/d
200 cpm

Detection efficiency =
Background =

Instrument Response (CPM)	
A	B
1	248 272 271 235
	256 238
2	229 213 203 207
	202 241 198 203
	240 220
	269 236 287 230

Activity Concentration (dpm/100 square cm)	
A	B
1	282 424 418 206
	329 224
2	171 76 18 41
	12 241 -12 18
	235 118
	406 212 512 176

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI-S-049 Large Probe

Location: Non-DU Catch Box Floor

0.17 c/d
200 cpm

Detection efficiency =
Background =

Instrument Response (CPM)

	Instrument Response (CPM)			
	A	B		
1	1038	740	1053	739
2	1113	795		830
	567	598	941	804
		464	488	598
	947	516		543
		202	459	677

Activity Concentration (dpm/100 square cm)

	Activity Concentration (dpm/100 square cm)			
	A	B		
1	4929	3176	5018	3171
2	5371	3500		3706
	2159	2341	4359	3553
		1553	1694	2341
	4394	1859		2018
		12	1524	2806

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-049 Large Probe
 Location: Non-DU Catch Box Step Face

0.17 c/d
 170 cpm

Detection efficiency =
 Background =

Instrument Response (CPM)	
A	B
1 450	434 384 426
403	437 416 407

Activity Concentration (dpm/100 square cm)	
A	B
1 1647	1553 1259 1506
1371	1571 1476 1394

- [redacted] = less than 1000 dpm/100 square cm
- [redacted] = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm
- [redacted] = greater than 5000 dpm/100 square cm

APPENDIX E
ANALYSIS OF DATA FOR DU FIRING RANGE

ARDEC Picatinny Arsenal
Building 611B Characterization
DU Firing Range

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

North Wall			Floor		South Wall		
3	2	1	1	2	1	2	3
A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D
E	E	E	E	E	E	E	E
F	F	F	F	F	F	F	F
G	G	G	G	G	G	G	G
H	H	H	H	H	H	H	H
I	I	I	I	I	I	I	I
J	J	J	J	J	J	J	J
K	K	K	K	K	K	K	K
DU Target Room Location: All Surfaces Above Limits							

 = less than 1000 dpm/100 square cm.

 = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

 = greater than 5000 dpm/100 square cm.

Table DU-1

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-032 Large Probe
 Location: DU Tunnel West End

0.17 b/d
 300 cpm

Detection efficiency =
 Background =

Instrument Response (CPM)

	Instrument Response (CPM)		
	A	B	C
1	1005	1227 1956	748 1416 1403
		596	758 970
2	1503	3202	1212 906 722
	1148	1754	1557 1007 845
	1359	516	902
	994	2800	632 1221 1063

Activity Concentration (dpm/100 square cm)

	Activity Concentration (dpm/100 square cm)		
	A	B	C
1	4147	5453 9741	2635 6565 6488
		1741	2694 3941
2	7076	17071	5365 3565 2482
	4988	8553	7394 4159 3206
	6229	1271	3541
	4082	14706	1953 5418 4488

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEG Proximity Aerial
 Survey Number: GPS-S-032 Large Probe
 Location: DU Tunnel South Wall

Detection efficiency =
 Background = 0.17 dR
 300 cpm

Instrument Response (CPM)														
A	B	C	D	E										
1	509	545	455	488	550	542	592	462	429	429	453			
	935	804	700	901	1079	685	949	1042	552	429	808			
	279		261	354	293		343	353	325		308			
2		308		394		331		390		358				
	276		349		400		385	339	333		373			
	315		326		341		361	345	323		426			
3		307		312		387		329		347				
					312		453	471	293		307			
	323		287		371		342							

Instrument Response (CPM)														
	F	G	H	I	J	K								
1	304	407	397	427	560	451	550	1424	1941	1206	1653	1290	1166	475
	562	732	529	560	783	1004	1424	2938	1379	2606	2246	812	830	830
	279	316	283	327	298	254	347	319	386	423	893	927	927	927
2	277	277	313	279	293	254	347	347	487	715	654	723	1224	1224
	292	313	279	312	412	407	313	390	528	633	1073	708	853	853
	392	356	363	312	347	334	321	431	406	922	836	876	876	876
3	337	337	376	331	347	334	321	431	406	922	836	876	876	876
	324	376	331	347	334	321	431	406	922	836	876	876	876	876

Activity Concentration (dpm/100 square cm)														
A	B		C		D		E							
1	1229	1441	912	1471	1106	2265	1424	1718	1953	953	759	759	900	
2	3741	4188	2353	4582	3535	182	4382	3818	4365	1482	341	1812	53	
	-124	-76	-229	-41	318		435	253	529	312				147
3	-141	124	288	588	400	635	500	229	194	276	41	429	741	
	88	159	153	241	541	335	359	285	135					
	135	41	85	-76	71	512	247	900	171	1006	-41	276	41	

Activity Concentration (dpm/100 square cm)														
F	G	H	I	J	K									
1	24	571	747	1529	888	1471	9653	5329	7959	5824	5094	1029	2488	1478
2	1541	629	2541	1347	2841	4141	15518	6347	7959	13565	11447	1835	3118	
	-124	94	-100	159	-12	-271	112	506	541	724	3488	3688		
3	-47	-135	76	-124	-41	-271	276	1100	541	2441	2082	3424	2488	5435
	541	218	329	371	859	629	529	1341	624	1959	4547	3659	2388	4853
	141		447	182	276	200	78	124	771	1924	2588	3153	3388	

■ = less than 1000 dpm/100 square cm
 ■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm
 ■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
Survey Number: GPLS-0 Large Probe
Location: North Well DU Tunnel

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)																				
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	575	454	383	654	452	387	788	412	533	786	422	525	683	593	693	1634	1078	242	305	397
2	750	873	968	1059	1196	735	927	735	927	293	287	1344	1112	909	2631	372	233	272	382	330
	281	264	293	277	289	293	293	293	293	287	287	253	393	341	372	233	272	382	330	424
3	274	245	294	288	323	306	323	306	323	372	320	312	349	349	384	345	366	402	397	402
	247	281	264	287	315	336	415	386	415	372	320	312	349	349	384	345	366	402	397	402
	293	388	407	387	412	412	430	430	413	372	320	312	349	349	384	345	366	402	397	402

Activity Concentration (dpm/100 square cm)

Activity Concentration (dpm/100 square cm)																
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	1618	906	488	2082	894	512	2871	659	1371	2859	718	1324	2253	1724	2312	7947
	1865	3371	3929	4465	5271	-65	2559	3688	-41	-41	6141	4776	547	3582	13712	4576
2	-112	-212	-41	-135	-82	-135	-165	-41	-41	-76	-278	547	241	424	-394	-341
	-82	-324	-35	-82	135	-76	35	135	35	88	312	482	176	482	176	-165
	-153	-112	-212	-82	88	88	508	676	676	547	824	824	288	729	484	29
3	-312	18	41	41	212	212	212	765	665	424	118	71	288	218	388	571
	-41	518	629	512	659	659	659	665	665	424	118	71	288	218	388	285
	-41	518	629	512	659	659	659	665	665	424	118	71	288	218	388	600

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

Instrument Response (CPM)

Instrument Response (CPM)												
	G	H	I	J	K							
1	1137	3461	956	1346	2211	606	1629	814	841	859	1135	786
2	3448	2345	2904			3632	3499	2080	3279	950	2623	810
	345	268	328			374	532		376	861	782	912
3	338					320		467		939		
	326	300	334			376	826	527	527	750	1029	1044
	365	326	375			463	633	602	657	987	854	
	346				402					755		
	343	308	366			337	601		508	650	825	923
												574

Activity Concentration (dpm/100 square cm)

Activity Concentration (dpm/100 square cm)													
	G	H	I	J	K								
1	4924	18594	3859	6153	11241	1900	7818	3024	3182	4912	3288		2859
2	18518	12029	15318		20776	18818		17524	3824				3000
	265	-188	165		435	1365		447	3300	2835			3600
3		224		118			982			3759			4376
	153	0	200		447	3094		1335	2647	4288			
	382	153	441		959	1959		2100	4041	3259			3665
	253	271	35	388	600		1776	1224	2059	2676	3088		2200
						218	1771						

ARDEC, Picatinny Arsenal

Survey Number: GPI-3-033 Large Probe

Location: DU Tunnel Floor

Detection efficiency = 0.17 c/d
Background = 300 cpm

Instrument Response (CPM)									
A	B	C	D	E	F				
1	1103	909 862	1333 463	811 842	1555 754	977			
2	674	876 1236 1103 964	963 1030 1050	792 840 907	1218 708 1238	934 718	2547	7209	
	1355	1125 1020 1117	1121 1876	1208 1821	1632				

Activity Concentration (dpm/100 square cm)									
A	B	C	D	E	F				
1	4724	3582 3306 6118 19847	959 2741 3882 3682	3188 3006 2894 3176	2671 7382 5400	3982			
2	2200	5506 4724 3906 4294 4412	3571 3959 5518	2400 5518	5829 2400 2459	3729	13218	40641	
	6206	4853 4235 9271	4829 8947	5341 5694 7835					

■ = less than 1000 dpm/100 square cm
■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm
■ = greater than 5000 dpm/100 square cm

Instrument Response (CPM)									
G	H	I	J	K					
1	1487	1346	1593	7352	3148 1342	9308 13292			
2	1364	946 2351 2012 4325 2321	1241 4016 5180	4457 3462	7170 2105 3411 26490				
		770 2428 3880 1994	3090 3771	3929 6320					
	3650								

Activity Concentration (dpm/100 square cm)									
G	H	I	J	K					
1	6982	6153	7606	41482	16753 6129	52988 76424			
2	6259	3800 12065 10071 23676 11888	5535 21859 28706 10618	24453 18300 154059	40412 52988 76424				
		2765 12518 16359	18600	21347 35412					
	13253 21059 9965	16412 20418							
	19706								

APPENDIX F
ANALYSIS OF DATA FOR DU TARGET ROOM

ARDEC Picatinny Arsenal
Building 611B Characterization
DU Target Room

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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ARDEC Picatinny Arsenal

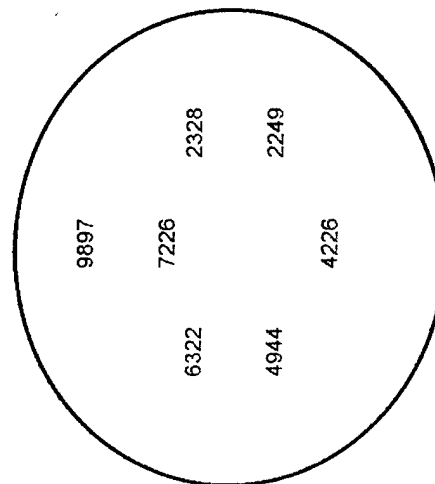
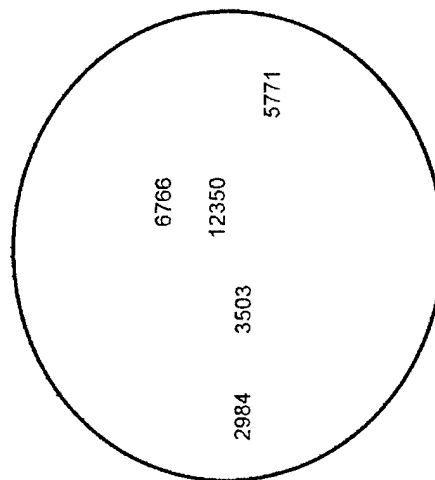
Direct Activity

Survey Number: GPI-S-059 Large Probe
Location: DU Target Room

Detection efficiency: 0.17 counts/disintegration

Instrument Response (CPM)		Activity Concentration (dpm/100 square cm)		Average	Component
1	2	1	2		
A	4387	25806	34465	28455	
B	7239	42582	61982	42878	
C	1414	8318	10941	9149	Floor
D	3186	18741	44759	27135	Table
E	9964	58612	39512	38316	
F	7273	42782	35229	38096	
G	12100	71176	22976	39896	
H	15086	88741	132176	101559	Vent
I	10754	63259	50871	50753	Light
J	8178	48106	43235	45343	
K	4075	23971	24688	24945	

Note: All locations exceed the 5000 dpm/100 square cm remediation level



ARDEC Picatinny Arsenal Loose Surface Activity

Survey Number: GPI-S-059 Loose Surface Activity (Smears)
 Location: DU Target Room
 Detection efficiency: 0.429 counts/disintegration

Instrument Response (CPM)		Activity Concentration (dpm/100 square cm)		Average Component
1 Smear #	2 Smear #	1 Smear #	2 Smear #	
A 13068	22 3520	A 30462	22 8205	12896
B 1379.5	20 1331.5	B 3216	20 3104	2113
C 94	37 35.5	C 219	37 83	113
D 63.5	36 64.5	D 148	36 150	111
E 242.5	34 401.5	E 565	34 936	936
F 1658	32 1291.5	F 3865	32 3010	300
G 275.5	30 553.5	G 642	30 1290	2302
H 1169	28 5399	H 2725	28 12585	654
I 2086.5	26 6101	I 4864	26 14221	5113
J 1645.5	24 2666.5	J 3836	24 6216	6370
K		K		3358

Note: All locations do not exceed the 1000 dpm/100 square cm remediation level



APPENDIX G
ANALYSIS OF DATA FOR INSIDE STORAGE AREA

ARDEC Picatinny Arsenal
Building 611B Characterization
Inside Storage Room

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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ARDEC Picatinny Arsenal

Storage Room Grid Layout

			NA3	NB3	NC3	ND3	NE3	North Wall (N)		
			NA2	NB2	NC2	ND2	NE2			
West Wall (W)			NA1	NB1	NC1	ND1	NE1	East Wall (E)		
WC3	WC2	WC1	FE3	FD3	FC3	FB3	FA3	EA1	EA2	EA3
WB3	WB2	WB1	FE2	FD2	FC2	FB2	FA2	EB1	EB2	EB3
WA3	WA2	WA1	FE1	FD1	FC1	FB1	FA1	EC1	EC2	EC3
Floor (F)			SE1	SD1	SC1	SB1	SA1	South Wall (S)		
			SE2	SD2	SC2	SB2	SA2			
			SE3	SD3	SC3	SB3	SA3			
			CE1	CD1	CC1	CB1	CA1	Ceiling (C)		
			CE2	CD2	CC2	CB2	CA2			
			CE3	CD3	CC3	CB3	CA3			

 = less than 1000 dpm/100 square cm.

 = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm.

 = greater than 5000 dpm/100 square cm.

Table SR-1

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-060 Large Probe
 Location: Storage Room at the end of DU Tunnel Floor

Efficiency (d/d)=
 Background (cpm)±

0.17
 300

Instrument Response (CPM)				
A	B	C	D	E
1	1823	2059	2112	1527
	1485	1045	1565	945
2	828	689	1025	833
	563	911	451	595
	525	693	575	488
3	573	1358	462	479
	647	1672	433	371
	669	478	396	338
	600	537	366	352
			425	362
			311	1265
			1116	907
			1116	395
			295	382
			340	340
			410	410
			341	379

Activity Concentration (dpm/100 square cm)				
A	B	C	D	E
1	8959	10347	10659	7218
	6971	4382	7441	3794
2	3106	2171	4265	3135
	1547	3594	888	1735
	1324	2312	1618	1106
3	1606	6224	953	1053
	2041	8071	782	418
	2171	1047	565	388
	1765	6265	688	306
		2324	4829	5806
		2082	3982	2224
		1976	1394	1729
		1094	935	894
		1135	653	788
		1394	735	306
			6553	5676
			912	976
			1194	776
			-29	235
			276	647
			385	465

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI -S-060 Large Probe
 Location: Storage Room at the end of DU Tunnel South Wall

Efficiency (c/d) = 0.17
 Background (cpm) = 150

	A	B	C	D	E
1	217	170	153	130	142
	167		126	147	129
2	161	199	163	145	141
	1396	977	1065	726	637
	168		167	156	152
3	200	169	163	154	149
	1267	715	744	432	406
	186		580	156	147
	193	207	150	161	144
			201	147	138

	A	B	C	D	E
1	394	118	18	-118	-47
	100		-141	-18	-124
2	65	288	76	-29	-53
	7329	4865	5382	3388	2865
	106		100	35	12
3	294	112	76	24	-82
	6571	3324	3494	1659	1788
	212		2529	71	-18
	253	335	0	65	-35
			300	24	-71

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-060 Large Probe
 Location: Storage Room at the end of BU Tunnel East Wall

Efficiency (g/d)= 0.17
 Background (cpm)= 150

Instrument Response (CPM)				
A	B	C		
1	529	497	336	284
	322		2717	252
2	709	284	355	188
	1442	2015	1783	896
		345	677	230
3	455	773	418	258
	252	407	437	150
	200		319	172
	162	260	318	229
				181

Activity Concentration (dpm/100 square cm)				
A	B	C		
1	2229	2041	1094	788
	1012		15100	600
2	3288	788	1206	224
	7600	10971	9606	4388
		1147	3100	471
3	1794	3665	1576	635
	600	1512	1688	0
	294		994	129
	71	647	988	182
				465

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal

Survey Number: GPI S-060 Large Probe

Location: Storage Room at the end of DU Tunnel West Wall

Efficiency (c/d)= 0.17
Background (cpm)= 150

Instrument Response (CPM)

	A			B			C		
	1	2	3	1	2	3	1	2	3
1	146	173	174	137	152	126	181	174	166
	165	348	151	107	410	147	137	220	197
2					474	168		492	
						141	559		168
3					148	141	131	146	155
	153			158	163		150	161	152

Activity Concentration (dpm/100 square cm)

	A			B			C		
	1	2	3	1	2	3	1	2	3
1	-24	135	141	-76	12	-141	182	141	94
	88	1165	6	-24	1529	-18	-76	412	276
2				1441	1906	106	1306	2012	382
						-53	2406		1706
3							71	135	106
							24	-24	47
							-112		-6
	18			47	76		0	65	29
									12

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-060 Large Probe
 Location: Storage Room at the end of DU Tunnel Ceiling

Efficiency (c/d)= 0.17
 Background (cpm)= 150

Instrument Response (CPM)				
	A	B	C	E
1	175	241		
	316		180	184
2	207	401		161
	440	620		
	203	704		
	200	420	197	176
		184		180
3				
	186		179	142
			157	142

Activity Concentration (dpm/100 square cm)				
	A	B	C	E
1	147	535		
	976		176	200
2	335	1476		65
	1706	3259		
	312	559	276	153
	294	200		176
3				
	212		171	-47
			41	-47

█ = less than 1000 dpm/100 square cm

█ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

█ = greater than 5000 dpm/100 square cm

Note: Due to the presence of the HEPA ventilation system on top of this room, the activity determination for the ceiling of this area is questionable. A reevaluation should be made after removal of the HEPA system and decontamination of the roof area where the HEPA was.

APPENDIX H
HEPA VENTILATION SYSTEM SURVEY

Radiological Survey Report
Gutierrez-Palmenberg, Inc.
 Routine Radiological Survey Form

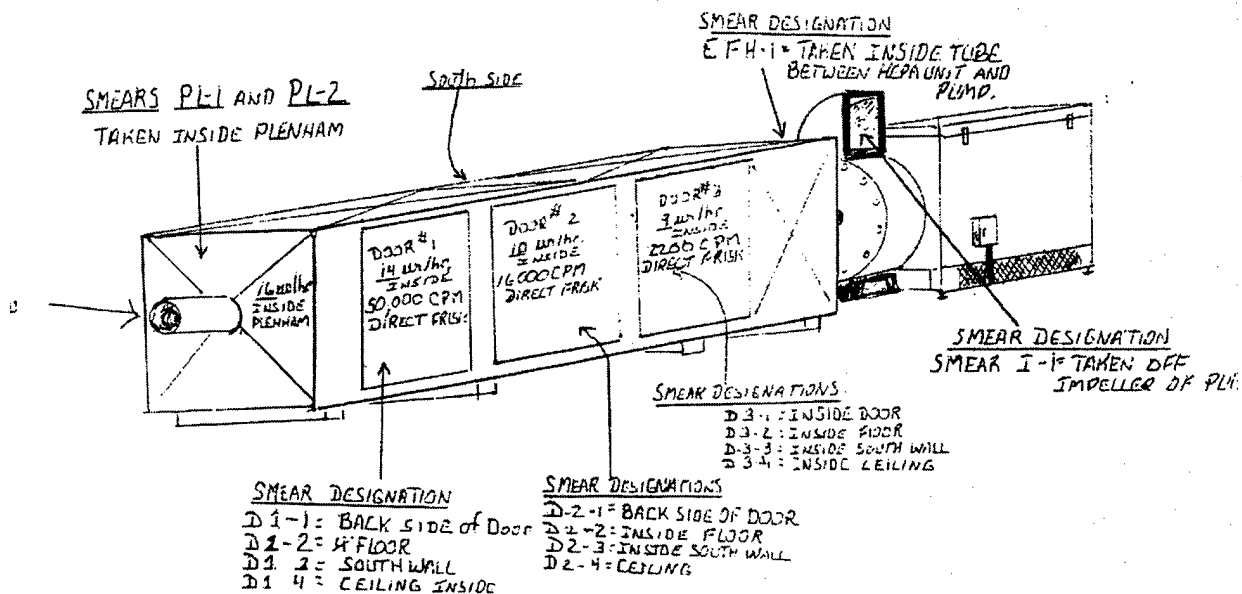
Facility: 611B

Survey Number: GPI-S-087

Date: <u>5 8 97</u> Time: <u>1300hr</u>	Instrumentation Used in Survey			
Surveyed by: <u>[Signature]</u>	Model	Serial #	% Efficiency	Calibration Due Date
Location: <u>HEPA VENTILATION SYS.</u> <u>ABOVE STORAGE ROOM</u> <u>Building 611B PICTON WAY ARDEC</u>	<u>LUDLUM 3</u>	<u>93101</u>	<u>10%</u>	<u>9 18 - 97</u>
	<u>MODEL 19</u>	<u>109970</u>	<u>N/A</u>	<u>10-4-97</u>
Review by: <u>[Signature]</u>				

Smear location = (Number) Dose rate = μ R/hour Frisk, count rate = cpm

Indicate North 



Location or item description TOP OF STORAGE ROOM HEPA UNIT FOR DUT TUNNEL

Notes Background for Ludlum 3 42-50 CPM BY BACKGROUND FOR MICROR METER 6 uR/hr
ALL SMears WERE FIELD COUNTED ON LUDLUM 3. SEE ATTACHED FOR RESULTS.

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Radiological Survey Report
Gutierrez-Palmenberg, Inc.

Facility: Palmenberg ARDEC 611B

Survey Number: GPI-S-087

Date: <u>5-8-97</u> Time: <u>1300</u>	Instrumentation Used in Analysis					
Analyzed by:	Model	Serial #	Probe	Probe Serial#	%Efficiency	Cal Due Date
<u>Bldg. 611B</u> <u>Hepa unit above storage</u> <u>Room</u>	<u>3</u>	<u>93101</u>	<u>44-9</u>	<u>360</u>	<u>10</u>	<u>9-18-97</u>
	<u>19</u>	<u>109970</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>10-4-97</u>
Review	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>

Counting Results

Sample #	Count Time (min)	α Count	β Count	α CPM	β CPM	α DPM	β DPM
<u>PL-1</u>	<u>NA</u>				<u>4600</u>		<u>46000</u>
<u>PL-2</u>	<u>NA</u>				<u>1000</u>		<u>10000</u>
<u>DI-1</u>	<u>NA</u>				<u>2600</u>		<u>26000</u>
<u>DI-2</u>	<u>NA</u>				<u>4700</u>		<u>47000</u>
<u>DI-3</u>	<u>NA</u>				<u>4700</u>		<u>47000</u>
<u>DI-4</u>	<u>NA</u>				<u>3400</u>		<u>34000</u>
<u>D2-1</u>	<u>NA</u>		<u>NA</u>		<u>1000</u>	<u>NA</u>	<u>10000</u>
<u>D2-2</u>	<u>NA</u>				<u>1600</u>		<u>16000</u>
<u>D2-3</u>	<u>NA</u>				<u>600</u>		<u>6000</u>
<u>D2-4</u>	<u>NA</u>				<u>1000</u>		<u>10000</u>
<u>D3-1</u>	<u>NA</u>				<u>240</u>		<u>2400</u>
<u>D3-2</u>	<u>NA</u>				<u>1600</u>		<u>16000</u>
<u>D3-3</u>	<u>NA</u>				<u>150</u>		<u>1500</u>
<u>B3-4</u>	<u>NA</u>				<u>140</u>		<u>1400</u>

Gutierrez-Palmenberg, Inc. * Phoenix - Las Vegas * 702-647-5699

Survey Number GPI-S-087 Dated 5-8-97

[illegible]

GPI Survey Counting Form 1/97

Page 3 of 3

APPENDIX I
ANALYSIS OF DATA FOR OPEN STORAGE AREA

ARDEC Picatinny Arsenal
Building 611B Characterization
Open Storage Area

Notes

1. Electrical equipment was left in place for this characterization, it will be surveyed upon removal.
2. A detection efficiency of 10% was assumed for conservatism in evaluation of the data. The actual detection efficiency would range from 10% to 30% for energetic beta particles in a known open configuration, in this case however, the configuration of activity on the surface is not homogeneous and it's depth under dust and dirt is unknown but anticipated to be small.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour, background count rates for the different instruments varied and are recorded on the evaluation forms.

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A1	B1	C1	D1
A2	B2	C2	D2
A3	B3	C3	D3
A4	B4	C4	D4
A5	B5	C5	D5
A6	B6	C6	D6
A7	B7	C7	D7

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

Table QS-1

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-029 Large Probe
 Location: 611 B Gazebo

Detection efficiency =
 Background =

0.17 c/d
 300 cpm

Instrument Response (CPM)											
	A		B			C			D		
1	484		481	437		385	518		459	338	272
		950			659			6602			661
2	433		485	698		739	747		781	407	487
	436		376	515		295	438		653	475	371
		286			447			856			445
3	355		337	458		600	604		696	437	414
	308		271	345		1034	367		526	433	599
		387			386			359			434
4	392		476	375		420	453		396	331	384
	481		806	613		427	380		316	279	350
		520			393			472			405
5	598		480	422		403	478		439	384	416
	444		435	351		368	498		542	747	780
		866			457			470			1018
6	769		485	405		1034	699		381	526	1614
	401		576	495		587	516		438	458	605
		1954			538			396			546
7	475		577	503		307	381		331	504	572
		557			412			373		458	612
											546
										504	572

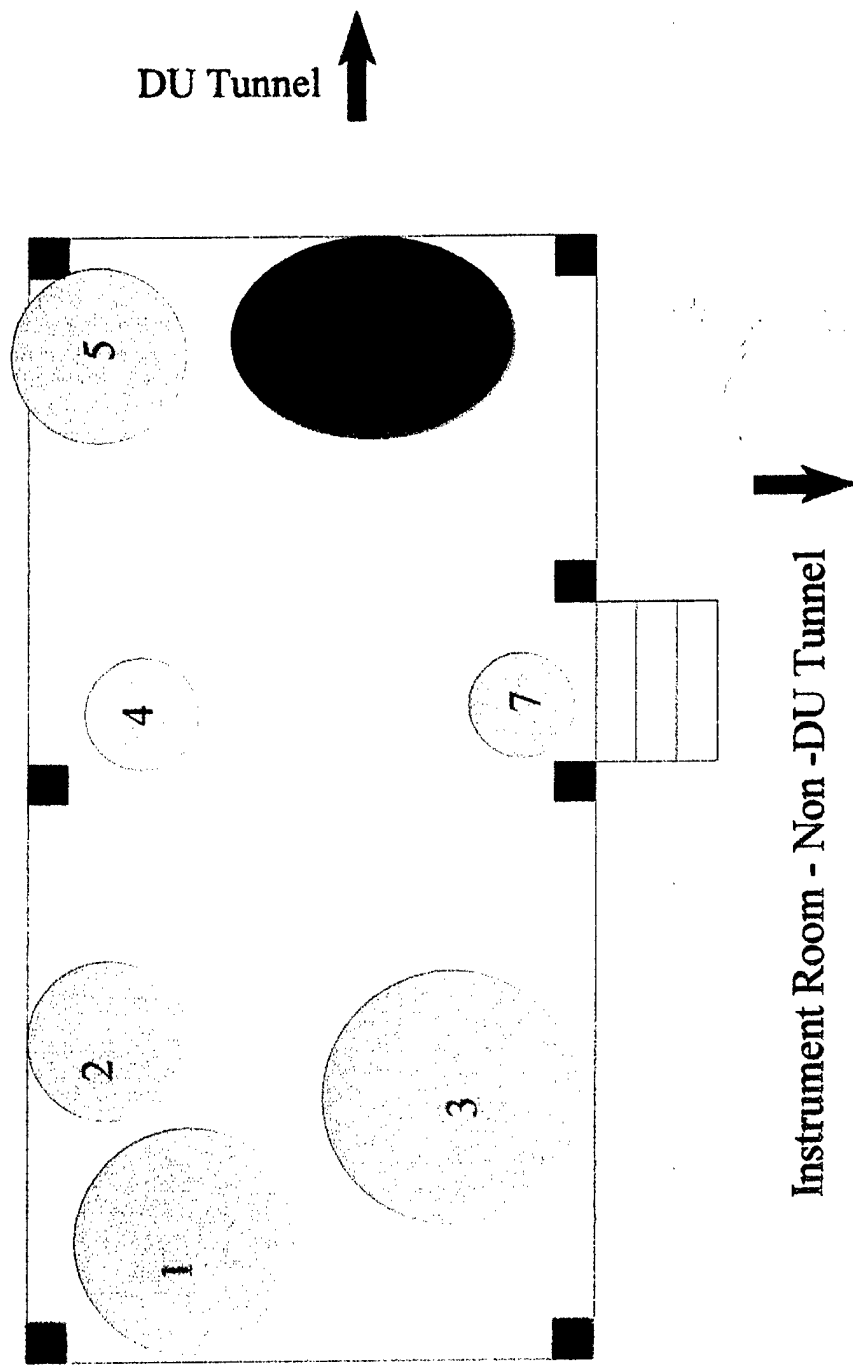
Activity Concentration (dpm/100 square cm)											
	A		B			C			D		
1	965		947	806		500	1282		935	224	-165
		3824			2112			37071			2124
2	782		1088	2341		2582	2629		2829	629	982
	800		447	1265		-29	812		2076	1029	418
		-82			865			3271			853
3	324		218	929		1765	1788		2329	806	671
	47		-171	265		4318	394		1329	782	1759
		512			508			347			788
4	541		1035	441		706	900		565	182	494
	1065		2976	1841		747	471		94	-124	294
		1294			547			1012			618
5	1753		1059	718		806	1047		818	494	682
	847		794	300		400	1165		1424	2629	2824
		3329			924			1000			4224
6	2759		971	618		4318	2347		476	1329	1794
	594		1624	1147		1688	1271		812	929	1835
		9729			1400			565			1447
7	1029		1629	1194		41	476		182	1200	1600
		1512			659			429		929	1835
											1447
										1200	1600

■ = less than 1000 dpm/100 square cm

■ = greater than 1000 dpm/100 square cm and less than 5000 dpm/100 square cm

■ = greater than 5000 dpm/100 square cm

Approximate locations of radioactive material found on the open storage area at
ARDEC - Picatinny Arsenal, Building 611B



APPENDIX J
ANALYSIS OF DATA FOR BUILDING 611B GROUNDS

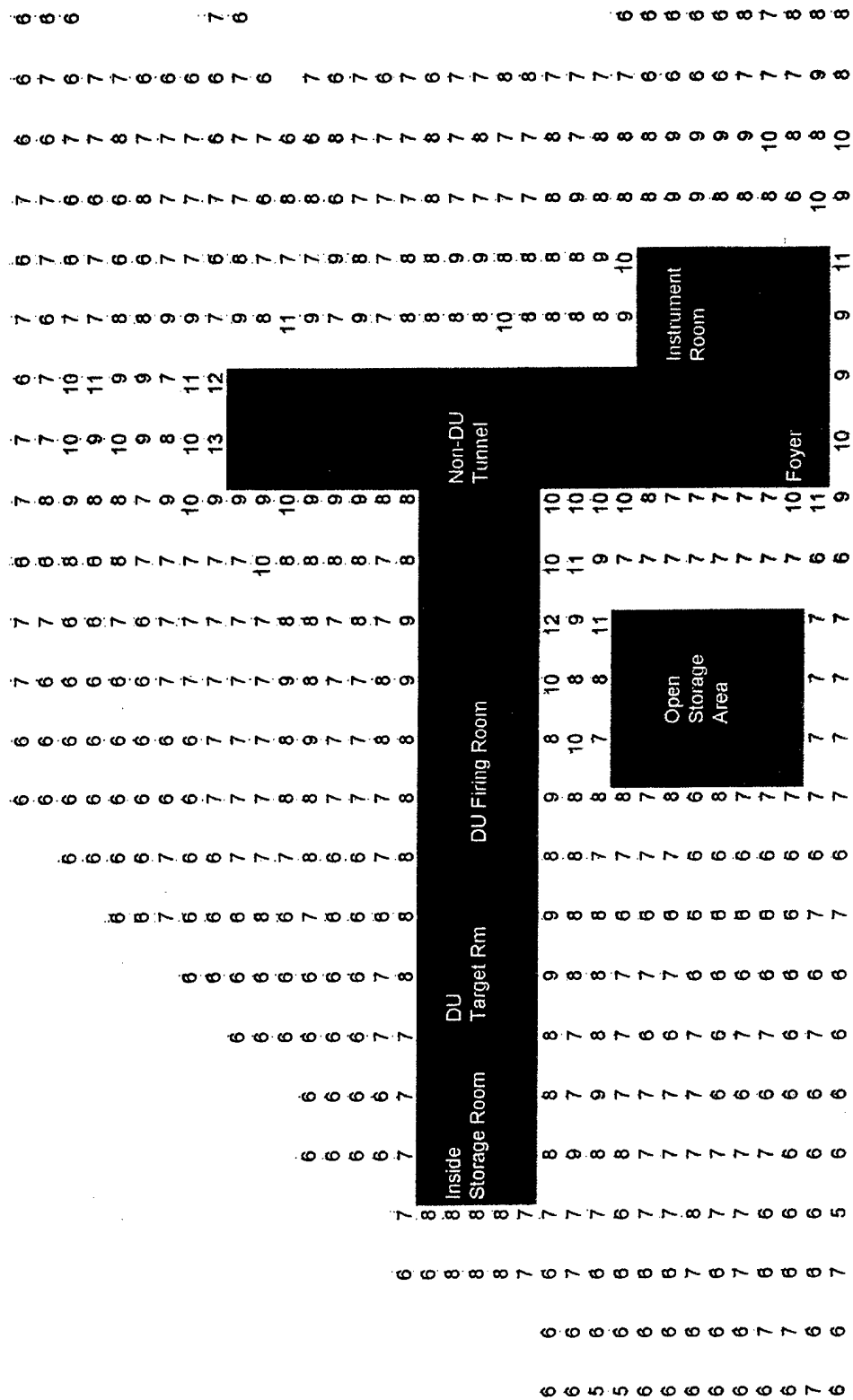
ARDEC Picatinny Arsenal
Building 611B Characterization
Grounds

Notes

1. Unexploded ordinance present in the area had no detectable activity.
2. Dose rates measured in the area around the building are consistent with background dose rates.
3. Background evaluations revealed a background dose rate of approximately 7 to 12 uR/hour.

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333 North Rancho Drive
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702-647-5699

ARDEC Picatinny Arsenal
 Survey Number: GPI-S-088 Micro-R meter
 Location: 811 B Outside Grounds



APPENDIX K
BUILDING 611B OPERATOR'S LOG

TIME

111

112

BE6 VS. TRIPLE TARGET (.1" - .250" - .500")

PROPELLANT IMR-4996 - 14' 20 MM SMOOTH BORE ABL.

RD#	CHG	INST. VEL.	VEL.	PRESS.	X-RAY TIME	X-RAY VEL.
26 7/10/79	965	856.0	3268	19900	269.8	3288/3286
28	875	943.7	2964	12800	260.7	2987/2985
		Changed	to 20KV charging voltage (Dillon)			
34	925	902.5	3099	15.500	No TIME	No X-RAY
40	835	977.3	2862	12.300	297.8	2880/2878
46 7/12/79	735	1064.3	2627		300.8	2629/2631
18 7-20-79	790	1034	2757	12400	286.5	2789/2786

BE5 GROUP B SAME AS ABOVE

BE5 30 7-23-79	710	1172	2501	less than 9000	297.7	2555/2555
34 7-24-79	651	1122	2376	less than 9000	295.8	2425/2428

DU

65° USING 30MM FAT 15EI CASES WITH 7" CHAMBER
 PRIMERS M52RBI ELECT. BASE LINE $33\frac{9}{16}" = 2.797"$

TIME	VEL.	TIME	VEL.	TIME	VEL.	PENETRATION	REMARKS
H-5	H-5	6-7	6-7	8-9	8-9	.1" .250" .500"	PROJ. WT.
						AVG. .102" .248" .575"	
91.8	NO X-RAY	94.8	3074	249.6		PR#1 C. C. C.	174298
						RDS#26+28 1/2" PLATE #1 HARD	
94.2	29.47	79.7	2415	252.3		NO PEN PR#2 C. C. C.	PROJ. WT. 1741
						P.P. C. C. P.	
NO TIME	NO X-RAY	NO TIME	NO X-RAY	NO TIME	NO X-RAY	PR#3 C. C. C.	PROJ. WT. 1741
						PR#4 C. C. C.	PROJ. WT. 1738
87.9	2830	117.9	2415	251.8		PR#1 C. C. C.	PROJ. WT. 1741
						AVG. 0.074 IN. 252	
88.8	2577	117.7	2102	0.0		PR#1 C. C. C.	PROJ. WT. 1741
						PR#2 C. C. C.	PROJ. WT. 1741
88.0		119.4		0.0		PR#3 C. C. C.	PROJ. WT. 1741
						PR#4 C. C. C.	PROJ. WT. 1741
						PR#5 C. C. C.	PROJ. WT. 1741
88.4	2500	118.1	2274	0.0		PR#1 C. C. C.	PROJ. WT. 1741
						PR#2 C. C. C.	PROJ. WT. 1741
88.5	2354	118.0	2155	203.1		PR#3 C. C. C.	PROJ. WT. 1745
						PR#4 C. C. C.	PROJ. WT. 1745

BE4 GROUP "C" SAME AS ABOVE

RO*	CHG	INST VEL	VEL	PRESS	X-RAY TIME	X-RAY VEL	TIME
4	590	12823	2181	⁴⁰⁰² 3993	300.5	2160/2162	88.2
12	645	13573	2279	⁴⁰⁰² 3997	298.5	2303/2305	99.1

BE5- GROUP "D" SAME AS ABOVE

5	686	1113.7	2511	⁴⁰⁰² 3997	284.6	2530/2528	90.9
7	742	975.2	2601	3700	298.0	2616/2616	88.3
5	875	923.1	303	14,700	0.0		88.5

BE1 GROUP "E" SAME AS ABOVE

1	690	1112	250	⁴⁰⁰² 3992	283.4	2436/2438	97.5
Q1	1200	678.4	4123	31,700	—	—	—
Q2	1140	FALSE	—	24800	174.2		62.0

VEL 4-5	TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION			REMARKS
					1"	.25"	.500"	
					PRG PRG	PRG	PRG	WT PROJ. 1141g.
2101	118.1	1839	252.0		C	C	P. 56	
					PR2	PR2	PR4	
2243	118.3		253.7		C	C	P. 56	WT. PROJ. ?
					PR3	PR3	PR3	WT. PROJ
2496	116.3	2115	252.3		C	C	P. 56	1732.5
					PR4	PR4	PR4	
2572	116.5	2311	253.5		C	C	P. 56	WT. PROJ 1732.
					AVG PR-1	AVG PR-1	PR3	WT. PROJ
2931	117.6	2754	248.7		C	C	C	1757
					PR2	PR2	PR2	WT. PROJ
2341	118.0	2042	253.7		C	C	P. 56	1733
-	84.8		131.9		C.	C.	C.	WT. PROJ. 1007.5
	85.0		131.9		C.	C.	C.	WT. PROJ. 1006.5

STABALLOY VS TRIPLE TARGET (.1" -.250" -.500")

PROPELLANT IMR 4996 14' 20 MM SMOOTH BORE BBL.

							TIME, VEL.	
RD#	CHG.	INST. VEL.	VEL.	PRESS.	X-RAY TIME	X-RAY VEL.	4-5	4-5
260- 00A-1	1140	697.5	4017	26600	197.7	$1229.3 / 127.3$	62.0	1204.7
260- 00A-2	1040	752.5	3724	20,700	231.3	$1140.9 / 1139.9$	94.0	LOST
260- 00A-3	975	598.2	4684	17,400	250.5	LOST	99.6	1060
260- 00A-4	975	803.4	3488	17,900	249.4	$1080.0 / 1081.0$	99.4	1051.5
260- 02B-5	950	814.3	3441	15,700	248.7	$1059.0 / 1059.0$	89.9	1028.7
260- 02B-6	900	859.2	3261	14,200	215.1	$1005 / 1006$	83.7	968.1

65° USING 30MM FATISEI CASES WITH 7" CHAMBER
 PRIMERS M52A3 BI ELECT. BASE LINE 33 5/8" = 2.802'

TIME.	VEL.	TIME.	VEL.	PENETRATION			REMARKS.
6-7	6-7	8-9	8-9	.1"	.250"	.500"	
84.8	870.7	132.2		C.	C.	C.	260-00A 63.75 .3007 X 3.000 PROJ. WT. 982.8 GRNS.
89.8	LOST	132.2	?	C.	C.	C.	260-00A 63.8 gms. .3007 X 3.002 PROJ. WT. 983.0 GRNS.
96.1	995	135.8		C.	C.	C.	PP.PoS 260-00A 63.8 gms. L.B. .3008 X 3.000 PROJ. WT. 983.3 GRNS. PROJ. FRAGMENTS RECOVERED
97.6	946	135.4	210.9	C.	C.	C.	260-00A 63.8 gms. .3007 X 3.002 PROJ. WT. 984.0 GRNS.
85.6	916	132.3	581.6	C	C	C	260-02B 63.75 gms .3007 X 3.001 PROJ WT. 984.0 GRNS
76.4	890.6	132.7		C	C	C	260-02B 63.8 gms 3007 X 3.002 PROJ. WT 984.0 GRNS

		Inst VEL	VEL	Press	X-Ray Time	X-Ray VEL	Time	VEL
260-850	906.9	3090	10200	233.7	951.4 850.5	81.5	4-5	920.4
260-875			12300	243.4				
260-900	850.0	3296	13700	232.4	1009.9 1009.5	80.9		980.3
260-925	688.0	4072	14600	247.5		79.2		990.7
261-950	811.2	3454	15000	242.1	1057.3 1056.9	79.9		1024.9
261-975	818	3425	14400	237.0	1045.1 1045.1	80.4		1035

TIME	VEL	TIME	VEL	PENETRATION			REMARKS
				.1"	.250"	.500"	
6-7	67	8-9	8-9				
76.2	855	133.0		C	C	P	260-02B 63.85 GMS .3007 X 3.002 Proj wt 984.0 gms
							260-01D 63.7 GMS
				C	C	MB	.3008 X 3.003 Proj wt 984.5 gms FRAG. FRAGMENTS RECOVERED.
73.6	891.7	133.1		C	C	MB	260-01D 63.85 GMS .3007 X 3.003 Proj wt. 984.2 gms
73.7	823	131.9		C	C	SB	260-01D 63.2 GMS .3005 X 3.001 Proj wt 981.5 gms
73.5	925.1	131.2	361.1	C	C	C	261-00A 63.7 gms .3007 X 3.000 Proj wt 982.0 gms
			X				
75.1	945	131.7	174.5	C	C	C	261-00A 63.7 gms .3007 X 3.001 Proj wt. 982 gms
			? X				

2.802

CHG	INST VEL	VEL	PRSS	X-RAY TIME	X-RAY VEL	TIME 4-5	VEL 4-5
920	844.1	3320	12800	237.5	1009.2	80.0	980.8
910	838.0	3344	11900	233.0	1026.2 1027	79.7	995
915	838.0	3344	?	233.3	1024.3 1027	87.7	1000
950	953.1	2940	15700	224.8	1069 1070	79.9	1038
975	791.2	3541	17200	227.2	1077 1080	88.3	1051
1000	778.8	3598	17000	241.2	1110.3 1111.5	79.9	1080
1100	710.2	3945	24100	238.6	1208.9 1211.5	79.1	1179
1075	724.9	3866	22800	244.2	1185.5 1187.5	76.1	1163

TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION 1" 250" 500"			REMARKS
75.1	909	127.3	310.4	C	C	C	261-00A 63.7gms 3006 X 3.000 Proj wt. 982.0
			*				
75.0	912	128.0		C	C	MB	261-01A 63.7gms Proj wt 982.5gms 10-31-79
75.3	898	128.6		C	C	C	261-01A 63.65gms. 3007 X 3.0 Proj. wt. 981.0 10-31-79
74.2	947	128.6		C	C	LB	261-00A 63.75 Gms 3007 X 3.001 Proj wt 980.5 11-1-79
73.8	941	129.2		C	C	MB	261-01A 63.65gms Proj wt 981.0 11-1-79
73.5	964	?		C	C	MB	261-02C 63.7gms 3007 X 3.000 Project wt 983.0 Gms 11-6-79
43.6	1095	128.5	487	C	C	C	261-02C 63.7gms 3007 X 3.002 Pen wt 985.0
60.6	1054	128.5	389	C	C	C	261-02A 63.8gms 3008 X 3.001 PENETRATOR WT 985.0 slight yaw No Pitch

2.802

RD	chg	Inst. Vel	Vel	Press	X-RAY Time	X RAY Vel	Time 4-5	Vel 4-5
266 021A-21	1050	730.1	3838	21400	242.4	1124.4	72.7	1147
266 021A-22	1025	946.7	2960	12900	231.5	1038.8 1040.2	66.9	1007
266 021A-23 11-13-79	1000	759.7	3688	18000	232.8	1127.2 1126.5	-	-
266 021A-24	950	768.7	3645	16800	223.4	1117.5 1118.5	73.7	1091
266 021A-25 11-10-79	950	803.1	3489	14900	231.5	1068.7 1069.2	68.6	1041
266 021A-26	925	839.4	3338	21400	239.1	1083 1025.8	65.8	-
266 021A-27	975	795.0	3525	17000	233.6	1081.3 1081.6	65.7	1052
266 021A-28	1000	767.9	3649	18000	239.0	1087 HIT CABLE	66.6	1050
266-028 29	1000	771.0	3654	16,800	234.5	1118 1119	64.7	1099

Time	Vel	Time	Vel	Penetration			Remarks
				.1	.250	.500	
1.2	1064	128.4	298	C	C	C	266-014A 63.89grams .3004 X 3.003 Proj wt 983.0
1.4	912	129.2		C	C	SB	266-014A 63.5grams 13030 X 3.002 Proj wt 979.0
59.6	1019	128.0	527	C	C	C	266-021A-23 63.8grams .3007 X 3.001 Proj wt 983.0
60.0	972	128.0	184	C	C	C	266-021A-24 63.85 gms .3007 X 3.003 Proj wt. 983.5
60.0	957	130.3	249	C	C	C	266-021A-25 63.6 gms .3004 X 3.001 Proj wt 981.0
59.5		128.6	-	C	C	MB	266-014A 63.8 gms .3006 X 3.001 Proj wt 983.5
59.5	971	128.9	460	C	C	C	266-018 63.8 gms .3007 X 3.001 Proj wt 983.5
59.8	Lost	128.3	Lost				266-021B 63.85 gms .3008 X 3.001 Proj wt 984.0
58.8	992	108.3	547	C	C	C	266-02B 63.8 gms .3008 X 3.001 Proj wt 985.0 gms

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$\frac{3}{4}$ TI
 TRI ALLOY V.S. TRIPPLE T&T (.1-.28-.500) 65° DEGREE L
 IMR 4996 14' 20 mm SMOOTH BORE BBL. PRIMERS MS2A3B1 ELEC.

Rd.	CHG	INST. VEL	VEL	PRESS	X-RAY TIME	X-RAY VEL	TIME 4-5	VEL 4-5
202-1	975GR	7864	3563	114500	237.7	$\frac{1098.1}{1089}$	62.8	1063
202-2	9501	8009	3490	15200	237.0	$\frac{1069.1}{1068}$	63.2	1043
202-3	1000	7704	3637	18100	266.8	$\frac{1112.4}{1112.4}$	70.2	1083
202-4	1000	7490	3741	18500	267.0	$\frac{1143.1}{1144.4}$	61.7	1116
202-A-1	10509	7462	3760	20000	221.4	$\frac{1154.0}{1154.4}$	65.0	1127
202A-2	1075	728.6	3500	20500	223.5	$\frac{1181.1}{1181.92}$	62.3	1154
202A-3	1100	712.5	3934	20500	218.1	$\frac{1196.8}{1196.4}$	63.4	1172
202A-4	1125	699.8	4014	24800	218.2	$\frac{1217.5}{1218.2}$	63.6	1193

USING 30MM FAT 15E1 CASES WITH 7" CHAMBER PROPELLANT
 BASE LINE $33\frac{5}{8}" = 2.802$

TIME 6-7	VEL 6-7	TIME 8-9	VEL 8-9	PENETRATION 100,500	REMARKS
56.8	971	108.8	Low	C C C	202-1 12-12-79 63.1 GMS L 3.000 X C.300 DIA 976.5 GR
57.3	950	—	—	C C	18-CK 205-2 12-12-79 63.1 GMS L 3.000 X DIA 0.300 980.0 GR
56.6	989	109.1	731	C C C	202-3 12-13-79 63.2 GMS L 3.002 X DIA 0.300 977.5 GR
57.1	1025	109.0	500	C C C	202-4 12-13-79 63.2 GMS L 3.000 X DIA 0.300 977.0 GR
56.7	1011	110.8	622	C C C	202A-1 12-13-79 63.2 GMS L 3.002 X DIA 0.300 977.0 GR
57.0	1074	109.9	807	C C C	202A-2 63.2 GMS L 3.003 X DIA 0.300 977.0 GR
57.2	1105	110.0	787	C C C	202A-3 63.2 GMS 976.0 GR
57.9	1117	99.8	881	C C C	202A-4 63.0 GMS 975.0 GR

staballoy PO-B483					14' 20M/M smooth barrel						
IMR4996					4-5	4-5	6-7	6-7	8-9		
Rd #	Chrg.	Inst Vel	Vel	Press	XRAY Time	XRAY Vel	XRAY Time	Vel	XRAY Time		
					505	1	2		3		
6-2	800	948.7	2954	8800	304.8	117.6	123.4		518.2		
6-3	880	889.1	3152	11600	268.9	106.6	113.1		414.4		
6-4	880	874.1	3199	11000	280.1	117.6	84.4		413.6		
6-5	960	771.2	3627	15300	298.2	110.2	85.1		415.5		
6-6	900	840	3330	11700	286.4	116.8	87.4		413.7		
6-7	890	853.3	3278	11100	282.2	118.4	85.2		409.4		
6-8	900	848.8	3287	13300	289.9	111.5	85.3		410.8		
6-9	915	834.6	3343	13300	288.0	110.5	85.2		410.7		
6-10	915	833.9	3354	12600	285.5	107.1	85.6		411.8		
6-11	925	827.5	3380	15300	285.2	110.1	85.6		415.9		
6-12	940	826.7	3383	15900	286.7	110.9	86.0		414.8		
6-13	955	823.9	3394	13000	292.5	102.9	85.1		410.1		
6-14	920	847.2	3301	13200	288.8	102.7	85.0		410.5		
6-15	960	816.2	3426	15400	292.3	109.6	84.5		411.2		
6-16	920	801.9	34	14600	294.1	110.7	85.1		411.7		
6-17	900	870.9	3216	12400	284.7	109.5	85.6		411.3		
6-18	900	854.0	3275	13300	288.3	118.8	86.0		415.6		
6-19	915	849.3	3293	13400	283.9	109.9	86.5		416.9		
6-20	885	871.6	3209	11900	286.3	110.4	86.9		416.9		
6-21	966	796.4	35	16500	295.7	117.2	85.0		410.0		
6-22	885	818.3		12	288.0	109.0	85.5		413.6		
6-23	955	815.4	3430	14800	?	?	?		?		
6-24	915	839.2	3333	13400	288.0	110.2	85.6		415.2		
6-25	900	821.6	3444	9900	295.4	108.5	86.2		410.0		
6-26	935	797.4	3520	11900	289.5	108.6	86.7		415.6		

Angle Triple Plates

Eng. Nawat

2.777

RAY	Penetration Plate	1	2	3	Remarks
1	C	1250	500		DU Projective wt 1006 grains
	C	C	MB		Penetrator wt. 1007 grains
	C	C	SB		Penetrator wt. 1008 grains
	C	C	NO		Penetrator wt. 1006 grains
4	C	1100	29		Penetrator wt. 1005.8 "
5	C	100	29		Penetrator wt. 1004.2 "
6	C	98	7		Penetrator wt 1006.0 "
7	C	98	5B		Penetrator wt 1006.0 "
8	C	98	5B		Penetrator wt 1004.8 "
9	C	97	14		Penetrator wt 1007.2 "
10	C	97	14		" " 1007.0 "
11	C	97	14		Penetrator " 1007.5 "
12	C	96	36		Penetrator " 1005.5 "
13	C	97	14		Penetrator " 1006.0 "
14	C	97	36		Penetrator " 1006.0 "
15	C	96	29		Penetrator " 1005.5 "
16	C	95	24		Penetrator " 1006.0 "
17	C	95	36		Penetrator " 1005.7 "
18	C	95	36		Penetrator " 1006.0 "
19	C	95	36		Penetrator " 1006.0 "
20	C	95	36		Penetrator " 1006.0 "
21	C	100	37		Penetrator " 1006.5 "
22	C	100	37		Penetrator " 1006.5 "
23	C	95	32		Penetrator " 1006.0 "
24	C	98	19		Penetrator " 1006.0 "
25	C	98	19		Penetrator " 1006.0 "
26	C	98	19		Penetrator " 1006.0 "
27	C	98	19		Penetrator " 1006.0 "
28	C	98	19		Penetrator " 1006.0 "
29	C	98	19		Penetrator " 1006.0 "
30	C	98	19		Penetrator " 1006.0 "
31	C	98	19		Penetrator " 1006.0 "
32	C	98	19		Penetrator " 1006.0 "
33	C	98	19		Penetrator " 1006.0 "
34	C	98	19		Penetrator " 1006.0 "
35	C	98	19		Penetrator " 1006.0 "
36	C	98	19		Penetrator " 1006.0 "
37	C	98	19		Penetrator " 1006.0 "
38	C	98	19		Penetrator " 1006.0 "
39	C	98	19		Penetrator " 1006.0 "
40	C	98	19		Penetrator " 1006.0 "
41	C	98	19		Penetrator " 1006.0 "
42	C	98	19		Penetrator " 1006.0 "
43	C	98	19		Penetrator " 1006.0 "
44	C	98	19		Penetrator " 1006.0 "
45	C	98	19		Penetrator " 1006.0 "
46	C	98	19		Penetrator " 1006.0 "
47	C	98	19		Penetrator " 1006.0 "
48	C	98	19		Penetrator " 1006.0 "
49	C	98	19		Penetrator " 1006.0 "
50	C	98	19		Penetrator " 1006.0 "
51	C	98	19		Penetrator " 1006.0 "
52	C	98	19		Penetrator " 1006.0 "
53	C	98	19		Penetrator " 1006.0 "
54	C	98	19		Penetrator " 1006.0 "
55	C	98	19		Penetrator " 1006.0 "
56	C	98	19		Penetrator " 1006.0 "
57	C	98	19		Penetrator " 1006.0 "
58	C	98	19		Penetrator " 1006.0 "
59	C	98	19		Penetrator " 1006.0 "
60	C	98	19		Penetrator " 1006.0 "
61	C	98	19		Penetrator " 1006.0 "
62	C	98	19		Penetrator " 1006.0 "
63	C	98	19		Penetrator " 1006.0 "
64	C	98	19		Penetrator " 1006.0 "
65	C	98	19		Penetrator " 1006.0 "
66	C	98	19		Penetrator " 1006.0 "
67	C	98	19		Penetrator " 1006.0 "
68	C	98	19		Penetrator " 1006.0 "
69	C	98	19		Penetrator " 1006.0 "
70	C	98	19		Penetrator " 1006.0 "
71	C	98	19		Penetrator " 1006.0 "
72	C	98	19		Penetrator " 1006.0 "
73	C	98	19		Penetrator " 1006.0 "
74	C	98	19		Penetrator " 1006.0 "
75	C	98	19		Penetrator " 1006.0 "
76	C	98	19		Penetrator " 1006.0 "
77	C	98	19		Penetrator " 1006.0 "
78	C	98	19		Penetrator " 1006.0 "
79	C	98	19		Penetrator " 1006.0 "
80	C	98	19		Penetrator " 1006.0 "
81	C	98	19		Penetrator " 1006.0 "
82	C	98	19		Penetrator " 1006.0 "
83	C	98	19		Penetrator " 1006.0 "
84	C	98	19		Penetrator " 1006.0 "
85	C	98	19		Penetrator " 1006.0 "
86	C	98	19		Penetrator " 1006.0 "
87	C	98	19		Penetrator " 1006.0 "
88	C	98	19		Penetrator " 1006.0 "
89	C	98	19		Penetrator " 1006.0 "
90	C	98	19		Penetrator " 1006.0 "
91	C	98	19		Penetrator " 1006.0 "
92	C	98	19		Penetrator " 1006.0 "
93	C	98	19		Penetrator " 1006.0 "
94	C	98	19		Penetrator " 1006.0 "
95	C	98	19		Penetrator " 1006.0 "
96	C	98	19		Penetrator " 1006.0 "
97	C	98	19		Penetrator " 1006.0 "
98	C	98	19		Penetrator " 1006.0 "
99	C	98	19		Penetrator " 1006.0 "
100	C	98	19		Penetrator " 1006.0 "

14' X 20" M Barrel Smooth
 Pwr IMR 4996 ^{longden} R ST Projectile versus Triple Target
 65° Angle

FT VAR SRC

Rd No	Grains	Reading	Vel	Press	1st X-Ray Time	1st X-Ray Vel	4+5 X-Ray Time	4+5 X-Ray Vel	6+7 X-Ray Time	6+7 X-Ray Vel	8+9 X-Ray Time
#1-M2	1140	731	3648	17600	206.8	3651	31.1	3441	42.2	3034	None
#2-M3	1250	635	4200	32300	204.5	4195	3742		43.	3582	108.9
#3-M1	1275	623	4280	40600	220.0	4257	50.3	4065	23.0	3489	98.2
#4-M	1300	641	4160	30600	216.2	4142	40.6	3942	23.9	3415	98.6
#5-M	1350	621	4294	31200	212.2	Miss	43.3	Miss	34.3	3665	98.2
#6-G1	1325	625	4266	32900	212.2	4229	28.4	4004	39.7	3582	142.2
#7-G3	1350	622	4287	38600	212.4	4275	27.5	4043	40.3	3611	142.5
#8-M4	1350	612	4356	40400	205.6	4330	29.4	4128	59.7	Miss	140.9
#9-G2	1340	617	4322	39100	216.8	4300	29.2	Miss	47.7	3513	141.9
#10-B1	1340	613	4349	35440	216.7	4318	29.1	Miss	39.1	3576	140.2
#11-B2	1345	615	4335	37800	220.2	4304	28.4	Miss	48.6	3418	141.0
#12-T5	1345	620	4306	35800	213.2		241		44.1		141.5
Series 7025											
#13-V	1340	626	4259	33300	207.4	4266	23.5	4079	48.2	3735	139.7
#14-X	1350	624	4274	31500	216.3	4269	23.6	4075	40.0	3672	140.6
#15-3	1350	624	4274	33100	215.8	4270	29.0	Can't be identified	45.8	Can't be identified	139.1
#16-4	1360	624	4274	36500	212.5	4260	29.2	4072	40.7	Can't be identified	140.0
#17-5	1360	623	4280	39500	211.7	4285	29.5	4122	49.1	3623	140.2
#18-6	1365	617	4322	37400	216.1	4300	30.0	4073	48.6	3512	144.2
#19-7	1370	614	4343	35300	213.3	4316	29.8	4154	49.5	3363	144.4
#20-8	1345	623	4280	33600	213.1	4257	29.8	Lost	50.7	Lost	144.5
#21-9	1345	622	4287	36200	222.7	4269	30.4	4082	71.9	3749	147.8
#22-1	1350	622	4287	30200	221.6	4263	30.3	4129	59.3	3634	148.2
#23-#2	1350	623	4280	32400	220.6	4273	Lost		60.1	3697	148.1
#24-D	1350	614	4342	33000	204.1	4326	29.9	Can't be identified	58.6	4159	148.9

30 M/n Fat 15E1 Cases				Eng. Dr. Cytron	
Penetration				Primer M52A3B1 Elect	
				Base line 32" = 2.666	
				Remarks	
Pt. of Rel	Plate	Plate	Plate	Date	
100	C	C	SB	10-19-82	Series S7 7" Chamber
	C	C	LB	10-20-82	" "
	C	C	LB	10-20-82	" "
	C	C	LB	10-20-82	8" Chamber
	C	C	LB	10-20-82	" "
113	C	C	MB	10-21-82	" "
128	C	C	C	10-21-82	" "
	C	C	C	11-22-82	" "
	C	C	SB	11-23-82	Plate
	C	C	MB	11-23-82	Red to B-Target 500 the direction of arrow was vertical
	C	C	MB	11-23-82	" "
	C	C	SB	11-24-82	" "
					8" Chamber
	C	C	MB	11-30-82	" "
	C	C	SB	11-30-82	" "
	C	C	SB	12-1-82	" "
	C	C	LB	12-1-82	" "
	C	C	MB	12-1-82	" "
	C	C	MB	12-2-82	" "
	C	C	LB	12-2-82	" "
180	C	C	MB	12-2-82	No Good
	C	C	MB	12-3-82	" "
	C	C	LB	12-3-82	" "
180	C	C	C	12-3-82	" "
	C	C	MB	12-6-82	" "

Staballoy Barrel 14.5" x 20" m Smooth vs Triple Target 65° Angle Pwr # 4996													
Rd. No.	Weight, Charge	Reading 1251	Vel.	Copper 1251	Reading 1251	1+2	Reading 425	4+5	Reading 647	6+7	Reading 849	8+9	Vel.
164-70	950	869	3219	12,000	285.0	3209	649	3101	42.9	5832	210.9		
164-71	1100	746	3780	18,100	285.5	3673	654	3531	46.2	8226	210.7		
164-72	1300	667	4193	30600	206.5	4189	495	4084	69.2	3845	195.2		
164-73	1200	709	3945	23100	225.2	3958	50.2	3829	69.2	3558	96.1		
164-74	1225	699	4001	24900	226.3	4005	50.1	3873	57.5	3629	96.2	2753	
164-75	1200	708	3950	24900	226.0	3954	50.1	3838	57.0	3580	99.6		
164-76	1190	711	3934	23500	222.2	3927	50.7	3817	57.1	3417	82.8		
164-77	1000	834	3354	12900	267.7	3277	61.7	3274	71.2	2999	92.7		
164-78	1100	766	3651	18300	236.9	3693	58.8	3606	62.7	3253	81.7		
164-79	1100	755	3705	20200	237.1	3703	59.4	3572	63.7	3295	166.5		
164-80	1090	761	3675	21000	238.0	3665	59.0	3565	62.5	3182	342.0	263	
164-81	1080	771	3628	20900	239.6	3651	59.0	3532	63.4	3266	339.4		
164-82	1085	761	3675	20900	239.9	3657	58.8	3559	62.9	3250	221.0		
164-83	1085	767	3647	18700	238.3	3700	58.7	3570	62.6	3014	208.2		
164-84	1090	760	3686	26400	239.4	3649	58.6	3575	58.2	3361	213.4		
164-85	1075	179	No Reading		231.1	No Reading	58.7	3577	57.4	3237	221.5		
164-86	1100	753	3714		No Reading	Miss	620	3610	57.2	3301	217.3		
164-87	1100	752	3719		229.3	3681	57.6	3571	56.5	3202	278.5		
164-88	1125	740	3780		242.5	3723	57.7	3591	59.2	3165	167.1	1823	
164-89	1090	764	3661		245.2	3668	57.5	3554	59.2	Miss	166.8		
164-90	1080	763	3666		254.2	3623	57.7	3509	57.3	3207	165.2		
164-91	1085	768	3642		266.0	3651	57.6	3519	56.6	3177	165.2		
164-92	1095	775	3609		269.7	3663	57.6	3535	57.6	3171	166.0		
164-93	1110	757	3695		243.3	3705	57.0	3626	58.4	3319	168.2		
164-94	1100	769	3637		256.3	3706	58.6	Miss	59.9	Miss	156.3	2273	

30 M/m Chamber Elect. Primer
30 M/m Fat Case M52A

Base Line = $33 \frac{9}{16} = 2.7969$
Eng. Kinas + Muldoon (Watertown, MA)

Penetration Plate #	Proj. #	Weight + Package	Date	Shot No	Remarks
C	C	SB Proj-976.3 PKG-1550.1	12-13-82	1	
C	C	MB Proj-955.7 PKG-1524.5	12-14-82	2	
C	C	C Proj-955.2 PKG-1523.4	12-16-82	3	
C	C	L.B. Proj-953.0 PKG-1525.7	12-16-82	4	Large Bulge small crack
C	C	C Proj-955.2 PKG-1525.6	12-16-82	5	
C	C	C Proj-953.3 PKG-1530.4	12-16-82	6	
C	C	MB Proj-961.2 PKG-1535.2	12-17-82	7	
C	C	MB Proj-958.7 PKG-1631.2	12-20-82	#8	
C	C	C Proj-959.5 PKG-1535.5	12-21-82	#9	Projectile just pass through, it was removed right behind the plate.
C	C	C Proj-959.0 PKG-1538.9	12-21-82	#10	
C	C	C Proj-958.8 PKG-1538.2	12-22-82	#11	
C	C	L.B. Proj-960.3 PKG-1530.0	12-22-82	#12	Crack appears in the Large bulge
C	C	MB Proj-960.0 PKG-148.0	12-22-82	#13	
C	C	MB Proj-962.0 PKG-1538.0	12-23-82	#14	penetrator is hooked up, had flight penetration
C	C	LB Proj-961.0 PKG-1536.2	12-23-82	#15	
C	C	LB Proj-961.6 PKG-1535.0	12-28-82	#16	Instant velocity wrong reading due to early break in penen.
C	C	C Proj-958.0 PKG-1525.4	12-29-82	#17	New Plates being used for
C	C	C Proj-958.1 PKG-1522.6	1-3-83	#18	No 10 plot - (Rockwell 41°C)
C	C	C Proj-960.0 PKG-1523.0	1-3-83	#19	
C	C	MB Proj-960.0 PKG-1531.7	1-4-83	#20	
C	C	MB Proj-960.0 PKG-1514.5	1-4-83	#21	
C	C	MB Proj-960.5 PKG-1553.5	1-4-83	#22	
C	C	C Proj-955.19 PKG-1545.1	1-5-83	#23	LONGER + HEAVIER SHOT
C	C	C Proj-958.9 PKG-1545.1	1-5-83	#24	just about initiating in the fragment
C	C	C Proj-958.9 PKG-1545.1	1-5-83	#25	

TABALLOY BARREL = 14.8 x 20 M.M. - smooth Triple Target 5.1
 UNDER #4496 2.11. plates 65° inclined

RD NO.	WEIGHT CHARGE	INST. READING	INST. VEL	COPPER REMARKS	TIMER READING 1-2	1-2 VEL.	TIMER READING 4-5	4-5 VEL.	TIMER READING 6-7	6-7 VEL.	TIMER READING 8-9	8-9 VEL.
18-1A	1125	754	3709	19700	240.3	3745	55.7	3645	59.2	Miss	153.8	
18-2A	1100	768	3642	26200	239.8	3688	53.3	3560	53.2	Miss	108.4	
19-1A	1110	763	3666	19500	241.9	3703	54.7	3609	56.0	3349	91.7	1602
19-2A	1105	755	3705	8500	240.8	3671	53.7	3577	44.4	3340	91.1	
20-1A	1100	772	3623	18800	238.3	3652	53.4	3540	53.2	3293	207.6	
20-2A	1100	773	3618	18600	237.5	3638	53.5	3533	53.5	3271	56.0	
21-1A	1100	792	3531	19700	239.0	3610	53.5	3497	67.3	3362	82.8	
21-2A	1090	769	3637	20200	235.0	3635	53.4	3542	67.4	3389	105.4	
22-3A	1085	780	3586	16900	240.0	3677	50.1	3526	59.7	3345	106.4	
22-1A	1095	778	3595	15800	240.4	3628	50.2	3525	62.4	3334	106.7	
22-2A	1090	779	3590	17200	240.8	3629	49.6	3489	61.8	3270	78.7	
23-1A	1090	776	3604	20600	241.8	3639	50.3	3502	56.2	3224	77.9	
23-3A	1095	778	3595	18100	237.3	3634	50.2	3564	64.2	3381	76.8	
23-2A	1100	756	3700	19800	238.2	3667	50.0	3581	67.7	3417	77.1	
24-1B	970	851	3287	13400	258.8	3280	50.0	3185	53.2	2937	78.5	
24-2B	1010	823	3398	16500	259.7	3400	50.1	3273	53.9	3048	79.6	
25-1B	1060	785	3563	17200	246.1	3334	50.2	3472	54.3	3251	79.7	
25-2B	1090	776	3604	19700	225.9	3634	47.3	Miss	46.9	3403	79.8	
26-1B	1060	791	3536	18200	221.1	3521	40.7	Miss	43.9	3162	79.3	
26-2B	1090	779	3590	15800	226.4	3605	45.4	Miss	45.8	3051	79.7	
27-1B	1060	792	3531	15800	225.0	3533	45.8	3397	48.0	3288	77.0	
28-1A	1100	754	3709	19800	225.60	3667	45.3	3557	51.9	3219	77.4	
29-1A	1100	770	3632	18200	222.1	3647	44.5	3459	38.1	CAN'T SEE TARGET	78.1	
30-1B	1100	778	3595	16500	225.1	3631	44.8	3548	41.7	3365	78.2	
31-1A	1100	779	3590	19100	226.0	3635	44.8	3510	42.5	3308	77.4	
32-1A	1100	776	3604	19600	226.1	3625	45.0	CAN'T SEE TARGET	42.1	3515	77.3	
33-2A	1100	790	3540	17400	217.8	3590	41.7	3577	44.2	3313	42.1	
34-1A	1100	776	3604	12900	215.8	3622	35.8	CAN'T SEE TARGET	35.7	3399	42.3	
35-1A	1100	761	3675	23800	217.7	3645	32.1	3521	37.2	3465	42.9	
36-1A	1100	771	3628	18500	220.9	3625	34.1	3521	30.8	3525	44.1	

50 m/m electric primer 52A 5161
30 m/m Fat Case

BASE line = $33^{\circ}16' = 2.7969 \text{ ft.}$

MR. GREENSPAN

PENETRATION			PROJECTILE	DATE	SHOT	REMARKS
1	2	3	WEIGHT			
C	C	C	PROJ. 1031.0 PKG 1621.5	1-6-83	1	GROUP I A
C	C	MB	PROJ. 1033.0 PKG 1614.5	1-6-83	2	GROUP I A
C	C	C	PROJ. 1033.5 PKG 1606.5	1-7-83	3	GROUP I A
C	C	C	PROJ. 1029.0 PKG 1619.5	1-10-83	4	GROUP I A
C	C	C	PROJ. 1018.7 PKG 1606.2	1-11-83	5	Group II A
C	C	C	PROJ. 1021.0 PKG 1606.9	1-11-83	6	Group III A
C	C	C	PROJ. 1031.3 PKG 1632.0	1-11-83	7	GROUP I A
C	C	LB	PROJ. 1032.0 PKG 1624.4	1-11-83	8	Group III A
C	C	MB	PROJ. 1018.0 PKG 1604.5	1-12-83	9	" III A
C	C	C	PROJ. 1032.0 PKG 1618.0	1-12-83	10	" III A
C	C	SB	PROJ. 1014.7 PKG 1590.9	1-12-83	11	" III A
C	C	SB	PROJ. 1032.0 PKG 1619.7	1-12-83	12	" IV A
C	C	C	PROJ. 1031.0 PKG 1616.0	1-13-83	13	" IV A
C	C	C	PROJ. 1028.0 PKG 1611.2	1-13-83	14	" IA
C	C	SCR	PROJ. 1031.0 PKG 1638.2	1-14-83	15	" IB
C	C	SCR	PROJ. 1030.0 PKG 1637.0	1-14-83	16	" IB
C	C	MB	PROJ. 1020.0 PKG 1615.2	1-14-83	#17	" IB
C	C	C	PROJ. 1017.0 PKG 1624.2	1-14-83	#18	" IB
C	C	SB	PROJ. 1022.0 PKG 1617.0	1-19-83	#19	" III B
C	C	SB	PROJ. 1022.5 PKG 1605.6	1-19-83	#20	" III B
C	C	SB	PROJ. 1028.0 PKG 1602.0	1-19-83	#21	" IV B
C	C	C	PROJ. 1026.5 PKG 1608.9	1-19-83	#22	" IA
C	C	SCR	PROJ. 1030.2 PKG 1606.9	1-20-83	#23	
C	C	SB	PROJ. 1027.7 PKG 1613.4	1-20-83	#24	} Greensburg special projectile
C	C	SB	PROJ. 1005.2 PKG 1590.7	1-20-83	#25	
C	C	C	PROJ. 1033.5 PKG 1651.6	1-20-83	#26	" II
C	C	SCR	PROJ. 1031.5 PKG 1644.5	1-21-83	#27	Group II
C	C	C	PROJ. 1032.0 PKG 1647.0	1-21-83	#28	Group IV
C	C	MB	PROJ. 1032.0 PKG 1647.0	1-21-83		

Alloy
Powder
#4996

Barrel = 14.5" x 21
Tungsten 14.5" x 20 m.m. - smooth Triple target = .1" } plates 65' inclined &
.25" }
.5" }

Rel No.	Weight charge	Instr. READING	Instr. VEL	Copper plane	TIMER READING 1-2	1-2 VEL	TIMER READING 4-5	4-5 VEL	TIMER READING 6-7	6-7 VEL	TIMER READING 8-9	8-9 VEL
				ALLOY			3059					
M	1350	652	4290	33100	200.1	4290	20.0	4126	52.8	3435	40.8	
B	1375	648	4316	34200	201.0	4335	26.9	4095	54.4	3395	40.9	
V	1450	623	4489	41200	199.3	4503	31.5	4289	44.8	3917	39.8	
4	1500	611	4578	43900	201.4	4594	31.5	4343	45.2	3802	39.6	
5	1600	584	4789	53000	192.8	4792	30.2	4580	38.9	4229	42.0	
6	1625	579	4831	56200	190.8	4836	31.8	4622	38.3	4525	58.4	
7	1625	576	4856	56200	193.1	4838	30.1	4652	37.2	4392	42.0	
				ALLOY			30	65				
V	1375	646	4330	35000	192.4	4331	22.0	CAN'T BE IDENTIFIED	52.3	CAN'T BE IDENTIFIED	51.5	
1	1375	650	4303	35400	192.6	4308	21.7	3930	52.7	CAN'T BE IDENTIFIED	51.9	
3	1325	667	4193	32000	204.8	4219	miss	Miss	54.0	CAN'T BE IDENTIFIED	52.7	
4	1600	586	4773	54100	189.1	4785	miss	Miss	32.2	CAN'T BE IDENTIFIED	51.1	
Kind of charge:												
	1200 Gr	Lot 693-15-029 WEB \$ T SHOT										
	800 Gr	Lot RAD-E30-015 WEB										
	20 Gr	BLACK POWDER										
#1	2020	567	4933	48500	187.1	4956						
	1260	Lot 693-15-029 WEB										
	820	Lot RAD-E30-015 WEB										
	20	BLACK POWDER										
#2	2100	545	5132	58100	184.7							
	1260	Lot 693-15-029 WEB										
	860	Lot RAD-E30-015 WEB										
	20	BLACK POWDER										
	2100	732		55200	1920							

n/m electric primer
n/m fat base
generation

baseline = 2.7969 ft

projectile and
package weight Date Shot# REMARKS

1	2	3	4	5	6
C	C	SCRACK	PROJ. 997.5 PKG. 1542.5	1-26-83	#1
C	C	SB	PROJ. 1002.2 PKG. 1542.3	1-26-83	#2
C	C	MB	PROJ. 1002.2 PKG. 1549.7	1-27-83	#3
C	C	MB	PROJ. 1002.2 PKG. 1548.2	1-27-83	#4
C	C	LBWC	PROJ. 1001.2 PKG. 1547.2	1-27-83	#5 Large bulge with crack.
C	C	C	PROJ. 1002.5 PKG. 1541.4	1-27-83	#6
C	C	C	PROJ. 1002.0 PKG. 1537.7	1-28-83	#7
C	C	CCR	PROJ. 997.0 PKG. 1531.7	1-28-83	#8 VERY slight matter scratch. ^{penetration} disintegrate
C	C	SCR	PROJ. 993.5 PKG. 1533.9	1-28-83	#9
C	C	CCR	PROJ. 987.1 PKG. 1547.7	1-28-83	#10
C	C	SCR	PROJ. 988.2 PKG. 1561.9	1-31-83	#11

← → PROJ. 1002.0
PKG. 1527.5 1-3-83 #1

← → PROJ. 1002.5
PKG. 1576.0 2-4-83 #2

← → PROJ. 1002.5
PKG. 1554.9 2-4-83 #3

TEST SHOT FOR VELOCITY

WIT change.

#A/ 1250 Gr. Lot 693-15-029 WEB
850 y Lot RAD-E-30-015 WEB
.20 y Black powder

Total: 2120

Instr. TIME	Instr. VEL	Copper pressure	X-RAY TIME	X-RAY VEL.	Date
538	5199	60,300	165.7	5119	2-28-83

#5A 1340 G Lot 693-15-029 WEB 3-1-83
820 G Lot RAD-E-30-015 WEB
20 G black powder

551 5076 52,000 164.6 5076

#5B 1500 Gr. Lot 693-15-029 WEB -1-83
790 Gr. Lot RAD-E-30-015 WEB
20 Gr. black powder

559 5003 165.5 5019

#5C 1200 Gr Lot 693-15-029 WEB 3-1-83
760 Gr Lot RAD-E-30-015 WEB
20 Gr black powder

522 5358 66500 173.3

TEST #01

TEST #40T					EAM	
INST TIME	INSTR VRL	COPPER PRESSURE	XRAY TIME	VRAY JEL		
525	5327	66100	184.6			

Stab Alloy Du. BARREL: 13 ft x 20 M.M - Smooth Triple target .1" } plates 65° incline POWDER # 4996 #0 # WEIGHT change Instr. Instr. READING VELOCITY COPPER PRIMING TIMER 1-2 1-2 VEL TIMER 4-5 4-5 VEL TIMER 6-7 6-7 VEL TIME 8-9 8-9 VEL													
#1	1050	Lost	Lost	14700	237.7	Lost	53.5	3190	50.5	3095	106.3		
#2	1010	860	3252	11300	243.4	3285	52.9	3190	50.3	2917	70.1	1920	
#3	1025	851	3287	13700	245.7	3315	55.0	3199	48.6	2952	69.5		
#4	975	884	3164	12200	284.5	3208	58.5	3129	59.1	Lost	71.9		
#5	990	863	3241	13900	276.6	3234	53.7	3165	54.2	2954	72.1		
#6	980	880	3178	13000	270.2	3226	52.3	3121	46.8	2836	70.4		
#7	985	876	3193	12300	271.9	3244	49.5	3120	50.0	Lost	70.9	1421	
#8	980	878	3186	12500	272.5	3232	49.3	Lost	51.1	2799	70.2		
#9	975	888	3150	11900	269.2	3195	49.0	3087	47.9	2780	68.7		
#10	978	862	3245	13200	269.9	3228	49.1	3121	50.4	2896	68.9		
#11	970	888	3186	12300	271.1	3203	49.0	3117	50.4	2751	69.2		
#12	970	Miss	Miss	13100	255.1	3198	48.0	3078	48.5	2926	70.7		
#13	975	Miss	Miss	12400	262.2	3210	48.3	3069	51.8	2852	71.5		
#14	1040	830	3370	13100	255.7	3390	56.7	3281	54.6	2883	72.1		
#15	985	866	3230	11800	254.9	3271	55.9	3163	53.9	2934	72.1		
#16	970	867	3226	13100	255.0	3199	55.9	3147	54.6	2527	72.2		
#17	990	859	3256	11400	228.8	3218	15.5	3186	35.8	2879	72.2		
#18	975	887	3153	16500	244.2	3157	26.2	3112	37.5	2963	70.9		
#19	970	875	3196	13600	248.2	3215	47.1	3081	51.8	2808	72.5		
#20	980	865	3233	9100	256.7	3254	51.4	3132	51.8	2847	72.9		
#21	990	856	3267	9100	256.0	3283	48.5	3171	49.9	2892	72.9		
#22	1010	848	3298	13000	249.0	3341	49.9	3230	55.7	3001	72.5		
#23	1025	Lost	Lost	13200	257.6	3393	51.1	3255	55.0	2849	71.1		
#24	1050	814	3436	16800	258.5	3462	52.2	3340	55.7	3098	71.2		
#25	1060	793	3527	17200	257.4	3500	52.3	3384	55.3	3144	71.6	2374	
#26	1050	823	3398	12100	256.8	3435	52.1	3314	55.8	3095	71.6		
#27	1025	843	3318	12200	246.3	3383	51.4	3255	55.4	2998	73.1		
#28	1055	824	3394	15100	246.6	3438	53.4	3317	55.1	3077	73.1		
#29	1060	825	3390	12400	261.1	3460	53.3	3343	60.5	3061	82.1		
#30	1075	814	3436		245.1	3505	52.7	3399	75.0	3104	74.9		

30 m/s static pressure

30 m/s flat case

PENETRATION

Machine 2.7969'

Zabinski (repaired metric system.)

Zebietzky

DATE	1	2	3	PROJECTILE WGT.	DATE	SHOT #	REMARK
C	C	C	488.5	1582.7	24 March 83	#1	
C	C	C	488.5	1579.2	24 March 83	#2	
C	C	C	488.5	1558.5	24 March 83	#3	
C	C	SB	488.5	1569.0	7 March 83	#4	
C	C	C	488.5	1579.0	7 March 83	#5	
C	C	MB	488.5	1580.5	8 March 83	#6	
C	C	C	488.5	1570.7	8 March 83	#7	
C	C	C	488.5	1572.9	8 March 83	#8	
C	C	SB	488.5	1576.4	9 March 83	#9	
C	C	C	488.5	1574.7	9 March 83	#10	
C	C	MB	488.5	1574.4	9 March 83	#11	FIRE
C	C	SB	488.5	1566.5	25 March 83	#12	
C	C	SB	488.5	1576.0	25 March 83	#13	
C	C	C	488.5	1573.5	28 March 83	#14	
C	C	LB	488.5	1561.5	28 March 83	#15	
C	C	SCRATCH	488.5	1613.0	28 March 83	#16	
C	C	SB	488.5	1625.0	28 March 83	#17	
C	C	C	488.5	1617.2	28 March 83	#18	
C	C	C	488.5	1007.5	29 March 83	#19	
C	C	SB	488.5	1692.5	6 Apr. 83	#20	
C	C	MB	488.5	1574.0	6 Apr 83	#21	
C	C	MB	488.5	1567.5	6 Apr 83	#22	
C	C	MB	488.5	1572.4	6 Apr 83	#23	
C	C	LB	488.5	1573.0	6 Apr 83	#24	
C	C	LB	488.5	1560.2	7 APR 83	#25	
C	C	LB	488.5	1566.2	7 APR 83	#26	
C	C	LB W/CRACK	488.5	1566.4	7 Apr 83	#27	
C	C	C	488.5	1574.2	7 Apr 83	#28	
C	C	LB	488.5	1585.5	7 Apr 83	#29	
C	C	MB	488.5	1585.0	8 Apr, 83	#30	
C	C	MB	488.5	1582.8	8 Apr, 83	#31	
C	C	MB	488.5	1582.7	8 Apr, 83	#32	
C	C	MB	488.5	1575.7	8 Apr, 83	#33	
C	C	C	488.5	1575.7	8 Apr, 83	#34	

Staballoy
powder # 4996

BARREL = 13 qt x 20 m. m - smooth barrel, Triple length

.1
.25
.50 } plates
65 ft/sec

RD#	WT CHARGE	Inst. READING	Inst. VEL	COPPER RANGE	TIMER 1-2	J-2 VEL	TIMER 4-5	VEL 24-5	TIMER 6-7	VEL 6-7	TIMER 8-9	VEL 8-9
#7	1340	685	4083	29300	198.6	4105	44.1	3989	35.9	3041	64.7	—
#8	1040	832	3362	—	260	3379	52.6	3259	77.5	3041	89.5	2036
#9	1040	lost	—	—	260	3379	52.2	3204	56.7	3109	89.9	—
#3	1350	684	4089	28000	200.3	4094	42.8	3962	53.9	3806	54.1	—
#4	1360	681	4101	35700	201.5	4126	40.2	4032	50.5	3858	54.3	—
#5	1200	747	3744	18900	210.9	3768	46.7	3629	50.7	3407	54.8	—
#2	1400	683	4095	31800	201.4	4108	40.6	3991	49.5	3748	54.0	—
#1	1420	660	4238	34000	199.2	4226	39.6	4133	51.0	3932	54.2	3399
#6	1100	807	3466	23500	204.9	3991	52.5	3388	53.1	3176	80.5	—

THE BELOW TESTING SHOTS ARE Tungsten Alloy.

30 m/min electric pressure
30 m/min penetration

location: 27401, L.R. Alhamed, ME

PLATE	1	2	3	Projectile Diameter	wt.	Date	Shot #	REMARKS
C	C	C	997.0 1592.5	6-6-83	#1	Residue projectile wt.		
C	C	C	1007.0 1631.0	6-6-83	#2	Residue		
C	C	SB	1005.0 1631.0	6-6-83	#3	meter-clamp request		
C	C	MB	1010.00 1631.2	6-8-83	#4	After 1 st disint.		
C	C	C	1001.0 1628.7	6-8-83	#5	After 2 nd disint. half up > 1/2 proj.		
C	C	Scratch	998.5 1631.0	6-8-83	#6	disintg. < 1/2 proj.		
C	C	C	1005.0 1631.0	6-9-83	#7			
C	C	C	1007.0 1631.7	6-9-83	#8			
C	C	MB	1000.0 1642.7	6-9-83	#9			

POWDER 4996 (Tungsten)

Rd#	wt charge	Instr. READING	Instr. VEL	COPPER PRES.	TIMER 1-2	F2 VEL	TIMER 4-5 VEL	VEL 4-5	TIMER 6-7	VEL 6-7	TIMER 8-9	VEL 8-9
43	1275	699	4001	26800	203	3975	40.0	3841	50.9	3528	86.6	—
44	1200	747	3744	20500	220.7	3780	49.2	3637	58.4	3400	87.0	—
71	1100	795	3518		320.2	3528	57.5	3429	Lost	Lost	69.6	—
72	1150	74	3614		229.7	3655	51.3	3488	57.1	3308	69.7	—
73	1175	752	3719		232.3	3734	49.9	3472	55.6	3289	70.3	—
74	1225	413	205		235.1	Lost	53.0	3722	55.6	3457	70.3	—

50000. electric pressure
100000. Fat Gas #

baseline - 27969 . Dr. AHMAD (MIKE)

1	2	3	projectile. package wt	DATE	SHOT #	REMARK.
C	C	C	965 1538.5	7-25-83	#1	50.9
C	C	C	985 1538.5	7-25-83	#2	
C	C	MB	901.0 1579.5	7-26-83	#3	
C	C	MB	1002.0 1598.0	7-26-83	#4	
C	C	MB	991.5 1554.0	7-26-83	#5	
C	C	LBWC	998.0 1572.0	7-26-83	#6	

BARREL: 13 ft x 20. in. - smooth BARREL - Single Target										
WT charge										
Rd #	6915019WEB	PAPE-20115-WRE	Black powder	Inst. READING	Inst. Velocity	COPPER pressure	TIME 1-2	VELOCITY 1-2	TIME 6-7	
115	1340	820	20	567	5188	61200	163.2	5154	23.1	
12	1330	800	20	592	4966	Lost	2084.4	205	198.8	
13	1330	770	20	579	5077	52000	172.4	5062	218.6	
14	1330	750	20	505	—	48500	156.5	5006	21.3	
15	1200	690	20	660	4455	31100	167.0	4435	211.7	
16	1270	710	20	606	4836	23900	172.0	4804	218.5	
17	1260	700	20	622	4727	39390	177.2	4727	219.2	
18	1200	690	20	638	4608	30100	184.3	4589	169.2	
19	1190	660	20	644	4565	21300	185.9	4542	168.0	
20	1100	580	20	696	4210	23100	193.0	4210	167.5	
21	1260	690	20	620	4726	36800	Loss	Loss	170.1	
22	1330	750	20	591	4958	32600	161.0	4963	164.7	
23	1330	780	20	Loss	Loss	31300	161.7	5038	165.5	
24	1350	800	20	574	5105	24315	166.3	—	166.3	
25	1360	800	20	591	4958	51100	159.4	4909	167.2	
26	1380	820	20	562	5214	55500	151.2	3206	167.6	
27	1200	690	20	641	4571	53500	182.6	4577	130.2	
28	1110	590	20	704	4162	21000	182.2	4168	151.3	
29	1340	820	20	569	5149	53600	156.0	5148	149.0	
30	1340	790	20	581	5043	51000	167.8	5038	147.6	
#5	1340	780	20	583	5026	50800	141.4	5023	163.4	
#6	1320	720	20	604	4851	21000	159.0	4836	143.1	
#7	1340	740	20	597	4908		157.2	4908	144.2	
31	1320	720	20	599	4891		166.5	4895	—	
#32	1300	720	20	603	4859		162.2	4854	107.6	
#33	1200	690	20	636	4607		171.0	467	108.5	
#34	1180	650	20	652	4494		171.9	4488	109.4	
435	1200	690	20	648	4522		176.0	4532	107.1	
26	1150	670	20	697	4201		179.0	4208	108.2	

of the ...

... 13

ARAP

2811

of the ...

WT -

1116

1000 ... 1000 ... 1000 ...

...

...	C	1005	1578.0	8-16-83	1) ...
...	C	1005	1561.7	8-16-83	2) ...
...	C	1004.0	1576.7	8-23-83	3) ...
...	C	1004.0	1573.0	8-23-83	4) ARAP Target.
...	S.B	1005.0	1567.4	8-23-83	5) ARM. t. plate (2")
...	CPALch	1003.5	1571.5	8-24-83	6) projectile went down ARM. t. plate
...	C	1005.0	1570.5	8-24-83	7) ARAP Target.
707	C	1005.7	1570.2	8-24-83	8) " "
783	C	1003	1571.7	8-25-83	9) " "
...	C	1004.0	1572.0	8-25-83	10) " "
...	N.B	1003.5	1574.0	8-25-83	11) " "
...	S.B	1003.7	1574.7	8-26-83	12) " "
...	M.B	1005.0	1580.0	8-26-83	13) " "
...	S.B	1004.0	1569.7	8-26-83	14) High Impact ARCA on target
...	S.B	1004.0	1560.0	8-26-83	15) Case Chase - blow off
...	S.B	1004.0	1560.0	8-28-83	16)
2824	C	1004.0	1575.5	8-30-83	17)
...	C	1004.0	1574.2	8-30-83	18) partial completion
...	PC	1004.0	1576.0	8-30-83	19) to just light through (ballistic limit)
624	C	1005.0	1569.5	8-31-83	20)
1195	C	1005.5	1574.0	8-31-83	21) All projectiles ARM. plate
...	S.B	1008.0	1571.0	9-1-83	22)
757	C	1007.5	1568.0	9-1-83	23)
...	N.B	1003.2	1565.4	11-28-83	24) Tungsten, ARM. plate
...	S.B			12-1-83	25) Arpd. 3 delay in 6.5 mil
...	C			12-1-83	26) projectile started go through
2121	C			12-1-83	27) the cover plate.
...	C			12-2-83	28)
...	C			12-2-83	29)

50. Caliber Long Pool. Wyluda Paul Wyluda

Type Read	Test Reading	Inst. Val.	Pressure	X-Ray Time	X-Ray Vel.	Date
4-A	824	3556	4024	207.6		9-2-8
4-A	837	3501	37320	207.7		9-8-8
2-	1001	2927	37600	205.5		9-2-8
2-A	877	3341	37440	258.7		9-2-8
3	830	3530	38360	252.6		9-6-8
1A	846	3463	42120	251.1		9-6-8
3	829	3534	35480	250.0		9-6-8
1B	808	3626	39320	249.7		9-6-8
5	1096	2673	49240	223.0		9-6-8
5A	1053	2783	47640	222.6		9-6-8
1B	775	3910	N/A	—	—	9-9-8
2B	790	3709	57040	206.3		9-9-8
1X	1159	2528	49480	191.4		9-12-8
2X	1185	2473	28800	219.9		9-12-8
3X	1142	2566	52440	233.9		9-12-8
4X	1071	2736	54000	253.1		9-12-8
5X	1139	2528	54160	203.3		9-13-8
6X	1099	2666	21400			
P2	1585	1848	19280	190.3		10-17-8
P1	1352	2167	31360	206.4		10-18-8
P3	1768	1657	Loss	332.7		
P4	1966	1490	Loss	333.4		
P5	6427	456	21440			
P7	1766	1159	2240	161.4		11-19-8
P8	934	3137	28080	192.7		
P9	493	3909	30960			

52 Colton
-RA/ TIME

Baseline - 293

REMARKS

Sabit fragment block thermal litter's holes.

second bush ^{power} paper is not punctured circuit block off. scope switch is off ^{electronically}.

new baseline 2348 (1927)

stabilloy
powder 4996 wt change BARREL = 13' X 20 m.m - smooth BARREL single target
A.R.R.B.P. In ch. In ch. (GREEN) In ch. vel. m/s

A.R.RAP

ID#	WEB	RAD-E30-015-WEB	Black powder	Instr.	Instr.	COPPER	TIME	VELOCITY	TIMER
				READING	VEL	PRES.	1-2	1-2	6-7
30	1360	740	20	585	5009	3022	161.9	5012	109.1
31	1200	690	20	639	4585		174.7	4588	109.3
32	1200	690	20	642	4567		181.2	4571	109.7
33	1340	790	20	577	5078		157.3	5101	102.2
34	1400	830	20	561	5223		157.0	—	102.7

mm. etched primer

mm. base chamber size - 10"

baseline - 2.93'

L 6-7. penetration projectile package		DATE	REMARK.
—	L.B.	12-2-83	#30 DU.
—	L.B.	12-7-83	#31 prepared V.C. 4589
393	C	12-7-83	#32 5038
—	MB	12-8-83	#33 5038 disappeared
—	—	12-8-83	#34 projectile is gone in the film

9106

stainless
powder #4996

BARREL 13 ft x 20 M.M. Smooth triple target
guanspan. D.4.

1.5" } pl
5" } 6

Ad#	wt charge	Instr. READING	Instr. VEL	Cu. pressure	READING TIMERS	1-2 VEL	READING 4-5	VEL 4-5	READING 6-7	VEL 6-7	READING 8-9	VEL 8-9
769- 16	1095	810	3284	12400	237.6	3323	—	—	—	—	—	—
769- 11	1095	800	3325	11400	232.1	3355	53.7	3248	51.4	—	—	—
758- 2	1130	788	3375	9700	218.8	3396	45.2	3283	55.7	3154	105.2	—
766- 6	1130	789	3371	12400	206.8	3406	35.9	3325	45.4	3241	81.1	26
760- 7	1170	766	3473	14900	218.5	3513	14.0	3401	37.0	3254	81.8	21
758- 7	1140	906	2936	9000	217.2	2960	27.7	2807	38.1	2696	82.8	—
766- 7	1170	860	3093	9500	216.4	3145	38.9	3075	38.7	2959	86.2	—
766- 7	1250	722	3684	18500	215.9	3712	39.1	3619	38.4	3519	83.3	—
763- 2	1185	755	3523	11200	215.7	3553	39.1	3435	39.2	3381	82.1	—
754- 2	1185	763	3486	11200	211.6	3519	33.1	3410	39.3	3228	65.1	9
757- 7	1170	717	3710	11200	212.0	3739	33.3	3692	39.1	3552	65.4	22
761- 4	1160	773	3441	11200	212.3	3468	31.3	3346	38.0	3287	61.4	14
758- 4	1160	762	3491	11200	211.6	3511	31.7	3455	39.0	3341	88.4	—
758- 5	1160	762	3491	11200	213.2	3517	30.8	3487	37.3	3279	86.8	—
765- 8	1140	788	3395	11200	211.5	3395	29.6	3349	40.9	3091	87.8	—
765- 8	1150	772	3465	11200	210.9	3467	29.9	3325	41.5	3220	89.1	—
758- 4	1030	845	3166	11200	210.7	3160	20.2	3060	35.5	2915	89.0	15
764- 5	980	875	3057	11200	210.3	3056	30.2	2967	42.8	2795	88.9	—
764- 5	1000	862	3103	11200	210.0	3105	30.3	3091	41.7	2713	90.1	—
760- 3	1100	779	3434	11200	209.6	3436	30.1	3314	42.9	3112	90.2	7

electric primer
4. flat case

baseline 2.675

penetration	projectile packaging	WT	DATE	REMARK
C SB	1020.5 1583.2	12-13-83 #1	4/D=20	
C SB	1018.5 1578.5	12-13-83 #2	4/D=15.5	
C C	1025.0 1642.0	12-14-83 #3	4/D=15 / > 2500	
C C	1015.0 1590.0	12-14-83 #4	4/D=20	
C C	1023.5 1579.5	12-15-83 #5	4/D=15 / 3/4" third plate	
C NB	1001.0 1590.0	12-15-83 #6	4/D=20 v.l. is low relative to powder charge	
C SB	1022.0 1588.0	12-15-83 #7	4/D=20 change	
C C	1020.0 1599.2	12-15-83 #8	4/D=20 > 3000	
C SB	1021.2 1598.2	12-15-83 #9	4/D=20	
C C	1022.0 1601.2	12-15-83 #10	4/D=20	
C C	1001.0 1581.0	12-15-83 #11	4/D=20 x	
C C	1021.0 1590.0	12-16-83 #12	" "	
C NB	1020.5 1617.7	12-16-83 #13	4/D=30 projectile Break Apart	
C match	1022.0 1610.0	12-17-83 #14	any powder velocity 3400 4/D=25	
C SCR.	1023.5 1614.7	12-17-83 #15	tail plate 4/D=20	
C SCR.		12-17-83 #16	1/2 deep but inner hole 4/D=20	
C C		12-17-83 #17	1/2" plate 4/D=20	
C SC		12-17-83 #18	1/2" " 4/D=20	
C SC		12-17-83 #19	1/2 plate 4/D=30 2 IMPACT AT 4000 in 1/2" the charge (11)	
C C		12-17-83 #20	1/2 plate " "	
			1/2 " "	
			1/2 " "	
				3406
				3595
				3323
				3160
				3145
				3156
				2964

Shotology POWDER # 4996 Dr. Zichilsky 20mm. x 118t. triple target .1" .25" ARMOR plate 65°													
Rd #	Charge	Inst. READY	Inst. VELOCITY	Cu. PRESS.	READING TIME 1-2	1-2 VEL	READING 4-5	4-5 VEL	READING 6-7	6-7 VEL	READING 8-9	8-9 VEL	
B1-6-3 #1	1070	809	3362	N.A.	228.8	3394	25.8	Loss	39.2	2798	92.6		
A1-7-1 #1	1080	813	3246		228.8	3349	26.3	3308	31.5	2975	91.2	Loss	
A1-7-1 #2	1060	820	3317		228.3	3311	25.7	3166	31.0	2811	95.6	Loss	
A1-7-1 #3	1040	827	3289		230.4	3290	0.80	3132	33.7	2867	78.5	Loss	
A1-7-1 #4	1020	849	3204		239.8	3184	1.0	3045	36.1	2774	79.9	Loss	
A1-7-1 #5	1000	854	3185		246.9	3184		Loss	35.2	2749	80.2		
B1-6-3 #2	1020	838	3246	9900	265.3	3260	49.8	3166	54.7	2886	171.9	538	
B1-6-3 #3	1000	844	3223	8700	263.1	3223	51.2	3121	59.7	2768	151.7	1943	
B1-6-3 #4	980	888	3060		282.0	3061			59.0	2659	153.5		
B1-6-3 #5	980	834	3261	8700	280.5	3155			(51.5)	2566	156.2		
A1-7-1 #6	1010	847	3211	9900	280.2	3187	51.0	3114	57.8	2767	155.3		
A1-7-1 #7	1050	812	3333	8700	280.2	3323	51.0	3216	59.4	2969	155.6	1555	
A1-7-1 #8	1025	838	3246	8700	283.3	3228			55.5	2803	155.7	954	
A1-7-1 #9	1015	833	3265		280.3	3224	56.8	3130	57.3	2823	155.6		
A1-7-1 #10	1020	820	3317		279.1	3227	57.1	3141	57.1	2901	155.4		
B1-2-4 #1	1030	814	3342		278.7	3256	57.2	3160	58.8	2899	144.9	1530	
B1-2-4 #2	1000	856	3178		286.8	3168	60.6	3067	55.1	2694	153.5		
B1-2-4 #3	1015	841	3244		281.6	3217	60.2	3141	56.3	2827	152.2		
B1-2-4 #4	1020	809	3362		279.9	3313	59.9	3219	51.9	2960	154.8	2166	
B1-2-4 #5	1020	839	3242		280.2	3244	59.9	3144	51.5	2836	151.8	1627	
B1-2-4 #6	1025	840	3238		288.0	3227	59.3	3138	52.7	2788	149.5		
B2-1-2 #1	1035	816	3333		284.1	3300	60.0	3196	51.7	2869	150.8	1689	
B1-1-4 #1	1020	823	3305		282.1	3294	60.0	3191	49.9	2892	151.0		
B1-1-4 #2	1030	811	3353		282.2	3269	59.9	3163	52.2	2893	151.6		
B1-1-3 #1	1033	808	3366		281.6	3285	59.9	3204	52.6	2932	151.2	1926	
B1-1-3 #2	1100	819	3321		240.3	3324	36.2	3226	47.7	2958	62.3		
B2-1-2 #3	1200	743	3661		238.8	3650	38.7	3526	37.0	3326	51.2	1210	
B2-2-2 #1	1150	759	3584		240.9	3584	38.3	3512	42.5	3227	65.3	1062	
B2-2-2 #2	1100	803	3387		240.3	3372	38.6	3306	42.1	3045	65.3	51	
B2-2-2 #3	1070	799	3426		238.8	3342	38.5	3259	41.1	2960	65.9		

Baseline: ~~2675~~ '2.72'

initiation	projectile package wt.	date	REMARK.
C LB	1005.5 1367.0	8-21-84 #1	SMOKE Bomb Test accompany w/ Test
C C	1005.0 1569.0	9-17-84 #2	1/2 1/2" plate
C C	1005.0 1566.0	" #3	1/2"
C C	1006.5 1567.2	" #4	1/2"
C C	1008.2 1568.7	9-18-84 #5	1/2"
C MB	1007.2 1567.2	9-18-84 #6	1/2" new 1/2" plate
C C	997.0 1550.0	9-26-84 #7	1/2"
C C	1005.0 1569.7	9-26-84 #8	1/2"
C C MB	1008.0 1543.0	9-26-84 #9	1/2"
C C LB	1006.0 1569.7	9-26-84 #10	1/2"
C MB	1005.0 1565.9	9-27-84 #11	"
C C C	1006.0 1567.5	9-27-84 #12	"
C C C	1005.1 1565.7	9-27-84 #13	"
C C MB	1005.5 1569.0	9-27-84 #14	"
C C LB	1003.7 1559.9	9-27-84 #15	" 135/1903
C C C		9-28-84 #16	" B1-2-3 #1
C C MB		9-28-84 #17	"
C C MB		9-28-84 #18	"
C C C		9-28-84 #19	B1-2-4 #1
C C C		9-28-84 #20	
C C LB		9-28-84 #21	B2-1-2 #1
C C C		9-28-84 #22	
C C LB		9-29-84 #23	
C C LB		9-30-84 #24	
C C C		9-30-84 #25	
C C MB		10-4-84 #26	3/4" 3/4" deep on 3rd plate
C C C		10-5-84 #27	"
C C C		10-12-84 #28	"
C C C		10-12-84 #29	pieces of armor plate hanging inside the hole
C C LB		10-12-84 #30	4 A1-3 #6

Stainless powder 4946 69315029WEB, RAD-G30-015-WEB Rd# WT CHARGE Instr. READY VEL. CH. PRES. TIMER 1-2 VEL 1-2 TIMER 4-5 VEL 4-5 TIMER 6-7 VEL 6-7 TIMER 8-9 VEL 8-9												.1" / 25" / 3/4"
773-2	1150	764	3560	3	231.6	3532	18.8	3430	36.1	3286	746	136
773-2#1	1340	541	5028	45300	152	4939	2.5	4912	17.4	4744	551	36
	780											
773-2#2	1030	843	3226		223.9	3189	27.7	3102	30.3	2813	85.4	
772-2#1	1340	660	4121	51300	159.2				25.2		55.2	
	790											
776-2#1	1130	4121		13300								
776-2#2	1130	618	4401		24.3	LOSS	18.5	3424	35.1	3118	85.0	
776-2#3	1340	393	6921	46200	161.1	1365	8.8	4873	22.5	4725	70.2	2421
#1	790											
776-2#4	1150	766	3550	14300	246.1	3529	19.1	3512	32.5	3412	83.8	
776-2#2												
777-2	1350	632	4303	51200	156.6		14.0		24.3		54.0	
#1	790											
777-2#2	1350	547	4972	39600	163.0	4961	0.6	4687	23.4	4687	0.6	4436
	790											
773-2	1370	595	4571	54000	150.2		15.3		23.7			
	790											
776-2	1140	792	3434	16300	162.7	3380	15.08	3356	24.5	3026	36.5	
774-2	1370	580	4690	53100	162.7		16.0		23.3			
	790											
777-4	1150	758	3588	13700	246.6	3503	23.7	3452	36.8	3269	80.8	
777-4	1150	760	3579	15300	247.5	3541	23.6	3493	37.5	3367	81.6	1040
772-4	1170	778	3496	17500	251.4	3454	23.9	3349	36.6	3204	85.9	
772-1	1165	767	3546	8700	252.0	3500	23.7	LOSS	44.0	LOSS	84.3	143
773-2	1350	678	4012	22500	211.9	3960	21.1	3852	22.4	3695	77.4	3112
772-4	1350	674	4035	21600	210.8	3977	23.2	104	23.2	3716	74.8	
772-1	1160	742	3665	8700	244.6	3620	15.7	3519	39.4	3390	79.9	2515
774-4	1290	750	3627	190,000	242.7	3581	18.3	3561	35.3	3415	76.3	2628

50

penetration

JAY GREENSPAN 2.72' = BASELINE

			PROJECTILE PACKAGE	DATE	REMARK	
C	C	C	1022.0 1593.2	9-18-84	#3 1/4" 1" Greenrain	15:1 D
C	C	C	1022.0 1594.0 1025.0 1598.0	9-18	#2 3/4"	15:1 D
C	C	NB		9-18	#3 3/4"	15:1 D
C	C	NB	1026.0 1614.5	9-18	#4 3/4" Penetrator & Broke up	
				20:1	#5 1/4" ALL X-RAY MISSED	A
			1021.0 1599.0			A
C	C	NB		9-19	#5 1/4"	20:1
C	C	C	1024.0 1605.5	9-19	#6	20:1 ✓ A
C	C	C	1022.5 1612.5	9-19	#7 penetrator Tumble, hit A	
					the plate side way. 20:1	
C	C	NB	1617.5 1017.07	9-20	#8	20:1 A
C	C	C	1025.0126-5 = 1024.5 1607.2128-0	9-20	#9 Greenspan has hit all A	
					the X-ray from shot 1-9	
C	NB	NB	1024.0 1594.5	9-20	#10 penetrator disintegrate, # Du.	
					fragment found inside the Test Range	
C	C	MB	1294.0 1279.5	9-20	#11	30:1 ✓ B
C	C	NB	1021.0 1580.5	9-20	#12	30:1 ✓ B
					penetration shatter	
C	C	LB	1025.5 1612.5	9-21	#13 (20:1) A	✓
C	C	C	1024.0 1616.5	9-21	#14 (20:1)	A group ✓
C	C	MB	1025.0 1588.0	9-22	#15 (30:1)	B group ✓
C	C	C	1025.0 1615.5	9-22	#16 (20:1)	A ✓
C	C	C	1025.0 1600.7	9-22	#17	A 20:1 ✓
C	C	MB	1021.0 1594.5	9-23	#18	15:1 D ✓
C	C	C	1025.0 1607.0	9-23	#19	30:1 B ✓
C	C	C	1021.0 1457.2	9-23	#20	30:1 BB ✓

shidley powder 4996

Rd #	CHARGE	Inst. Ready	Inst. VEL	C.U. Pressure	TIMER 1-2	VEL 1-2	TIMER 4-5	VEL 4-5	TIMER 6-7	VEL 6-7	TIMER 8-9	VEL 8-9
#1	1180	760	3579	11100	248.1	3552	24.6	3410	39.0	3144	86.3	
#2	1180			12200	241.1	3624	38.1	3522	39.8	3227	86.4	
#3	1300	680	4000	11000	231.7	3907	50.8	3812	40.3	3613	86.5	66
#4	1400	656	4146	11300	218.1	4121	42.6	4021	37.9	3772	86.7	AA
#5	1380	668	4072		210.0	4069	29.4	3944	29.2	3720	80.6	
#6	1395	668	4096		214.5	4080	34.0	3855	35.3	3802	110.5	1406
#7	1385	666	4084									
#8	1380	668	4072		209.7	4061	32.1		32.1	3758	111.4	921
#9	1380	655	4153		209.1	4069	34.2	3977	34.0	3894	111.6	
#10	1385	657	4140		218.7	4066	34.1	4009	36.7	3802	111.9	2567
#11	1370	664	4096		206.3	4025	37.7	3951	31.3	3761	152.0	2384
#12	1250	713	3814		220.3	3766	35.0	3683	30.6	3503	65.3	

Baseline 2.72'

Joe Cox (Ahmad)

PENETRATION			PROJECTILE PACKAGE WT.	DATE	REMARK	PROJECTILE BREAKUP
C	C	NB	992.0	9-24-84	U-Ti	PURE D.U. 10:1
C	C	SB	548.9	9-24-84	U-Ti	" " "
C	C	MB	1520.4	9-24-84	"	" " "
C	C	C	993.7	9-24-84	"	" " "
C	C	C	998.5	9-24-84	"	" " "
C	C	LB	1560.5	9-25-84	U-Ti/W10	10:1
C	C	C		9-25-84	"	" " "
C	C	C		9-25-84 #7	"	" " "
C	C	C		9-25-84	"	" " "
C	C	LB		9-26-84	(U-Ti/W10)	20:1
C	C	C		9-26-84	"	" " "
C	C	C		9-26-84	(U-Ti)	20:1 (PURE D.U.)
C	C	C		9-26-84	"	" " "

powder # 4996

Tungsten

137K 20MM - smooth

Rd #	wt charge	instr reading	instr. vel.	cupper pressure	timer reading 1-2	1-2 velocity	timer 8-9	8-9 velocity
#1	1420							
#2	1425							
#3	1565	678	4351	38400	209.6	4366		
#4	1610	656	4447	39100	166.6	4490		
#5	1600	652	4525	35600	168.8	4494		
#6	1590	656	4547	33800	173.3	4497		
#7	1575	664	4443	35000	176.0	4450		
#8	1575	684	4313	11300	175.2	4409		
#9	1580	676	4364	32300	175.9	4418	103.8	
#10	1590	680	4338	37000	172.8	4484	104.2	
#11	1585	737	4002	20600	193.7			
#12	1565	667	4423	32800	194.5	4404		
#13	1560	730	4441		194.1	4414		
#14	1555	664	4443	21900	194.4	4423		
#15	1550	661	4463	33500	193.3	4401		
#16	1550	673	4401	32600	195.2	4357		
#17	1550	671	4383	28000	188.8	4396		
#18	1375	579	5095	50000	195.0	5110		
#19	1375	577	5113	36700	166.6	5078		
#20	1375	575	5130	42000	168.6	5104		
#21	1360	790	582	5069	48600	167.0	5029	
#22	1320	750	605	4276		170.0	4866	

baseline = 2.95

1 grain = 0.0648 gram

penetration	grain projectile wt & package wt	Date	REMARKS.
		10-10-85	
LB	65.1318 102.932	10-10-85	#1 1st. vel: 4450. 3" plate (ARMOR)
C	65.351 102.682	"	" : " 3" plate (ARMOR) <i>fiducial</i>
LB	65.156 101.069	"	" : " 3 1/4" " " <i>has been adjusted</i>
C	65.254 101.313	10-11-85	#4 2" 3"
C	65.225 103.112	"	#5 3"
C	65.654 102.767	"	#6 2.55 2"
C	64.764 102.082	"	#6558 1/2 x-ray film is exposed
SB	65.308 101.563	"	#8 65-59
C	65.186 101.988	10-15-85	Armor 1.8"
M.B.	65.081 103.191	10-15-85	ARMOR plate 1.8" (60°) vel. loss
M.B.	65.102 102.549	"	" 2" S
C	65.298 102.067	"	#12 Q561
BC	65.112 102.415	"	#13 Q562
SB	65.104 102.55	"	#14 Q563
M.B.	65.338 102.421	10-17-85	#15 1.8" armor
C	65.331 103.502	"	#16 2.15 1" (4.7-5.510)
C	65.184 102.643	"	#17 1" ARMOR (R.F.)
C	65.172 102.517	"	#18 Q560
SB	65.100 102.054	10-18-85	#19 Q564
LB w/brick		10-18-85	#120 2" RHA 1st. vel 4800 ft/s.

Tungsten (40=133)

Smooth BRL.
20mm. x 11"

Single target 60'

Rd #	019 WEB	015 WEB	BL P. WEB	Inst. READING	Inst. VELOCITY	PRESSURE (PSI)	TIME (s)
1	1350	776	20	581	5077	52100	105.5
2	1330	750	20	591	4991	50,000	155.0
3	1320	750	20	609	4844	47,100	155.0
4	1280	700	20	625	4720	/	166.0
5	1276	700	20	652	4525	37400	169.1
6	1220	660	20	645	4574		169
7	powder 4996			741	3981	22500	195
8	1435			741	3981	22500	195
9	1270	700	20	639	4617	39700	180.0
10	powder 4996						
11	1510			713	4137	28100	194
12	1430			751	3928	25400	214.1
13	1280			824	3580	18200	202.2
14							229
15	1200	660	20	/	/	33000	229
16	1530			725	4069	31600	188.0
17	1380			776	3802	23200	200
18	1275			848	3479	20,000	210.1
19		650					
20	1200	650	20	659	4476		183.0
21	#4996						
22	1520			689	4282		192
23	1320			759	3887		204
24	1100			876	3368		240

ARAP

Baseline = ~~2.95~~ 2.95' Dick Smucker.

velocity (ft/s)	TIME (1/8)	velocity (ft/s)	grain projectile wt	package wt	date	REMARKS	PERFORMANCE
Loss	114.8	1350	1008.5	1576.2	6-24-86	RHA: 2"	Complete
4958	114.5	1111	15"	1576	6-24-86	RHA: 2"	"
4928	118.3	N/A	1009.3	1580.1	6-25-86	Q5-65A (1st shot)	"
4707	139.1	635	1009.5	1590.0	6-25-86	Q5-65B (2nd shot)	"
4719	139.8		1007.5	1579.4	6-25-86	Q5-65A (2nd shot)	"
4566	140.0	1560	1007.8	1578.9	6-25-86	Q5-65A (2nd shot)	"
4128	142.6				6-26-86	Q5-65B (2nd shot)	"
4128	142.6		1008.6	1578.6	6-26-86	Q5-65A (2nd shot)	"
4665	127.7	1905	1009.1	1570.2	6-26-86	Q5-66A (1st shot)	Comp.
			1009.1	1570.2			
4272	133.4		1007.4	1572.2	6-26-86	Q5-66B (1st shot)	LB
4136	131.4	1777	1009.2	1575.3	6-26-86	Q5-66A (2nd shot)	Comp.
3816	125.3		1005.7	1563.7	6-27-86	Q5-66B (2nd shot)	"
4599	135.7		1002.7	1563.9			
4599	135.7	N/A	1002.8	1567.3	6-27-86	Q5-67A (1st shot)	
4331	131.5	N/A	1009.4	1574.2	6-27-86	Q5-67B (1st)	
4071	131.9	1297	1009.3	1569.5	6-27-86	Q5-67A (2nd)	
					6-27-86	Q5-67B (2nd shot)	
3829	131.7		1009.3	1583.2	6-27-86	Q5-67B (2nd)	"
4479	135.6	1198			6-30-86	Q5-68 (1st)	C
4309	133.2	N/A			6-30-86	Q5-68 (2nd)	C
3887	101.9	1529			6-30-86	Q5-69 (1st)	C
3405	96.7	N/A			6-30-86	Q5-69 (2nd)	C

Tungsten

Smooth Bore 20mm Rifle

Single target: 63°

ARAP.

30mm. case p.e. electric primer

Rd #	029 WEB	015 WEB	BL. POWDER	Instr. Reading	Inst. Velocity	PRESSURE	TIME
1	1320	750	20	636	4638	47100	179.1
1	1340	750					
2	1340	750	20	611	4828	45300	159.0
3	1380	760	20	608	4852	60600	159.1
4	1370	760	20	590	5000	64700	158.1
GPI-15)	1440	770	20	605	4876	60,000	138.0
GP2-16)	1440	770	20	595	4958	57300	115.1
GP3-17)	1480	770	20	600	4917	56200	114.9
GP4-18)	1470	770	20	605	4876	—	115.0
GPI-19)	1340	750	20	636	4638	51200	117.1
GP2-20)	1325	750	20	633	4660	—	127.2
GP3-21)	1220	700	20	473(?)	—	35800	130.0

Baseline 2-95'

Dick Sneider

Velocity (1/2)	Timer	Velocity	Projectile wt.	Package wt.	Date	Penetration	Remarks
4935	40.1	/	1004.7	1602.9	7/7/88	LB	L/D=15, Tungsten 2" RHA. LB, 3 piece 1/2" Al ₂ plate (witness).
4944	40.1	/	1007.7	1605.2	7/8/88	LB/C	L/D=15 Tungst. 2" RHA. 3 piece 1/2" Al-plate.
5000	40.1	/	1005.1	1598.7	7/8/88	S-B	L/D=15 Tungst. 2" RHA 3 pieces 1/2" Al plate (witness) penetration is bent (deformed)
5003	40.2	/	1005.	1602.8	7/8/88	NB	L/D=15 Tungst. 2" RHA 3 pieces 1/2" Al plate witness very small bulge. Light penetration in x-ray film
4920	40.2	/	998.9	1909.3	7/8/88	NB	Composite Red Tungsten antersiv) Graphite epoxy wrapped. witness plate Al 3 piece @ 1/2"
4950	40.2	N/A.	992.4	1853.20	7/8/88	C	penetrator went thru 3/4 witness plate and it the Concrete wall 45" 36" → 136"
4763	50.1	/	978.0	1935.5	7/11/88	SB	penetrator base is broken. OD = 0.278 ID = 0.185 (Tungsten)
4938	50.1	/	997.7	1926.7	7/11/88	NB	OD = .312 Tungsten 208 (GPR) 9650
4702	50.2	/	1000.6	1921.3	7/11/88	NB	OD = .312 Tungsten 208
4669	50.1	/	992.9	1874.0	7/11/88	SB	OD = .360 Tungsten 200 (very small)
Loss	50.1	/	977.4	1923.5	7/12/88	C	OD = 0.278 ID = 0.185 Tungsten went thru 1st Al witness plate and dent the 2nd one

SAME AS last page

Rd#	029 WEB	015 WEB	H. powder	PRESSURE	Inst. reading (psi)	Inst. velocity (ft/s)	TIME 1/2	VELOCITY (1/2)	TIME 1/2
GP4-2(12)	1220	700	20	37100	679	4345	130.1	4309	50.0
GP3-5	1250 1300	690	20	40400	618	4773	164.0	4709	50.2
Tungsten (13)	1370	760	20	51800			163.1	4973	50.0
GP1-2	1260	720	20	37800			132.0	4419	40.1
GP2-3	1250	710	20	33000	668	4416	132.1	4409 4365	40.2
GP3-3	1270	725	20	41600	685	4307	132.0	4367	40.1
GP4-3	1270	720	20	42900	657	4490	132.1	4474	40.2
GP1-3	1300	730	20	48900			126.0	4545	40.0
GP3-4	1200	705	20	32300			141.0	4286	40.2
Tungsten	1410	780	20	52900	608	4885	160.1	5087	40.1

ionization velocity	projectile wt.	package wt	Date	penetration	Remarks
/	1000.2	1926.8	7/12/88 7/12/88	LBW/Bright	1/2 completed penetration
/	1004.2	1577.0	7/12/88	NB	A.R.A.P Target (armic) Qs-70
/	1007.5	1576.6	7/14/88	NB	A.R.A.P Target Qs-71, proposed vel = 5000
/	999.0	1918.2	7/14/88	NB	A.R.A.P Target Qs-72. penetrator went downward and hit the bolt.
N/A	993.4	1870.4	7/14/88 7/14/88	C	A.R.A.P Target Qs-73 make a little dent on 1st nlz witness plate
/	979.8	1861.2 1941.2	7/14/88	SB	A.R.A.P. Target Qs-74. penetrator base is deformed
/	996.8	1926.3	7/14/88	NB	A.R.A.P Target Qs-75
/	1000.5	1934.7	7/18/88	SLB SLB	A.R.A.P Target Qs-76 small local bulge close to penetration
/	977.0	1937.1	7/18/88	NB	A.R.A.P Target Qs-77
/	1002.9	1574.2	7/18/88	CREASE	A.R.A.P Target Qs-78

Triple target: 63° Base line: 2.72'

Rd #	WEB	BL.	Cu.	Instr.	Instr.	Reading	Velocity	Reading	Velocity	Reading	Velocity
Tungsten	1385	765	20	48900	544	5000	162.9	4948	23.0	456	
#24.											
Tungsten											
#25	1380	760	20	46500	544	5000	162.9	18.2	23.0		
Tungsten											
#26	1250	680	20	44100	590	4610	N/A	Loss	Loss	Loss	Loss
GP1-6											
#27	1340	760	20	54600	578	4706	176.0	4670	23.2	20.1	433
#28	1300	700	20	42200	613	4433	223.0	20.0			
GP2-5(T5)											
#29	1340	700	20	42900	566	4806	171.0	4763	24.9	4697	20.0
Ref GP1(T6) Tungsten											
#30	1340	715	20	39100	635	4283	162.0	4360	17.2	16.9	
GP3-5(T7) Tungsten											
#31	1320	730	20	48300	602	4518	155.0	4526	14.1	4444	20.0
GP4-5(T8)											
#32	1315	710	20	45300	604	4503	155.0	4479	28.1	4413	28.0
GP2-6(T9)											
#33	1300	720	20	47100	600	4533	154.8	4517	28.2	4414	27.9
GP1-4(T10)											
#34	1200	700	20	32300			153.1	4217	28.1		
GP3-6(T11)											
#35	1310	720	20	46200	608	4474	154.9	4516	26.1	4407	27.0
GP4-6(T12)											

SAME AS last page. A.R.A.P. (Al₃ fixture).

avg 3/9	velocity 8/9	PENETRATION			projectile wt.	projectile dia.	date	REMARKS
		1 st pl.	2 nd pl.	3 rd pl.				
	N/A	C	C	C	1004.1	1573.2	8/10/88	penetrator projectile penetrates in three the and 3/16" and hit the corner.
0.0		C	C	C	1003.3	1571.2	8/10/88	(Triple) projectile penetrates all #2 target and makes a dent 3/16" depth on the plate in front of the corner wall.
0.55	Loss	C	C	NB	1005.1	1573.6	8/10/88	
0.0		C	C	NB	998.8	1917.9	8/10/88	projectile is broken near middle after penetrate 2 nd plate (1/4")
0.0		C	C	NB	993.3	1890.2	10/21/88	Triple Target, last plate = 1" est. vel: 4500 F/s, NO FILM.
0.0	1864	C	C	C	1002.4	1588.7	10/21/88	est. vel: 4800 F/s. Triple Target #6
0.0		C	C	NB	977.1	1943.1	10/21/88	est. vel: 4300 F/s. Triple Target #7 dent notch on impact side, back plate
0.0	1144	C	C	C	1000.3	1925.0	10/21/88	Est. vel: 4550 F/s. Triple Target #8
0.0		C	C	N/B	999.8	1882.4	10/21/88	Est. vel: 4550 F/s notch on third plate.
0.0		C	C	NB	1000.6	1947.6	10/21/88	est. vel: 4450 F/s scratch.
0.1		C	C	N/B	979.1	1903.3	10/26/88	est. vel: 4300 F/s. (scratch). Penetrator Break
0.1		C	C	N/B	1002.3	1891.9	10/26/88	est. vel: 4500 F/s

1st phase	velocity ft/s	1st phase	2nd phase	3rd phase	projectile wt.	Tot. packing wt.	Date	Remarks
								Test # (Target) TT-13 est. vel: 5200
30.1	N/A	C	C	C	105.8	1596.1	2/16/89	
90.0	/	C	C	HB	1002.1	1596.1	2/17/89	Test # TT-14 est. vel: 4800 ft/s
90.2	N/A	C	C	C	1001.9	1711.3	2/17/89	Target (Test): TT-15 est. vel: 4800
60.0	N/A	C	C	C	1001.4	1709.7	2/17/89	Target (Test) # : TT-16 ^{est.} vel: 4600
					993.5	1795.7	5/2/89	Target # : TT-17 (1") est. vel: 4600
59.5	N/A	C	C	C	993.5	1795.7	5/2/89	Target # : TT-17 (1") est. vel: 4600
/	N/A	C	C	C	1015.9	1757.8	5/2/89	Target # : TT-18 (1") est. vel: 4600
99.9	/	C	C	NB	991.7	1770.8	5/4/89	Target # : TT-19 (1") est. vel: 4400
99.9	/	C	C	NB	1009.7	1747.6	5/4/89	Target # : TT-20 (1") est. vel: 4400

Tungsten Smoothbore 20m" x 11' Single target = 63° 30mm. case electric primer									
Rd #	WEB	N.	Cu.	Inst.	Inst.	Timer	Velocity	Timer	
	029	015	PRIMER	PRESSURE	Reading	Velocity	1/2	1/2	
R Shot #38									
S REF-E-1	1360	750	20	N/A	602	4900	159.9	4958	69.0
R Shot #39									
S REF-E-2	1410	770	20	59700	618	4773	156.0	5054	—
R Shot #40									
S REF-E-2-1	1420	770	20	57300	579	5095	N/A	N/A	N/A
R Shot #41									
S REF-E-2-2	1445	785	20	61900	576	5122	156.0	5145	69.0
R Shot #42									
S REF-E-2-3	1430	775	20	61300	572	5157	156.0	5122	60.2
R Shot #43									
S REF-E-2-4	1460	795	20	65800	565	5221	156.1	5208	70.2
R Shot #44	1390								
S EP-1-2	1390	790	20	59500	592	4983	135.9	4967	70.2
R Shot #45									
S EP-2-3	1410	840	20	73700	559	5277	118.0	5232	70.2
R Shot #46									
S EP-3-1	1450	830	20	72300	571	5166	120.9	5144	70.1
R Shot #47	1470								
S EP-3-2	1450	800	20	67300	N/A	N/A	130.0	4963	70.1
R Shot #48									
S EP-4-1	1400	770	20	58600	592	4983	134.0	4959	80.2
R Shot #49	1480	830	20						
S EP-4-2	1480	830	20	71800	565	5221	124.0	5186	100.1
R Shot #50									
S EP-5-1	1370	740	20	40600	—	—	124.0	4807	100.1

baseline: 2.95'

A.R.A.P.

Dick Smolker

INER Velocity	projectile WT.	TOTAL package wt.	DATE	PENETRATION	REMARKS
					Estimated vel: 2922 f/s.
/	989.3	1582.2	2/13/89	MB	Test # RHA-13, Target #13
/	1004.8	1599.4	2/13/89		Target #14
/			2/13/89	LBWC	
/	1002.7	1597.7	2/13/89	LB	Target #15 RHA-15
N/A	1002.7	1595.4	2/14/89	C	Test #: RHA-16 Est. vel: 5100 f/s
/	1002.6	1592.9	2/14/89	LB	Target # Qs-81
/	999.6	1593.9	2/14/89	LB	Target Qs-82
N/B	1605.2	1713.8	2/14/89	NB	Target RHA-18 estimated: 4950 f/s
/	1002.4	1710.8	2/14/89	LB/c	Target RHA-20 estimated vel: 5100
N/A	1003.1	1769.9	2/14/89	C	Target RHA-21 est. vel: 5100
N/A	1003.0	1773.8	2/14/89	C	Target RHA-22 est. vel: 5000
/	995.6	1723.0	2/15/89	N/B	Target RHA-23 est. vel: 4900 f/s
/	996.6	1721.6	2/15/89	N/B	Target RHA-24
/	904.6	1402.9	2/15/89	N/B	Target RHA-25 estimated: 5200 f/s

baseline - 2.95'

SAME AS Last page

Rd#	029	015	AL puder	Cu pressure	Inst. reading	Inst. velocity	Time 1/2	velocity 1/2	Time
Shot #51									
EP2-4	1440	810	20	71200	573	5148	136.9	5092	100.3
Shot #52	1430	800	20		578		136.9		100.3
EP2-5	1430	800	20	64700	578	5104	136.9	5060	100.3
Shot #53									
EP3-3	1400	760	20	58500	602	4900	137.0	4869	100.3
Shot #54									
EP3-4	1440	790	20	68300	580	5086	137.0	5027	100.2
Shot #55	1445								
EP4-3	1440	810	20	55900	584	5051	136.0	4997	100.1
Shot #56									
EP4-4	1490	830	20	68300	570	5175	136.0	5095	100.3
Shot #57									
EP5-3	1400	760	20	42500	588	5015	136.0	4981	100.3
Shot #66									Time 6
HP-1-1	1400	745	20	50,000	620	4758	152.7	4741	99.8
Shot #67									
HP2-1	1410	745	20	55100	615	4797	152.9	4773	100.6
Shot #68									
HP-1-2	1440	780	20	58400	598	4933	152.9		100.6
Shot #69									
HP-2-2	1390	720	20	44100	627	4705	155.0	4677	99.9
Shot #70									
HP1-3	1410	760	20	56500	612	4820	153.0	4784	
Shot #71									
HP-2-3	1310	640	20	32000	671	4396	164.9	4371	
Shot #72									
HP1-4	1440	790	20	64600	601	4908	147.9	4889	100.
Shot #73									
HP2-4	1360	700	20	38600	646	4567	147.9	4549	

date #181	projectile weight	package wt	Date	penetration	Remarks
✓ 1/A	1005.6	1713.7	2/16/89	C	Target Qs-83 est. vel: 5100 f/s projectile hit bottom of frame
✓ 1/A	1002.2	1708.1	2/16/89	C	Target Qs-84 est. vel: 5050
✓	1003.8	1773.3	2/16/89	M/B	Target Qs-85 est. vel: 4800 f/s
✓ 771	1003.4	1770.8	2/16/89	C	Target Qs-86 est. vel: 5000 f/s
✓	995.0	1721.2	2/16/89	NB	Target Qs-87 est. vel: 5050 f/s
✓	996.3	1721.8	2/16/89	SB	Target Qs-88 est. vel: 5200 f/s
✓ 671	921.6	1420.1	2/16/89	NB NB	Target Qs-89 est. vel: 5200 f/s
✓	995.9	1788.2	5/4/89	V.S.B.	Target RHA #26 (2") est. vel: 4800 f/s
✓	1005.7	1766.8	5/4/89	C	Target RHA #27 (2") est. vel: 4800 f/s
✓	993.0	1780.6	5/5/89	LB	Target RHA #28 (2") est. vel: 4700 f/s
✓	1017.8	1756.6	5/5/89	C	Target RHA #29 (2") est. vel: 4650 f/s
✓	991.8	1783.1	5/5/89	MB	Target: Qs-90 Est. vel: 4800 f/s
✓	1014.3	1758.7	5/5/89 5/5/89	NB	Target: Qs-91 Est. vel: 4800 f/s
✓	994.7	1788.5	5/5/89	LB	Target: Qs-92 Est. vel: 4900 f/s
✓	1016.2	1763.5	5/5/89	MB	Target: Qs-93 Est. vel: 4800 f/s

MISCELLENIOUS BUILDING 611B TESTS

SMALL ARMS COPPER PRESSURE CYLINDERS (UNCOMPRESSIONED)
 MANUFACTURED AND ANNEALED AT FRANKFORD ARSENAL 1965
 SET IN 0.0001 INCH VS. CHAMBER PRESSURE (LBS. PER SQ. IN.) USING 1/30 SQ. IN. PISTON
 MEAN LENGTH .4002 INCH - MEAN DIAMETER .2200 INCH
 COMPRESSIONS MADE AT FRANKFORD ARSENAL, JANUARY 1966
 CYLINDER DRAWING A5039436
 LOT 1A 3C-65 SIZE OF LOT 59,000 APPROX.

SET IN INCHES	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009
.0030	8700	8800	9000	9100	9200	9300	9500	9600	9700	9800
.0040	9900	10100	10200	10300	10400	10500	10600	10800	10900	11000
.0050	11100	11200	11300	11400	11600	11700	11800	11900	12000	12100
.0060	12200	12300	12400	12500	12600	12800	12900	13000	13100	13200
.0070	13300	13400	13500	13600	13700	13800	13900	14000	14100	14200
.0080	14300	14400	14500	14600	14700	14800	14900	15000	15100	15200
.0090	15300	15400	15500	15600	15700	15800	15900	16000	16100	16200
.0100	16300	16400	16500	16600	16700	16800	16900	17000	17100	17200
.0110	17300	17400	17500	17600	17700	17800	17900	18000	18100	18200
.0120	18300	18400	18500	18600	18700	18800	18900	19000	19100	19200
.0130	19300	19400	19500	19600	19700	19800	19900	20000	20100	20200
.0140	20300	20400	20500	20600	20700	20800	20900	21000	21100	21200
.0150	21300	21400	21500	21600	21700	21800	21900	22000	22100	22200
.0160	22300	22400	22500	22600	22700	22800	22900	23000	23100	23200
.0170	23300	23400	23500	23600	23700	23800	23900	24000	24100	24200
.0180	24300	24400	24500	24600	24700	24800	24900	25000	25100	25200
.0190	25300	25400	25500	25600	25700	25800	25900	26000	26100	26200
.0200	26300	26400	26500	26600	26700	26800	26900	27000	27100	27200
.0210	27300	27400	27500	27600	27700	27800	27900	28000	28100	28200
.0220	28300	28400	28500	28600	28700	28800	28900	29000	29100	29200
.0230	29300	29400	29500	29600	29700	29800	29900	30000	30100	30200
.0240	30300	30400	30500	30600	30700	30800	30900	31000	31100	31200
.0250	31300	31400	31500	31600	31700	31800	31900	32000	32100	32200
.0260	32300	32400	32500	32600	32700	32800	32900	33000	33100	33200
.0270	33300	33400	33500	33600	33700	33800	33900	34000	34100	34200
.0280	34300	34400	34500	34600	34700	34800	34900	35000	35100	35200
.0290	35300	35400	35500	35600	35700	35800	35900	36000	36100	36200
.0300	36300	36400	36500	36600	36700	36800	36900	37000	37100	37200
.0310	37300	37400	37500	37600	37700	37800	37900	38000	38100	38200
.0320	38300	38400	38500	38600	38700	38800	38900	39000	39100	39200
.0330	39300	39400	39500	39600	39700	39800	39900	40000	40100	40200
.0340	40300	40400	40500	40600	40700	40800	40900	41000	41100	41200
.0350	41300	41400	41500	41600	41700	41800	41900	42000	42100	42200
.0360	42300	42400	42500	42600	42700	42800	42900	43000	43100	43200
.0370	43300	43400	43500	43600	43700	43800	43900	44000	44100	44200
.0380	44300	44400	44500	44600	44700	44800	44900	45000	45100	45200
.0390	45300	45400	45500	45600	45700	45800	45900	46000	46100	46200
.0400	46300	46400	46500	46600	46700	46800	46900	47000	47100	47200
.0410	47300	47400	47500	47600	47700	47800	47900	48000	48100	48200
.0420	48300	48400	48500	48600	48700	48800	48900	49000	49100	49200
.0430	49300	49400	49500	49600	49700	49800	49900	50000	50100	50200
.0440	50300	50400	50500	50600	50700	50800	50900	51000	51100	51200
.0450	51300	51400	51500	51600	51700	51800	51900	52000	52100	52200
.0460	52300	52400	52500	52600	52700	52800	52900	53000	53100	53200
.0470	53300	53400	53500	53600	53700	53800	53900	54000	54100	54200
.0480	54300	54400	54500	54600	54700	54800	54900	55000	55100	55200
.0490	55300	55400	55500	55600	55700	55800	55900	56000	56100	56200
.0500	56300	56400	56500	56600	56700	56800	56900	57000	57100	57200
.0510	57300	57400	57500	57600	57700	57800	57900	58000	58100	58200
.0520	58300	58400	58500	58600	58700	58800	58900	59000	59100	59200
.0530	59300	59400	59500	59600	59700	59800	59900	60000	60100	60200
.0540	60300	60400	60500	60600	60700	60800	60900	61000	61100	61200
.0550	61300	61400	61500	61600	61700	61800	61900	62000	62100	62200
.0560	62300	62400	62500	62600	62700	62800	62900	63000	63100	63200
.0570	63300	63400	63500	63600	63700	63800	63900	64000	64100	64200
.0580	64300	64400	64500	64600	64700	64800	64900	65000	65100	65200
.0590	65300	65400	65500	65600	65700	65800	65900	66000	66100	66200
.0600	66300	66400	66500	66600	66700	66800	66900	67000	67100	67200
.0610	67300	67400	67500	67600	67700	67800	67900	68000	68100	68200
.0620	68300	68400	68500	68600	68700	68800	68900	69000	69100	69200
.0630	69300	69400	69500	69600	69700	69800	69900	70000	70100	70200
.0640	70300	70400	70500	70600	70700	70800	70900	71000	71100	71200
.0650	71300	71400	71500	71600	71700	71800	71900	72000	72100	72200
.0660	72300	72400	72500	72600	72700	72800	72900	73000	73100	73200
.0670	73300	73400	73500	73600	73700	73800	73900	74000	74100	74200
.0680	74300	74400	74500	74600	74700	74800	74900	75000	75100	75200
.0690	75300	75400	75500	75600	75700	75800	75900	76000	76100	76200
.0700	76300	76400	76500	76600	76700	76800	76900	77000	77100	77200
.0710	77300	77400	77500	77600	77700	77800	77900	78000	78100	78200
.0720	78300	78400	78500	78600	78700	78800	78900	79000	79100	79200
.0730	79300	79400	79500	79600	79700	79800	79900	80000	80100	80200
.0740	80300	80400	80500	80600	80700	80800	80900	81000	81100	81200
.0750	81300	81400	81500	81600	81700	81800	81900	82000	82100	82200
.0760	82300	82400	82500	82600	82700	82800	82900	83000	83100	83200
.0770	83300	83400	83500	83600	83700	83800	83900	84000	84100	84200
.0780	84300	84400	84500	84600	84700	84800	84900	85000	85100	85200
.0790	85300	85400	85500	85600	85700	85800	85900	86000	86100	86200
.0800	86300	86400	86500	86600	86700	86800	86900	87000	87100	87200
.0810	87300	87400	87500	87600	87700	87800	87900	88000	88100	88200
.0820	88300	88400	88500	88600	88700	88800	88900	89000	89100	89200
.0830	89300	89400	89500	89600	89700	89800	89900	90000	90100	90200
.0840	90300	90400	90500	90600	90700	90800	90900	91000	91100	91200
.0850	91300	91400	91500	91600	91700	91800	91900	92000	92100	92200
.0860	92300	92400	92500	92600	92700	92800	92900	93000	93100	93200
.0870	93300	93400	93500	93600	93700	93800	93900	94000	94100	94200
.0880	94300	94400	94500	94600	94700	94800	94900	95000	95100	95200
.0890	95300	95400	95500	95600	95700	95800	95900	96000	96100	96200
.0900	96300	96400	96500	96600	96700	96800	96900	97000	97100	97200
.0910	97300	97400	97500	97600	97700	97800	97900	98000	98100	98200
.0920	98300	98400	98500	98600	98700	98800	98900	99000	99100	99200
.0930	99300	99400	99500	99600	99700	99800	99900	100000	100100	100200
.0940	100300	100400	100500	100600	100700	100800	100900	101000	101100	101200
.0950	101300	101400	101500	101600	101700	101800	101900	102000	102100	102200
.0960	102300	102400	102500	102600	102700	102800	102900	103000	103100	103200
.0970	103300	103400	103500	103600	103700	103800	103900	104000	104100	104200
.0980	104300	104400	104500	104600	104700	104800	104900	105000	105100	105200
.0990	105300	105400	105500	105600	105700	105800	105900	106000	106100	106200
.1000	106300	106400	106500	106600	106700	106800	106900	107000	107100	107200

SET IN INCHES	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009
.0560	48900	48900	49000	49100	49100	49200	49200	49300	49300	49400
.0570	49500	49500	49600	49600	49700	49800	49800	49900	49900	50000
.0580	50000	50100	50200	50200	50300	50300	50400	50400	50500	50600
.0590	50600	50700	50700	50800	50800	50900	50900	51000	51000	51100
.0600	51200	51300	51300	51400	51400	51500	51500	51600	51700	51700
.0610	51800	51800	51900	51900	52000	52000	52100	52200	52200	52300
.0620	52300	52400	52400	52500	52500	52600	52600	52700	52800	52800
.0630	52900	53000	53000	53100	53100	53200	53200	53300	53300	53400
.0640	53500	53500	53600	53600	53700	53700	53800	53900	53900	54000
.0650	54000	54100	54100	54200	54200	54300	54300	54400	54500	54500
.0660	54600	54600	54700	54700	54800	54900	54900	55000	55000	55100
.0670	55100	55200	55200	55300	55400	55400	55500	55500	55600	55600
.0680	55700	55700	55800	55800	55900	56000	56000	56100	56100	56200
.0690	56200	56300	56300	56400	56500	56500	56600	56600	56700	56700
.0700	56800	56800	56900	56900	57000	57100	57100	57200	57200	57300
.0710	57300	57400	57400	57500	57500	57600	57700	57700	57800	57800
.0720	57900	57900	58000	58000	58100	58100	58200	58200	58300	58400
.0730	58400	58500	58500	58600	58600	58700	58700	58800	58800	58900
.0740	58900	59000	59100	59100	59200	59200	59300	59300	59400	59400
.0750	59500	59500	59600	59600	59700	59800	59800	59900	59900	60000
.0760	60000	60100	60100	60200	60200	60300	60300	60400	60400	60500
.0770	60600	60600	60700	60700	60800	60800	60900	60900	61000	61000
.0780	61100	61100	61200	61200	61300	61300	61400	61500	61500	61600
.0790	61600	61700	61700	61800	61800	61900	61900	62000	62000	62100
.0800	62100	62200	62200	62300	62300	62400	62400	62500	62600	62600
.0810	62700	62700	62800	62800	62900	62900	63000	63000	63100	63100
.0820	63200	63200	63300	63300	63400	63400	63500	63500	63600	63600
.0830	63700	63800	63800	63900	63900	64000	64000	64100	64100	64200
.0840	64200	64300	64300	64400	64400	64500	64500	64600	64600	64700
.0850	64700	64800	64800	64900	64900	65000	65000	65100	65100	65200
.0860	65200	65300	65400	65400	65500	65500	65600	65600	65700	65700
.0870	65800	65800	65900	65900	66000	66000	66100	66100	66200	66200
.0880	66300	66300	66400	66400	66500	66500	66600	66600	66700	66700
.0890	66800	66800	66900	66900	67000	67000	67100	67100	67200	67200
.0900	67300	67300	67400	67400	67500	67500	67600	67600	67700	67700
.0910	67800	67800	67900	67900	68000	68000	68100	68100	68200	68200
.0920	68300	68300	68400	68400	68500	68500	68600	68600	68700	68700
.0930	68800	68800	68900	68900	69000	69000	69100	69100	69200	69200
.0940	69300	69300	69400	69400	69500	69500	69600	69600	69700	69700
.0950	69800	69800	69900	69900	70000	70000	70100	70100	70200	70200
.0960	70300	70300	70400	70400	70500	70500	70600	70600	70700	70700
.0970	70800	70800	70900	70900	71000	71000	71100	71100	71200	71200
.0980	71300	71300	71400	71400	71500	71500	71600	71600	71700	71700
.0990	71800	71800	71900	71900	72000	72000	72100	72100	72200	72200
.1000	72300	72300	72400	72400	72500	72500	72600	72600	72700	72700
.1010	72800	72800	72900	72900	73000	73000	73100	73100	73100	73200
.1020	73200	73300	73300	73400	73400	73500	73500	73600	73600	73700
.1030	73700	73800	73800	73900	73900	74000	74000	74100	74100	74200
.1040	74200	74300	74300	74400	74400	74500	74500	74600	74600	74700
.1050	74700	74700	74800	74800	74900	74900	75000	75000	75100	75100
.1060	75200	75200	75300	75300	75400	75400	75500	75500	75600	75600
.1070	75700	75700	75800	75800	75900	75900	76000	76000	76100	76100
.1080	76100	76200	76200	76300	76300	76400	76400	76500	76500	76600
.1090	76600	76700	76700	76800	76800	76900	76900	77000	77000	77100
.1100	77100	77100	77200	77200	77300	77300	77400	77400	77500	77500
.1110	77600	77600	77700	77700	77800	77800	77900	77900	78000	78000
.1120	78000	78100	78100	78200	78200	78300	78300	78400	78400	78500
.1130	78500	78600	78600	78700	78700	78800	78800	78900	78900	79000
.1140	79000	79000	79100	79100	79200	79200	79300	79300	79400	79400
.1150	79500	79500	79600	79600	79700	79700	79800	79800	79900	79900
.1160	79900	80000	80000	80100	80100	80200	80200	80300	80300	80400
.1170	80400	80500	80500	80600	80600	80700	80700	80800	80800	80900
.1180	80900	80900	81000	81000	81100	81100	81200	81200	81300	81300
.1190	81300	81400	81400	81500	81500	81600	81600	81700	81700	81800
.1200	81800	81800	81900	81900	82000	82000	82100	82100	82200	82200
.1210	82300	82300	82400	82400	82500	82500	82600	82600	82700	82700
.1220	82700	82800	82800	82900	82900	83000	83000	83100	83100	83200
.1230	83200	83300	83300	83400	83400	83500	83500	83600	83600	83700
.1240	83700	83700	83800	83800	83900	83900	84000	84000	84100	84100
.1250	84100	84200	84200	84300	84300	84400	84400	84500	84500	84600
	.0000	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009

VS: 1" plate 14', smooth Bore barrel

12-21-79

Grains

180

Base Line 1.942

30 Mm Fat 15 E1 Case x 7" Chamber

Pwdr. IMR 4996

INST VELD	REMARKS
1097	RECOVERED PROJECTILE INTACT $\frac{1}{4}$ " PENETRATION IN PLATE
1175	PROJECTILE STUCK INTO PLATE (INTACT) + REMOVED
1845	PROJECTILE SAME AS ABOVE (VERY EASILY REMOVED)
1496	PROJECTILE STUCK INTO PLATE (INTACT) + REMOVED
1497	SAME AS SHOT Q4
1250	PROJECTILE LOST IN BOX PENETRATION APPROX $\frac{1}{4}$ "
2198	PROJECTILE STUCK INTO PLATE NOT REMOVED
1026	RECOVERED PROJECTILE (INTACT) $\frac{1}{4}$ " PENETRATION
1965	Recovered Proj. Intact Flattened
1894	Projectile stuck in plate
1923	Recovered Proj. Intact Flattened
2075	Recovered Proj. intact Approx. $\frac{3}{8}$ penetration
1940	Recovered Proj. intact Flattened
1951	Projectile stuck in plate
2737	Recovered $\frac{3}{4}$ of proj. rest broke off in plate. approx $\frac{1}{2}$ " deep small Bulge in plate
1168	Recovered Proj. intact
766	Recovered Proj. intact
555	Recovered Proj. intact

Shot	Charge	Inst Vel	Vel	Pressure	X-RAY Time	X-RAY Vel	Time 4-5
Test Shot 2-26-80 Tungsten	780 grains IMR 4996	1231.8		None	298.5		117.8
2-27-80 T1	800	992.0	281.9	None	282.1		118.4
3-6-80 ST-6 Proj #RL-6	930 IMR 4996	786.8	355.5		283.1		120.5
3-7-80 ST-7	910 grains IMR 4996	826.5	338.2		285.9		102.1

Base Line $33 \frac{9}{16}'' = 2.797'$

$$65^\circ = 444.5 \text{ MILS}$$
[illegible]

Preliminary Test Shots to get 5000 FPS.
for a future Test-Firing into 2" plates

Powder Propellant IMR 4996-(take note powder charge)

Rd # or Shot	Grains Charge	Instant Velocity	Velocity	Staballoys				
				Copper Pressure	1+2 Time	1+2 Velocity	8+9 Time	8+9 Velocity
1	1150	771.6		20600	208.6	3809	167.6	
2	1250	693.7		33700	211.0	4219	162.8	
3	1400	643.7	4547	57900	179.1	4575	No Reading	
4	1500	606.9		70800	155.2	4842	145.5	
5	1650	581.6	5032	65900	156.1	4992	None	
6	1750	652.9	4483	76100	158.4	5164	None	
7	1550	618.1	4735	63800	160.0	4783	None	
8	1660	596.5	4907	66200	163.7	4907	163.7	
9	1400	211.0	4016	26200	211.0	4039	None	
10	1600	705.7	4147	To Low ?	211.4	4209	None	
11	1800	633.7	4619	40500	214.8	4589	None	
12	1900	615.0	4759	53300	180.3	4760	None	
13	2050	602.9	4854	70000	184.7	4894	None	
14	2050	606.7	4824	70100	No Reading	4894	None	
#138 15	2050	641.7	4561	High 24300 Low 77300	181.0	4856	165.8	
Copper Gage Had 4 Low & High Spots								
#82 16	1680 Charge Black Pwd. 20 grains		3985	26100	212.1	3993	None	
#83 17	1740 Charge Black Pwd. 20 grs.	708.7	4130	25300	213.1	—	None	
#88 #18	1820 Charge Black Pwd. 20 grs.	682.3	4290	35200	189.2	4305	None	

14' Barrel 20" M Smooth Bore - Base line 35.125 = 2.927
 30" M case Fat 15E1 - Elect Primers M52A3B1

			Chamber Size	Remarks	Projectile Weight	Date
4			7"	Package Weight	1003.2	4-17-80
1			7"	1535.4 grains		
2			7"	1537.9 "	1005.3	4-17-80
3			7"	1540.5 "	1007.0	4-17-80
4			7"	1536.5 "	1000.0	4-18-80
5			8" change	1531.1 "	999.5	4-18-80
6			8" "	1533.9 "	1004.0	4-18-80
7			8" "	1540.8 "	1007.0	4-18-80
8	Changed Powder From IMR4946 to NC-25-FS		8" staballoy	1535.1 "	1004.0	4-21-80
9	"		8" staballoy	1537.2 "	1003.8	4-23-80
10	"		9" change	1540.6 "	1003.8	4-23-80
11	"		9" staballoy	1533.6 "	1003.7	4-24-80
12	"		9" staballoy	1554.0 "	1003.3	4-24-80
13	"		9" staballoy	1668.2 "	1003.3	4-25-80
				Added two extra pushers		
14	"		9" staballoy	1684.3 "	1004.3	4-30-80
				Added 1 extra Disc + 2 pusher		
15	"		9" staballoy	1686.8 "	1003.5	5-1-80
				2 Disc 2 pusher		
16	Changed Powder. Black Pwd. 20 grains Lot CIL-7-5 MP30 WEB-.0317-1680 grains Lot-RAD-69315		9" staballoy	1669.9 2 Disc	1003.7	5-18-80
17	Black Pwd. 20 grains Lot CIL-7-5 MP30 WEB-.0317-1740 grains Lot-RAD-69315		9" "	2 Disc 1664.2	1004.5	5-18-80
18	Black Pwd. 20 grains Lot CIL-7-5 MP30 WEB-.0317-1820 grains Lot-RAD-69315			1665.7 2 Disc	1004.0	6-10-80

Test for ~~the~~ Rhoades to determine stability of
(M60 M.G. 7.62 M/M) sabot

(Base Line $23.3125'' = 1.942'$)

[illegible]

Continued 150m test - 1925

Preliminary Test Shots to get 5000 ft P.S.

Firing into 2" Armor plates

Pwds used have changed see below.

Shot #	Grains Charge	Instant Velocity	Velocity	Copper Pressure	1+2	1+2	8+9	8+9
					X-Ray Time	X-Ray Velocity	X-Ray Time	X-Ray Velocity
#19	1800 M30		4223	27900	1775	4228		
89	20 BLK							
20	1802 M30		4264	26400	1791	4276		
90	30 BLK							
#21	1000-446							
93	1800 M30	6472	4523	62200	1671	4871		
#22	1800 M30							
99	1770	736	3977	22200	180.2	4002		
#23	1820	668	4382	31600	180.3	3992		
96								
#24	1845	654	4475	33000	182.2	4493		
107								
#25	1820	652	4489	34400	179.9	4495		
105								
#26	1920							
108	1920	607	4822	49000	181.5	4822		
#27	1990	584	5114	64500	182.3	5010		
107								
#28	2060	572	5126	62800	161.6	5114		
109								
#29	1990	590	4961	58600	165.7	4951		
107								
#30	2000	587	4986	64300	166.8	5004		
107								
#31		585	5003	62800	157.9	5020	127.4	
107								
#32	2000							
107								

14' Barrel 20 M Smooth bore - Baseline (35-125-2927)
 30 M case Fat BEI - Elect Primers M52 A3 B1

		Chamber Size	Package Wt. Remarks	Projectile Weight	Date
#19	Black Pwdr	9" Staballoy	1560.0	1004.0	6-22-80
Rd 89	M30-.0317 WEB 1575 grs.	9" Staballoy	1664.5	1004.0	7-10-80
#20	Black Pwdr	9" Staballoy	1664.8	1003.5	7-10-80
Rd 90	M30-.0317 WEB 1575 grs.	9" Staballoy	1664.8	1004.0	7-10-80
#21	Black Pwdr	9" Staballoy	1664.8	1004.0	7-10-80
Rd 93	Black Pwdr - 20 grains	9" Staballoy	1664.8	1004.0	7-10-80
#22	M30-.0317 WEB 1575 grs.	9" Staballoy	1664.8	1004.0	7-10-80
	M30-.0152 WEB 175 grs.	9" Staballoy	1664.8	1004.0	7-10-80
#23	Black Pwdr - 20 grains	9" Staballoy	1664.8	1004.0	7-10-80
Rd 96	M30-.0317 WEB 1600 grs.	9" Staballoy	1664.0	1003.5	7-10-80
#24	Black Pwdr - 20 grains	9" Chamber	1650.6	1003.0	7-14-80
Rd 107	M30-.0152 WEB 225 grs.	9" Chamber	1670.2	1003.5	7-14-80
#25	Black Pwdr - 20 grains	9" Chamber	1670.2	1003.5	7-14-80
+05	M30-.0317 WEB 1440 grs.	9" Chamber	1670.2	1003.5	7-14-80
	M30-.0152 WEB 360 grs.	9" Chamber	1660.3	1004.07=21-80	
#27	Black Pwdr 20 grs	9" Chamber	1659.8	1004.5	7-21-80
Rd 127	M30-.0317 1210 grs.	9" Chamber	1667.8	1005.8	7-22-80
	M30-.0152 760 grs.	9" Chamber	1661.3	1004.5	7-22-80
28	Black Pwdr - 20 grs.	9" Chamber	1556.0	1006.0	7-30-80
Rd 91	M30-.0317-1280 grs.	9" Chamber			
29	Black Pwdr - 20 grs.	9" Chamber			
Rd 97	M30-.0152-760 grs.	9" Chamber			
30	Black Pwdr - 20 grs.	9" Chamber			
Rd 74	M30-.0317-1220 grs.	9" Chamber			
Shot # 30	Black Pwdr - 20 grs.	9" Chamber			
Rd 111	M30-.0317-1220 grs.	9" Chamber			
898-243	M30-.0152-760 grs.	9" Chamber			

Continued from last page

Rd. # Shot	Grains Charge	Instant Velocity	Velocity	Copper Pressure Chamber	#42 Time	Hz. #42 Velocity	#42 Time	#42 Velocity
H 32 Rd # 129	2000	582	5029	62300	155.5	5053	126.7	
33 Rd # 106	1995	578	5064	62800	157.7	5078	100.5	
34 Rd # 111	1985	578	5064	62400	158.5	5044	99.8	
35 76	1980	572	5126	61300	157.6	5020	101.7	
36 Rd # 81	1980	592	4944	60000	152.3	4984	103.1	
37 Rd # 73	1980	585 577	5072	64200	155.5	5043	104.3	
38 Rd # 87	1980	585	5003	65500	154.8	5035	103.6	
39 Rd # 94	1980	585	5003	64800	156.7	5020		

30 M/M Fat Case 15 E1
 20 M/M - 14' Smooth Bore Barrel
 Elect. Primer - M52A3B1

Base Line (35.125 = 2.927)
 VISITOR
 BADGE 117 Dick SAFARI
 119 Ross (NTL-1111)

	Powder Weight	Chamber Size	Package Weight	Projectile Weight	Chamber Size	Date
33 124	Lot Rad-69315-1200 grs. 0317 web " Rad-E-30-760 grs. 0152 web 20 grains Black Pwd.		1551.8	1004.0	9"	7-31-80
Beginning of ARAP Project						
37 06	Lot 69315 1215 grs. 0317 web Lot Rad-E-30-760 grs. 0152 web 20 gr BP		1545.0	1003.5	9"	8-1-80
11 134	Lot 69315 1205 grs. 0317 web Lot Rad-E-30-760 grs. 0152 web 20 gr BP		1542.6	1004.0	9"	8-1-80
75 76	Lot 69315-1200 grains 0317 web Lot Rad-E-30-760 grs. 0152 web 20 gr Black Pwd.		1544.6	1003.8	9"	8-8-80
36 81	Lot 69315-1200 grains 0317 web Lot Rad-E-30-760 grs. 0152 web 20 grs Black Pwd.			1004.5	9"	8-8-80
37 73	Lot 69315-1200 grains 0317 web Lot Rad-E-30-760 grs. 0152 web 20 grains. Black Pwd.		1541.6	1003.0	9"	8-11-80 RCB
38 87	Lot 69315-1200 grains 0317 web Lot Rad-E-30-760 grs. 0152 web 20 grains. Black Pwd.		1548.1	1004.0	9"	8-11-80 RCB
39 94	Lot 69315-1200 grains 0317 web Lot Rad-E-30-760 grs. 0152 web 20 grains Black Pwd.		1522.9	1003.7	9"	8-12-80 RCB

CONTINUED) FROM LAST PAGE MR. ROSS BADGE #122
8-14-80 CONTILIANO

MR. DICK SNECKER #122

SHOT	GRAINS CHARGE	INST VEL TIME	INST VEL	COPPER CRUSHING	1-2 TIME	1-2 TIME	1-2 TIME
40 RD 95	2005	575	5090	69.100	155.7	5081	101.8
41 RD 98	1980	588	4978	^{PISTON BROKE} 76.600	157.1	5023	102.1
42 RD 100	1980	581	5038	66.100	157.8	5076	104.9
43 RD 101	1980	582	5029	66.200	158.9	5040	NONE
44 RD 104	1980	582	5029	70.000	158.0	5029	100.6
45 RD 125	1980	591	4953	67.200	157.2	5013	101.5
46 RD 109	1980	588	4978	65.100	158.8	5017	96.9
47 RD 85	1980	588	4978	70.800	157.2	5025	93.2
48 RD 86	1980	582	5029	^{65.600} 76.600	158.3	5037	92.1

90 MM FAB CASE 15E1
20 mm - 14' smooth BORE BBL.

BASE LINE
35.125" = 2.927

Power WT	PACKAGE	PROV WT	CHAMBER	DATE
SHOT 40 RD 95	LOT 69315-1225 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB	1540.8	1003.5 9"	8-12-80 RCB
20 GRNS BLACK POWDER		1539.3	1003.4 9"	8-13-80 RCB
SHOT 41 RD 98	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS. BLACK PWD.		1531.7	1003.4 9"	8-13-80 RCB
SHOT 42 RD 100	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS. BLACK PWD.		1539.2	1003.9 9"	8-13-80 RCB
SHOT 43 RD 101	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS. BLACK PWD.		1538.5	1003.4 9"	8-13-80 RCB
SHOT 44 RD 104	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS. BLACK PWD.		1542.3	1003.7 9"	8-14-80 RCB
SHOT 45 RD 125	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS BLACK POWDER		1538.5	1004.0 9"	8-14-80 RCB
SHOT 46 RD 109	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS BLACK PWD.		1536.4	1003.5 9"	8-14-80 RCB
SHOT 47 RD 85	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS BLACK POWDER		1534.9	1003.9 9"	8-14-80 RCB
SHOT 48 RD 86	LOT 69315-1200 GRNS 0317WEB LOT RAD E-30 760 GRNS 0152WEB			
20 GRNS. BLACK POWDER				

CUT FROM LAST PAGE

MR. CONTILIANO BAGGO # 121
MR. SNOG EKOL BAGGO # 122

GRAINS	INCH	INCH	COPPER	1-2	1-2	8-9	8-9
CHARGE	VEL. TIME	VEL.	PRESS.	Time	VEL.	Time	VEL.
49 RD# 112	1980	591	4953 Piston BROKE	155.9	4949	91.6	

50 RD# 117	1980	582	5029 Piston BROKE	157.4	157.4	91.8	
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51 RD# 118	1980	631	4639	67400	157.6	5040	102.8
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52 RD# 140	1890	621	4713	61900	157.6	4726	102.9
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30 MM FAL CASE 15E1
30 MM 14" SMOOTH BORE BBL.
ELECT. PRIMERS MS2A8B1

BASE LINE
35.625 = 2.927

Shot Powder Wt. Locking Wt. Prim. Wt. Chamber DATE.
49 RD#112 Lot 69315-1200 GRNS .0317 WEB 1537.1 1003.1 9" 8-15-80
Lot RAD E-30 760 GRNS .0152 WEB RCB
20 GRNS BLACK POWD.

50 RD#117 Lot 69315-1200 GRNS .0317 WEB 1521.0 1004.0 9" 8-15-80
Lot RAD E-30 760 GRNS .0152 WEB RCB
20 GRNS BLACK POWD.

51 RD#118 Lot 69315-1200 GRNS .0317 WEB 1538.2 1003.1 9" 8-15-80
Lot RAD E-30 760 GRNS .0152 WEB RCB
20 GRNS BLACK POWD.

52 RD#110 Lot 69315 1350 GRNS .0317 WEB 1535.8 1002.9 9" 8-15-80
Lot RAD E-30 760 GRNS .0152 WEB RCB
20 GRNS BLACK POWDER

Shot	Grains	Inst Vel-Time	Inst Vel	Copper Press.	Time 1+2	Vel 1+2	T+9 Time	T+9 Vel
Test #1 T-1	1980	105.4 687.5	4820	84100	1.1	4829	415.1	
	1980	106			1.1	4829	246.4	
Test #2 T-2	1980	108.0 2081.1			158.8		246.4	
Test #3 T-3	1980	617	4821	52950	150.7		418.1	
Test #4								
Test #5				69400				
Test #6		594	4935	50.400				
ARAP TARGET TEST STABALLOY								
ASHA-1 #1	1980	592	4949	51.400	166.5	4957	415.1	2000 Black Powder
								steel case
#2	1985	590	4966	59.400	169.7	4955	412.6	20 GR BLACK POWD.
								BRASS CASE
#3	1985	585	5009	59.600	174.5	4993	413.4	"
#4	1985	581	5043	54.100	175.2	5048	414.1	
#5	1985	587	4991	52.900	210.4	5009	412.4	
#6	1985	582	5034	53.200	165.9	5037	412.8	
#7	1985	581	5043	44.100	165.6	5025	413.6	
#8	1985	577	5078	51.900	165.5	5058	414.0	
#9	1980	590	4966	50.200	165.1	4975	413.2	
#10	1980	581	5043	50.200	164.5		415.3	

Eke Primers M52A3B1

Base Line = 35.125 ± 2.927

Powdr Neight	Package Wt. Grain	Proj. Wt. Grains	Chamber	1" plate	Date
Lot 69315 - 1200 grs. 0317 web	1547.0	1003.0	9"	60° Penetration	9-1-81
Lot RAD-E-30-760 grs. 0152 web 20 grs. Black Powder					
Lot 69315 - 1200 grs. 0317 web	1550.5	1003.0	9"	60° Pent.	9-2-81
Lot RAD-E-30-760 grs. 0152 web 20 grs. Black Powder					
Lot 69315 - 1200 grs. 0317 web	1548.0	1003.0	9"	2" plate 60° Pent.	9-3-81
Lot RAD-E-30-760 grs. 0152 web					
Lot 69315 - 1200 grs. 0317 web	1547.0	1003.5	9"	2" plate 60° Pent.	9-4-81
Lot RAD-E-30-760 grs. 0152 web 20 grs. Black Powder					
Lot 69315 - 1200 grs. 0317 web					
Lot RAD-E-30-760 grs. 0152 web 20 grs. Black Powder	1545.0	1002.5	9"	2" plate 60° Pent.	9-8-81
				BASELINE 2.93 ±	
Lot 69315 - 1200 grs. 0317 web	1545.5	1003.0	9"	60° Pent.	9-9-81
Lot RAD-E-30-760 grs. 0152 web					
Lot 69315 - 1200 grs. 0317 web	1541.1	1003.7	9"	SPECIAL TARGET 60° Pent.	9-10-81
Lot RAD-E-30-760 grs. 0152 web				#7 PENT.	9-10-81
" "					
" "	1551.0	1003.0	"	"	9-10-81
" "					
SAME CHARGE	SAME CHARGE	1549.5	1004.0	" #8 PENT.	
"	"				
SAME CHARGE	SAME CHARGE	1545.0	1004.0	" #9 PENT.	9-11-81
"	"				
SAME CHARGE	SAME CHARGE	1550.0	1003.5	" #10 PENT.	9-11-81
"	"				
SAME CHG.		1557.4	1003.0	18" R.V. #11 PENT.	9-11-81
"	"				
SAME CHG.		1541.0	1003.0	" #12 PENT.	9-11-81
"	"				
Lot 69315 - 1200 grs. 0317 web	1545.6	1003.2		" #13 PENET.	9-14-81
Lot RAD-E-30-760 grs. 0152 web					
" "	1548.7	1003.5		" #14 PENET.	9-14-81
" "					

SHOT	TOTAL CHG WT	INST TIME	INST VEL	COPPER PRESS	PULSE TIME 1+2	VEL 1+2	PULSE TIME 7+9	VEL 7+9	
#11	1980	582	5034	49100	166.1	4969	415.1	-	20 GR BLACK PWD
#12	1980	588	4983	50600	160.9	4966	413.8	-	20 GR BLACK PWD
#13	1980	584	5017	50000	162.4	4994	414.7	-	20 GR BLACK PWD
#14	1980	588	4983	49600	163.9	4981	414.5	-	20 GR BLACK PWD
#15	1980	585	5009	52100	167.7	4996	418.0	-	20 GR BLACK PWD
#16	1980	594	4924	46600	166.4	4910	414.4	-	20 GR BLACK PWD
#17	1980	588	4983	48000	163.8	4970	412.9	2000	20 GR BLACK PWD
#18	1980	592	4949	46600	173.8	4949	415.4	-	20 GR BLK PWD
#19	1980	575	5096	51700	171.2	5006	414.7	-	20 GR BLK PWD
#20	1980	565	5186	44500	170.8	5044	414.3	-	20 GR BLK POWDER
#21	1980	571	5131	42700	171.4	4973	414.5	-	20 GR BLK PWD
#22	1980	582	5034	47900	151.6	4968	413.4	-	20 GR BLK PWD
#23	1980	588	4983	50000	165.5	4982	411.4	-	20 GR BLK PWD
#24	1980	582	5034	46600	165.3	4993	411.4	-	20 GR BLK PWD
#25	1985	575	5009	50100	165.0	4996	411.9	-	20 GR BLK PWD

30 MM FATCASE 15E1 20 MM 14' SMOOTH BORE		PKG WT GRAINS	PROJ WT GRAINS	BASE LINE 2.93 ÷ T	
PROPELLANT WEIGHT					DATE
LOT 693-15-0317 WEB 1200 GR	760 GR	1540.1	1002.7	#15 PROJ	9-14-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1550.9	1002.2	#16 PROJECTILE	9-15-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1545.4	1002.5	#17 PROJECTILE	9-15-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1545.9	1003.0	#18 PROJECTILE	9-15-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1547.9	1003.0	#19 PROJECTILE	9-15-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1546.7	1003.0	#20 PROJECTILE	9-16-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1534.5	1003.0	#21 PROJECTILE	9-16-81 *
LOT 693-15-0317 WEB 1200 GR	760 GR	1546.9	1002.5	#22 PROJECTILE	9-29-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1543.4	1002.7	#23 PROJECTILE	9-29-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1551.2	1003.0	#24 PROJECTILE	9-29-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1546.1	1003.0	#25 PROJECTILE	9-29-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1553.3	1002.5	#26 PROJECTILE	9-30-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1542.5	1002.5	#27 PROJ	9-30-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1535.0	1002.6	#28 PROJ	9-30-81
LOT 693-15-0317 WEB 1200 GR	760 GR	1542.8	1002.5	#29	9-30-81

SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	LOPPER PRESSURE	PULSE TIME 1+2	VEL 1+2	PULSE TIME 7+9	VEL 7+9	PROJ
#26	1980	588	4983	48500	168.2	4957	411.2	—	20 GR BLACK PWD
#27	1985	587	4991	51700	160.3	4974	411.5	—	20 GR BLK PWD
#28	1985	586	5000	47000	165.2	4984	412.2	—	20 GR BLK PWD
#29	1985	587	4991	48700	164.5	4976	435.6	—	20 GR BLK PWD
#30	1985	586	5000	47600	163.8	5001	411.3	—	20 GR BLACK PWD
#31	1985	576	5087	47500	164.9	4981	410.1	—	20 GR BLACK PWD
#32	1985	582	5026	51800	164.6	5012	410.1	20055	20 GR BLACK PWD
#33	1985	645	4543	50400	162.8	5003	409.2	—	20 GR BLACK PWD
#34	1985	590	4966	48900	160.7	4955	409.5	—	20 GR BLACK PWD
#35	1985	583	5026	50400	149.8	4990	409.4	2007	20 GR BLACK PWD
#36	1985	586	5000	50400	170.8	4978	414.1	—	20 GR BLACK PWD
#37	1985	584	5017	50100	171.7	5029	412.4	—	20 GR BLACK PWD
#38	1985	592	4949	*35400	172.9	4974	412.1	—	20 GR BLACK PWD
#39	1985	591	4958	47200	165.7	4949	412.4	—	20 GR BLACK PWD
#40	1965	588	4983	45100	168.1	4898	NO READING		20 GR BLACK PWD
* P/EDUCE HOLE NOT DRILLED PROPERLY.									

30mm FATCHSE 15E1		PYS	PROJECTILE	BASELINE 2.93-T	
200mm 14.5mm BORE		WT.	WT./GR	PROJECTILE NO.	DATE
LOT 693-15-0317 WEB	1200 GR	1546.2	1002.7	30	10/1/81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1548.8	1002.7	31	10-1-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1548.9	1002.7	32	10-1-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1549.1	1002.7	33	10-1-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1540.0	1003.0	34	10-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1538.0	1002.5	35	10-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1534.0	1003.0	36	10-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1548.1	1002.0	37	10-5-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1541.3	1003.7	38	10-5-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1544.5	1003.0	39	10-5-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1525.5	1003.0	40	10-6-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1541.0	1003.5	41	10-6-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1546.5	1003.0	42	10-6-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1545.6	1002.7	43	10-6-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR			44	10-7-81
LOT RAD-E30-0152 WEB	765 GR				

SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	GUNNER PRESSURE	PHASE TIME 1+2	VEL 1+2	PHASE TIME 7+9	VEL 7+9	PROPEL
41	1985	586	5000	49900	161.6	4977	LOST	-	20 GR BLACK POWDER
42	1890	641	4570	27600	166.4	4586	212.4	-	20 GR BLACK POWDER
43	1985	LOST	LOST	46300	166.5	4946	211.3	-	20 GR BLACK POWDER
44	1945	626	4681	44900	166.6	4863	211.4	-	20 GR BLACK POWDER
45	1985	593	4950	51500	164.2	4993	212.7	-	20 GR BLACK POWDER
46	1985	616	4755	49300	LOST	* LOST	LOST	-	20 GR BLACK POWDER
47	1740	1062	2759	26500	162.3	4408	213.1	2708	20 GR BLACK POWDER
48	1985	586	5000	** 38300	161.7	5005	211.4	-	20 GR BLACK POWDER
49	1920	606	4835	42600	168.3	4814	LOST	NONE	20 GR BLACK POWDER
50	1985	595	4924	** 31100	168.3	4913	251.6	-	20 GR BLACK POWDER
51	1985	589	4925	47900	168.6	4961	211.4	-	20 GR BLACK POWDER
52	1890	618	4741	37500	163.2	4740	213.1	-	20 GR BLACK POWDER
53	1925	607	4827	34100	164.6	4842	211.0	-	20 GR BLACK POWDER
54	1980	593	4950	44400	167.5	4973	211.1	-	20 GR BLACK POWDER
* GUNNER ERROR - DID NOT WAIT FOR SIGNAL TO FIRE.									
** PRESSURE HOLE IN CASE NOT DRILLED PROPERLY.									

30mm FAT CASE 15E1		GRAINS	PROJECTILE	BASELINE 2.93 ÷ T	
200mm 14' SMOOTH BORE		PKG	WEIGHT	PROJECTILE	DATE
ANT		WT	WEIGHT	GRAINS	#
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1546.7	1002.5	45	10-15-81
LOT 693-15-0317 WEB	1350 GR				
LOT RAD-E30-0152 WEB	520 GR	1546.3	1002.5	46	10-15-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1540.5	1002.5	47	10-16-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	715 GR	1550.2	1002.5	48	10-16-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1548.0	1002.5	49	10-16-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1543.8	1002.5	50	10-19-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	520 GR	1541.5	1002.7	51	10-19-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1541.2	1002.7	52	10-19-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	700 GR	1541.4	1002.7	53	10-20-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1548.0	1003.5	54	10-20-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	765 GR	1540.5	1003.5	55	10-20-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	670 GR	1448.4	850.1	56	10-28-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	705 GR	1447.4	850.6	57	10-28-81
LOT 693-15-0317 WEB	1200 GR				
LOT RAD-E30-0152 WEB	760 GR	1450.6	850.5	58	10-28-81

SHOT NO.	TOTAL CHARGE WEIGHT	INST TIME	INST VEL	UPPER PRESSURE	TIME 142	VEL 142	PULSE TIME 719	VEL 719	PRD
55	1985	599	4891	46800	178.3	4923	365.4	-	20 GR BLACK POWDER
56	1985	593	4941	48600	178.7	4924	365.2	-	20 GR BLACK POWDER
57	1985	586	5000	46100	173.3	4959	365.3	-	20 GR BLACK POWDER
58	1985	593	4941	46000	173.2	4964	365.5	-	20 GR BLACK POWDER
59	1985	603	4859	44800	161.1	4910	364.3	-	20 GR BLACK POWDER
60	1985	592	4949	48100	160.3	4976	364.6	-	20 GR BLACK POWDER
61	1985	594	4933	48300	159.8	4959	365.3	-	20 GR BLACK POWDER
62	1985	593	4941	35300	160.8	4954	366.0	-	20 GR BLACK POWDER
63	1985	594	4933	46000	166.7	4958	367.9	-	20 GR BLACK POWDER
64	1985	598	4900	47800	168.5	4953	369.6	-	20 GR BLACK POWDER
65	1985	589	4975	41700	165.9	4936	365.0	-	20 GR BLACK POWDER
66	1985	594	4933	51700	168.4	4964	365.3	-	20 GR BLACK POWDER
67	1820	652	4494	20100	168.7	4522	-	-	20 GR BLACK PWD
68	1850	635	4614	31600	170.1	4614	-	-	20 GR BLACK PWD

30MM FAT CASE 15E1		PKG	PROJECTILE	BASELINE 2.93 ±T	
20MM 14" SMOOTH BORE		WEIGHT	WEIGHT	PROJECTILE #	DATE
ELLIPIT		IN GRAINS	GRAINS		
LOT 693-15-0317 WEB	1200 GR	1541.9	1002.7	59	10-30-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1535.7	1002.7	60	10-30-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1543.3	1002.7	61	10-30-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1539.8	1002.8	62	10-30-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1538.7	1002.7	63	11-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1536.3	1002.7	64	11-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1541.2	1002.7	65	11-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1540.9	1003.0	66	11-2-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1540.8	1002.7	67	11-3-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1545.5	1002.5	68	11-3-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1530.0	1002.5	69	11-3-81
LOT RAD-E30-0152 WEB	765 GR				
LOT 693-15-0317 WEB	1200 GR	1544.8	1002.7	70	11-3-81
LOT RAD-E30-0152 WEB	765 GR				
TUNGSTEN					
LOT 693-15-029 WEB	1200 GR	1441.8	913.0	3	1/7/82
LOT RAD-E30-0152 WEB	600 GR				
LOT 693-15-029 WEB	1200 GR	1480.0	941.5	4	1/7/82
LOT RAD-E30-0152 WEB	630 GR				

SHOT #	WT.	INST TIME	INST VEL	COPPER PRESSURE	1+2 PULSE TIME	VEL	4+5 PULSE TIME	VEL	6+7 RT. VEL	8+9 P.T. VEL	PROPELLANT
69	1850	638	4592	19300	163.9	4624	-	-	-	-	20 GR BLACK POWDER
70	1850	LOST	LOST	36700	161.5	4650	362.7	-	-	-	20 GR BLACK PWD
71	1850	638	4592	35800	159.2	4608	362.6	-	-	-	20 GR BLACK PWD
SHOT #	TOTAL CHG WT.	INST TIME	INST VEL	COPPER PRESSURE	1+2 PULSE T	VEL	4+5 PULSE T	VEL	6+7 RT. VEL	8+9 P.T. VEL	
#1	1400	3556	872	34100	227.2	4300	72.6		83.1		84.0
#2	1000	785	3392		3480	None	41.9	3311	40.3	338	83.4 3327
#3	1150	641	4160		203.4	4098	42.0	4096	40.3	4090	83.8 4013
#4	1130	701	3804		166.7		83.7		82.3		83.5

20 mm FAT CASE 15E1		PKG	PROJECTILE	PROJECTILE	BASELINE 2.93-T	
20mm 14" SMOOTH BORE		WT.	WT.	NO.		
		WT	GRAINS	GRAINS	GRAINS	DATE
OT 693-15-029 WEB	1200 GR	1464.1	918.0	TEST	15 JAN 82	
OT PAD E30-0152 WEB	630			SHOT		
OT 693-15-029 WEB	1200 GR	1448.3	906.5	Q1	15 JAN 82	
OT PAD E30-0152 WEB	630 GR					
OT 693-15-029 WEB	1200 GR	1446.3	919.1	Q2	15 JAN 82	
OT PAD E30-0152 WEB	630 GR					
		PWDR	PROJECTILE	PROJ.	BASELINE 2.67	
		WT	WT.	#	DATE	
TYPE PROPELLANT		GRAINS	PKG WT.		Test-Shots	
IMR 4996	1400 GR	1576.5	1007.0	#1	6 Oct 82	
LOT 45030						
"	1000 GR	1296.3	701.00	#2	7-Oct-82	
"						
"	1150 Gr.	1293.2	704.5	#3	8-Oct-82	
IMR 4996						
LOT 45030		1287.0	702.3	#4	15-Oct-82	

APPENDIX L
UNEXPLODED ORDNANCE SURVEY BY SCIENTECH, INC.

ARDEC Picatinny Arsenal
Building 611B Characterization
Unexploded Ordinance Survey

Notes

1. This information describes the results of a survey done by Scientech, Inc. for identification of areas of the site which contain unexploded ordinance.
2. The material identified was flagged and personnel were instructed to prevent contact with the flagged devices.
3. All ordinance found inside the structure was removed and passed on to the ARDEC EOD group.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699



SCIENTECH, INC.®

15 N. SKYLINE DRIVE ■ IDAHO FALLS, IDAHO 83402 ■ PHONE: 208-523-9552 ■ FAX: 208-523-9380

April 21, 1997

Mr. Tom O'Dou
Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Suite 580
Las Vegas, NV 89106

Subject: DCL-16-97: Inventory of recovered or identified Unexploded Ordnance
and Ordnance and Explosives items at Picatinny Arsenal, New Jersey,
April 14-18, 1997.

Dear Mr. O'Dou:

As per your request on April 17, 1997, the following list of items recovered or identified
at building 611B is submitted.

7.62mm Armor Piercing Projectiles - (20)
50 Caliber Armor Piercing Projectiles - (34)
50 Caliber Primed Brass Cartridge Cases, - (5)
20mm Armor Piercing Incendiary Tracer (APIT) Projectiles - (111)
20mm Primed Brass Cartridge Cases, M103 - (62)
20mm Target Practice (TP) Projectiles - (156)
30mm Primed Brass Cartridge Cases, - (39)
30mm PGU-15B, Cartridges - (4)
Live Cartridge Primers - (6)
Smokeless Powder - (Less than 5 grams)
Tungsten Penetrators - (4)

The above items were removed from the existing buildings located on site 611B and
turned over to the local Explosive Ordnance Disposal (EOD) team for disposition on
April 17, 1997.

EMPLOYEE OWNED

CORPORATE HEADQUARTERS: 1690 INTERNATIONAL WAY ■ IDAHO FALLS, ID 83402 ■ PHONE: 208-523-2077 ■ FAX: 208-529-4721

Mr. Tom O'Dou
DCL-016-97
April 21, 1997
Page 2

The following list of items were located and identified during the magnetometer sweep of the 611B site.

2.36" High Explosive Anti-Tank (HEAT) (Bazooka) - (9)
3.5" High Explosive Anti-Tank (HEAT) Rocket (1)
3.5" Practice Rocket (Dummy) - (1)
57mm High Explosive Recoilless Rifle Projectiles - (5)
57mm High Explosive Armor Piercing Recoilless Rifle Projectile (1)
75mm High Explosive Recoilless Rifle Projectile - (7)
60mm Mortar Rounds - (2)
Grenade, High Explosive Impact Percussion - (1)
Suspect Pipe Bomb (1)

The above items were reported to the local EOD at 1615 on April 17, 1997. They responded on the morning of April 18, 1997 and assumed responsibility for the disposition of all items.

Respectfully Submitted,

David C. Lindsey, Jr.
UXO/OE Project Manager

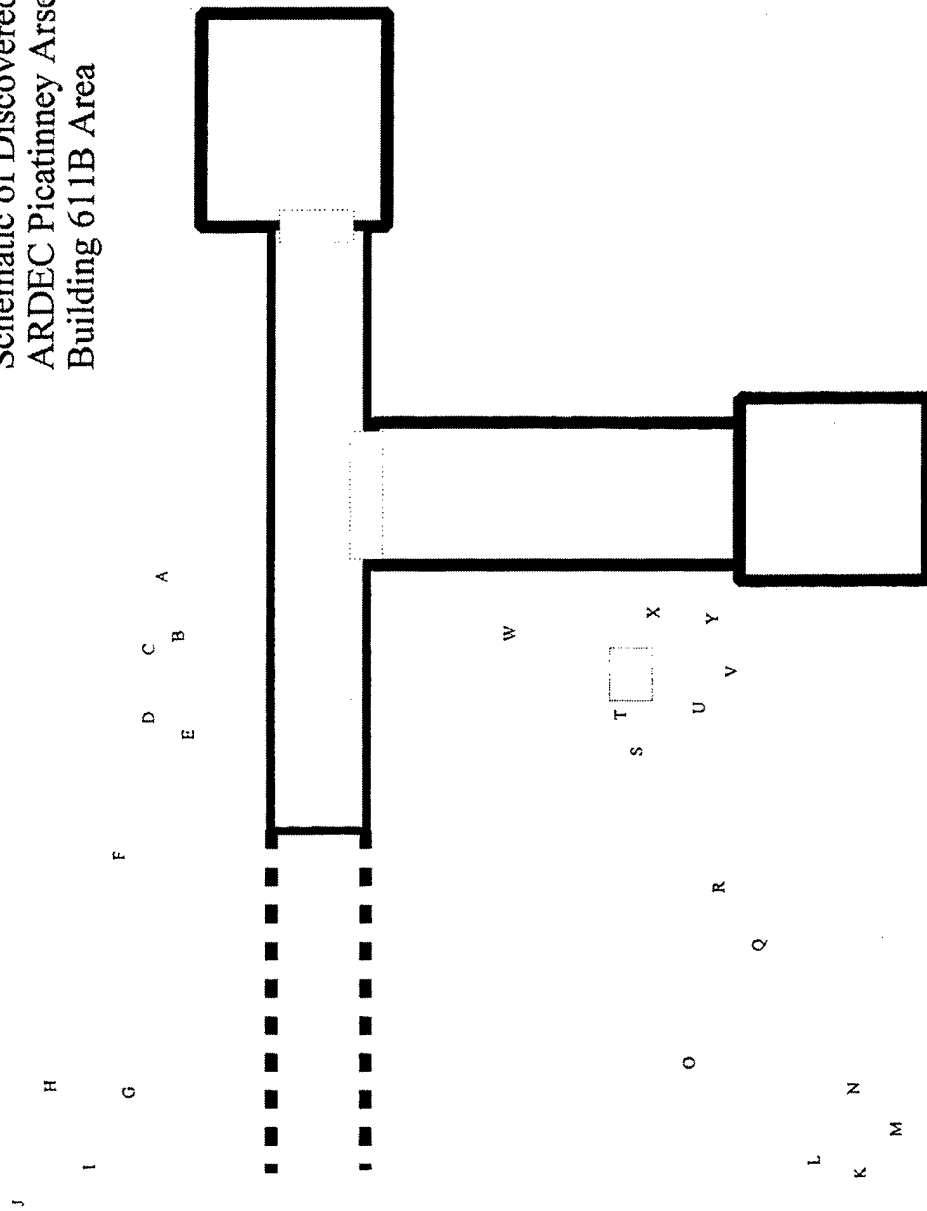
DCL:mr

**Unexploded Ordinance Discovered at ARDEC Picatinny Arsenal
Building 611B Area**

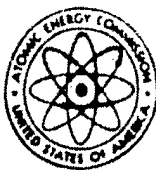
<u>Item Identified</u>	<u>Map Location</u>
2.36" Rocket (HEAT) High Explosive Anti-Tank	A,C,D,H,O,Q,U,W,X
57mm Recoiless Rifle (RR) High Explosive (HX) Projectile	B,E,I,K
75mm RR HX Projectile	F,G,J,L,M,N,P,R
2" Pipe Bomb	O
60 mm mortar rounds	S,T
High Energy Fragmentation Hand Grenade	V
3.5" HEAT	Y

The survey which identified these items was completed by Sciencetech Inc. under contract to GPI.

Gutierrez-Palmenberg, Inc.
 Schematic of Discovered Live Ordinance
 ARDEC Picatinney Arsenal
 Building 611B Area



APPENDIX M
REGULATION GUIDE 1.86, SECTION 5



U.S. ATOMIC ENERGY COMMISSION

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REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 1.06

TERMINATION OF OPERATING LICENSES FOR NUCLEAR REACTORS

A. INTRODUCTION

Section 50.51, "Duration of license, renewal," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that each license to operate a production and utilization facility be issued for a specified duration. Upon expiration of the specified period, the license may be either renewed or terminated by the Commission. Section 50.82, "Applications for termination of licenses," specifies the requirements that must be satisfied to terminate an operating license, including the requirement that the dismantlement of the facility and disposal of the component parts not be inimical to the common defense and security or to the health and safety of the public. This guide describes methods and procedures considered acceptable by the Regulatory staff for the termination of operating licenses for nuclear reactors. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

When a licensee decides to terminate his nuclear reactor operating license, he may, as a first step in the process, request that his operating license be amended to restrict him to possess but not operate the facility. The advantage to the licensee of converting to such a possession-only license is reduced surveillance requirements in that periodic surveillance of equipment important to the safety of reactor operation is no longer required. Once this possession-only license is issued, reactor operation is not permitted. Other activities related to cessation of operations such as unloading fuel from the reactor and placing it in storage (either onsite or offsite) may be continued.

A licensee having a possession-only license must retain, with the Part 50 license, authorization for special nuclear material (10 CFR Part 70, "Special Nuclear Material"), byproduct material (10 CFR Part 30, "Rules of General Applicability to Licensing of Byproduct Material"), and source material (10 CFR Part 40, "Licensing of Source Material") until the fuel, radioactive components, and sources are removed from the facility. Appropriate administrative controls and facility requirements are imposed by the Part 50 license and the technical specifications to assure that proper surveillance is performed and that the reactor facility is maintained in a safe condition and not operated.

A possession-only license permits various options and procedures for decommissioning, such as mothballing, entombment, or dismantling. The requirements imposed depend on the option selected.

Section 50.82 provides that the licensee may dismantle and dispose of the component parts of a nuclear reactor in accordance with existing regulations. For research reactors and critical facilities, this has usually meant the disassembly of a reactor and its shipment offsite, sometimes to another appropriately licensed organization for further use. The site from which a reactor has been removed must be decontaminated, as necessary, and inspected by the Commission to determine whether unrestricted access can be approved. In the case of nuclear power reactors, dismantling has usually been accomplished by shipping fuel offsite, making the reactor inoperable, and disposing of some of the radioactive components.

Radioactive components may be either shipped off-site for burial at an authorized burial ground or secured

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Published guides will be revised periodically, as appropriate to accommodate comments and to reflect new information or experience.

Copies of published guides may be obtained by request indicating the divisions desired to the U.S. Atomic Energy Commission, Washington, D.C. 20545. Attention: Director of Regulatory Standards. Comments and suggestions for improvement in these guides are encouraged and should be sent to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545. Attention: Chief, Public Proceedings Staff.

The guides are issued in the following ten broad divisions:

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|-----------------------------------|------------------------|
| 1. Power Reactors | 6. Products |
| 2. Research and Test Reactors | 7. Transportation |
| 3. Fuel and Materials Facilities | 8. Occupational Health |
| 4. Environmental and Site | 9. Antitrust Review |
| 5. Materials and Plant Protection | 10. General |

on the site. Those radioactive materials remaining on the site must be isolated from the public by physical barriers, or other means to prevent public access to hazardous levels of radiation. Surveillance is necessary to assure the long term integrity of the barriers. The amount of surveillance required depends upon (1) the potential hazard to the health and safety of the public from radioactive material remaining on the site and (2) the integrity of the physical barriers. Before areas may be released for unrestricted use, they must have been decontaminated or the radioactivity must have decayed to less than prescribed limits (Table I).

The hazard associated with the retired facility is evaluated by considering the amount and type of remaining contamination, the degree of confinement of the remaining radioactive materials, the physical security provided by the confinement, the susceptibility to release of radiation as a result of natural phenomena, and the duration of required surveillance.

C. REGULATORY POSITION

1. APPLICATION FOR A LICENSE TO POSSESS BUT NOT OPERATE (POSSESSION-ONLY LICENSE)

A request to amend an operating license to a possession-only license should be made to the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545. The request should include the following information:

- a. A description of the current status of the facility.
- b. A description of measures that will be taken to prevent criticality or reactivity changes and to minimize releases of radioactivity from the facility.
- c. Any proposed changes to the technical specifications that reflect the possession-only facility status and the necessary disassembly/retirement activities to be performed.
- d. A safety analysis of both the activities to be accomplished and the proposed changes to the technical specifications.
- e. An inventory of activated materials and their location in the facility.

2. ALTERNATIVES FOR REACTOR RETIREMENT

Four alternatives for retirement of nuclear reactor facilities are considered acceptable by the Regulatory staff. These are:

- a. **Mothballing.** Mothballing of a nuclear reactor facility consists of putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive

fluids and waste should be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures should be established under a possession-only license to ensure that the health and safety of the public is not endangered.

- b. **In-Place Entombment.** In-place entombment consists of sealing all the remaining highly radioactive or contaminated components (e.g., the pressure vessel and reactor internals) within a structure integral with the biological shield after having all fuel assemblies, radioactive fluids and wastes, and certain selected components shipped offsite. The structure should provide integrity over the period of time in which significant quantities (greater than Table I levels) of radioactivity remain with the material in the entombment. An appropriate and continuing surveillance program should be established under a possession-only license.

- c. **Removal of Radioactive Components and Dismantling.** All fuel assemblies, radioactive fluids and waste, and other materials having activities above accepted unrestricted activity levels (Table I) should be removed from the site. The facility owner may then have unrestricted use of the site with no requirement for a license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of.

- d. **Conversion to a New Nuclear System or a Fossil Fuel System.** This alternative, which applies only to nuclear power plants, utilizes the existing turbine system with a new steam supply system. The original nuclear steam supply system should be separated from the electric generating system and disposed of in accordance with one of the previous three retirement alternatives.

3. SURVEILLANCE AND SECURITY FOR THE RETIREMENT ALTERNATIVES WHOSE FINAL STATUS REQUIRES A POSSESSION-ONLY LICENSE

A facility which has been licensed under a possession-only license may contain a significant amount of radioactivity in the form of activated and contaminated hardware and structural materials. Surveillance and commensurate security should be provided to assure that the public health and safety are not endangered.

- a. **Physical security** to prevent inadvertent exposure of personnel should be provided by multiple locked barriers. The presence of these barriers should make it extremely difficult for an unauthorized person to gain access to areas where radiation or contamination levels exceed those specified in Regulatory Position C.4. To prevent inadvertent exposure, radiation areas above 5 mR/hr, such as near the activated primary system of a power plant, should be appropriately marked and should not be accessible except by cutting of welded closures or the disassembly and removal of substantial structures.

and/or shielding material. Means such as a remote-readout intrusion alarm system should be provided to indicate to designated personnel when a physical barrier is penetrated. Security personnel that provide access control to the facility may be used instead of the physical barriers and the intrusion alarm systems.

b. The physical barriers to unauthorized entrance into the facility, e.g., fences, buildings, welded doors, and access openings, should be inspected at least quarterly to assure that these barriers have not deteriorated and that locks and locking apparatus are intact.

c. A facility radiation survey should be performed at least quarterly to verify that no radioactive material is escaping or being transported through the containment barriers in the facility. Sampling should be done along the most probable path by which radioactive material such as that stored in the inner containment regions could be transported to the outer regions of the facility and ultimately to the environs.

d. An environmental radiation survey should be performed at least semiannually to verify that no significant amounts of radiation have been released to the environment from the facility. Samples such as soil, vegetation, and water should be taken at locations for which statistical data has been established during reactor operations.

e. A site representative should be designated to be responsible for controlling authorized access into and movement within the facility.

f. Administrative procedures should be established for the notification and reporting of abnormal occurrences such as (1) the entrance of an unauthorized person or persons into the facility and (2) a significant change in the radiation or contamination levels in the facility or the offsite environment.

g. The following reports should be made:

(1) An annual report to the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545, describing the results of the environmental and facility radiation surveys, the status of the facility, and an evaluation of the performance of security and surveillance measures.

(2) An abnormal occurrence report to the Regulatory Operations Regional Office by telephone within 24 hours of discovery of an abnormal occurrence. The abnormal occurrence will also be reported in the annual report described in the preceding item.

h. Records or logs relative to the following items should be kept and retained until the license is terminated, after which they may be stored with other plant records:

- (1) Environmental surveys,
- (2) Facility radiation surveys,
- (3) Inspections of the physical barriers, and
- (4) Abnormal occurrences.

4. DECONTAMINATION FOR RELEASE FOR UNRESTRICTED USE

If it is desired to terminate a license and to eliminate any further surveillance requirements, the facility should be sufficiently decontaminated to prevent risk to the public health and safety. After the decontamination is satisfactorily accomplished and the site inspected by the Commission, the Commission may authorize the license to be terminated and the facility abandoned or released for unrestricted use. The licensee should perform the decontamination using the following guidelines:

a. The licensee should make a reasonable effort to eliminate residual contamination.

b. No covering should be applied to radioactive surfaces of equipment or structures by paint, plating, or other covering material until it is known that contamination levels (determined by a survey and documented) are below the limits specified in Table I. In addition, a reasonable effort should be made (and documented) to further minimize contamination prior to any such covering.

c. The radioactivity of the interior surfaces of pipes, drain lines, or ductwork should be determined by making measurements at all traps and other appropriate access points, provided contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement should be assumed to be contaminated in excess of the permissible radiation limits.

d. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated in excess of the limits specified. This may include, but is not limited to, special circumstances such as the transfer of premises to another licensed organization that will continue to work with radioactive materials. Requests for such authorization should provide:

(1) Detailed, specific information describing the premises, equipment, scrap, and radioactive contaminants and the nature, extent, and degree of residual surface contamination.

(2) A detailed health and safety analysis indicating that the residual amounts of materials on surface areas, together with other considerations such as the prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

e. Prior to release of the premises for unrestricted use, the licensee should make a comprehensive radiation survey establishing that contamination is within the limits specified in Table I. A survey report should be filed with the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545, with a copy to the Director of the Regulatory Operations Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report should:

- (1) Identify the premises;
- (2) Show that reasonable effort has been made to reduce residual contamination to as low as practicable levels;
- (3) Describe the scope of the survey and the general procedures followed; and
- (4) State the finding of the survey in units specified in Table I.

After review of the report, the Commission may inspect the facilities to confirm the survey prior to granting approval for abandonment.

5. REACTOR RETIREMENT PROCEDURES

As indicated in Regulatory Position C.2, several alternatives are acceptable for reactor facility retirement. If minor disassembly or "mothballing" is planned, this could be done by the existing operating and maintenance procedures under the license in effect. Any planned actions involving an unreviewed safety question

or a change in the technical specifications should be reviewed and approved in accordance with the requirements of 10 CFR §50.59.

If major structural changes to radioactive components of the facility are planned, such as removal of the pressure vessel or major components of the primary system, a dismantlement plan including the information required by §50.82 should be submitted to the Commission. A dismantlement plan should be submitted for all the alternatives of Regulatory Position C.2 except mothballing. However, minor disassembly activities may still be performed in the absence of such a plan, provided they are permitted by existing operating and maintenance procedures. A dismantlement plan should include the following:

- a. A description of the ultimate status of the facility
- b. A description of the dismantling activities and the precautions to be taken.
- c. A safety analysis of the dismantling activities including any effluents which may be released.
- d. A safety analysis of the facility in its ultimate status.

Upon satisfactory review and approval of the dismantling plan, a dismantling order is issued by the Commission in accordance with §50.82. When dismantling is completed and the Commission has been notified by letter, the appropriate Regulatory Operations Regional Office inspects the facility and verifies completion in accordance with the dismantlement plan. If residual radiation levels do not exceed the values in Table I, the Commission may terminate the license. If these levels are exceeded, the licensee retains the possession-only license under which the dismantling activities have been conducted or, as an alternative, may make application to the State (if an Agreement State) for a byproduct materials license.

TABLE I

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE ^a	AVERAGE ^{b c}	MAXIMUM ^{b d}	REMOVABLE ^{b c}
U-nat, U-235, U-238, and associated decay products	5,000 dpm α /100 cm ²	15,000 dpm α /100 cm ²	1,000 dpm α /100 cm ²
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm ²	300 dpm/100 cm ²	20 dpm/100 cm ²
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm ²	3000 dpm/100 cm ²	200 dpm/100 cm ²
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm β - γ /100 cm ²	15,000 dpm β - γ /100 cm ²	1000 dpm β - γ /100 cm ²

^aWhere surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

^bAs used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

^cMeasurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

^dThe maximum contamination level applies to an area of not more than 100 cm².

^eThe amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

APPENDIX N
PROJECT MANAGER'S LOG (O'DOU)

ARDEC Picatinny Arsenal
Building 611B Characterization
Project Manager Log

Notes

1. This information describes the daily coordination of work and any obstacles observed at building 611B.
2. This log has been provided to Joe Fabiano, Health Physicist at the site for information.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

Project Status Daily ARDEC - Picatinny Arsenal Gutierrez-Palmenberg, Inc.

Day 1: Monday April 14, 1997

Completed book training of crew in the morning: six GPI employees:

Tom O'Dou	Dave Davis
Jimmy Maffessanti	JR Ruprecht
Ron Grosjean	Chuck White

At 1420 we arrived at the arsenal to visit with Mr. Fabiano regarding Safety, Police, Environmental, Chemistry, and Fire and emergencies. The meeting was canceled by Mr. Fabiano. However, Mr. Fabiano did meet with us to discuss the job and plans and most of what was expected to happen in the next few weeks, this meeting was very informative.

All but Chuck now have clearances. Chuck and Ron went to the airport to get the Scientech UXO contractors.

Day 2: Tuesday April 15, 1997

Met with Scientech people; went to site at 0630; got security clearances for them and Chuck.

We arrived at 611B at approximately 0700. After a brief tour of the facility to get everyone familiar with the safety needs there, Don Ebersole and Dave Lindsey from Scientech began their search for explosive devices in the 611B structure. Don and Dave found and removed several unfired primers in the instrument room and entryway into firing/target area.

By the end of this day we had all interior areas scanned and cleared for explosives, API projectiles were found in the storage area adjacent to the target room.

Radiological situation: There is not a serious radiological problem here. Any materials found with detectable activity have been segregated and will be stored in double bags in (nomenclature for the storage box). Items were found in the instrument room and in the closest storage area with count rates as high as 500 cpm on the Model 3 with a pancake probe.

Surveys were completed on materials in the instrument room, and the two storage areas. At this point I estimate that the instrument room is 30% clear, one storage area is 90% clear and the other is 50% clear. Characterization surveys have not been started, they will start when all unnecessary items and materials are removed from the facility.

Ray Siez, the building supervisor is providing support for the characterization by assisting in the removal of materials from the area after they have been cleared.

Day 3: Wednesday April 16, 1997

We arrived at the site at 0700 and began removal of clean materials for disposal in the dumpster at building 606. All disposed of materials were No Detectable Counts Above Background.

JR and Dave continued frisking in the instrument room. All electronics boxes showed no detectable counts above background.

Items found radioactive: One pair of gloves, a pair of shoes, the base structure for the electronics housing, and the drain lines from the sink in the instrumentation room.

Day 4: Thursday April 17, 1997

Arrived at the work site at 0700. It rained most of the day with a temperature of approximately 50 degrees. Continued work on clearing material from the building. Several items from the hallway including tools, cabinets, tyveks, rubber gloves, and boxes were found to have observable count rates above background. These items are now controlled as radioactive.

Mr. Fabiano and Mr. Styvaert visited the site and I gave Mike his copy of the work plan, health and safety plan and the quality assurance plan.

The base EOD crew (two sargents) arrived at 0830 to identify and contain the items found by the Scientech contractors Dave and Don. At approximately 0900 five more personnel arrived at the site, 4 military, 1 civilian. Several of the ordinance found were removed from the site, several more remain at the site and will have to be detonated in place. This should happen either Friday or Saturday.

Progress: The storage areas have been cleared (95%), the instrument room (90%), the foyer entrance to the firing areas (20%), the storage area in the building (35%). Gridding is complete for the outside survey.

Day 5: Friday April 18, 1997

We arrived at the site at 0700, Dave Lindsey and Don Ebersole left yesterday. Several unexploded ordinance remain at the site but the base EOD is now in charge of that material. It rained and then snowed at the site with the ambient temperature approximately 30 degrees.

We continued work on the instrument room then gridded most of the room for the characterization survey. I anticipate that we will complete gridding this room on Monday and complete it's characterization survey by Wednesday.

Work was also done on the DU range to clear as much of the miscellaneous instrumentation remaining in the area. This included tools used for pressing primers into place, large C clamps,

and the x-ray machine EM field monitors. Many of the items taken from the DU range have count rates of 100 to 50,000 cpm.

This room will provide the majority of radioactive waste generated. No radioactive material bags have been received. Radioactive items are being stored in heavy duty trash bags with radioactive material stickers. When we receive the materials we will re-bag the materials into more suitable bags.

Progress: The storage areas have been cleared (99%), the instrument room (95%), the foyer entrance to the firing areas (40%), the storage area in the building (35%). Gridding is complete for the outside survey. Outside work and work in the storage areas were not done today because of the weather.

Day 6: Saturday April 19, 1997

We didn't go to the site today, technicians completed survey forms.

Day 7: Sunday April 20, 1997

Bought 2 ladders and miscellaneous equipment for survey. Faxed time cards to Phoenix. Completed sample chain of custody forms, will ship samples this week.

Day 8: Monday April 21, 1997

Arrived at the site at 0700. Still no radioactive material bags.

Work completed on clearing material from the instrument room. This room has been completely gridded and some of the characterization surveys have been completed. The remainder of our surveys of this room will be complete tomorrow.

The entrance to the range areas were cleared today with most of the material released upon clearance survey. All materials found to be radioactive have been double bagged and labeled, logged into the tracking system and stored in the radioactive material storage area.

All wiring to pulsers and x-ray guns has been removed from the DU firing area and stored as radioactive waste. The x-ray guns have also been wrapped, removed from the area, and stored as radioactive. Some of these materials may be deconned and released during the remediation phase.

The target table and other miscellaneous materials have been packaged and removed from the target room. Will complete cleanup of the room tomorrow.

I met with Mr. Fabiano to discuss the project to this point and to get a briefing on operation of the Tennelec in the Health Physics lab. I will count smears in the lab tomorrow.

Day 9: Tuesday, April 22, 1997

Arrived at the site at 0700. Mr. Fabiano, IH and Safety called off their tour...may come tomorrow. We will continue on the characterization of the instrument room and cleanup of the non-DU range. Still no radioactive materials bags although this situation may be resolved in the next few days.

Jimmy continued characterization of the instrument room. Two areas were identified with fixed contamination on the wall (near where the sink was) and on the floor under where the sink was. This survey should be finished by tomorrow.

Dave, JR, and Chuck worked on cleanup and disassembly of equipment in the non-DU firing range hallway. Many pieces of equipment were found with the highest reading at 48 uR/hour on a target stand which was stored in the non-DU range. All radioactive materials found were packaged and as possible were stored in the storage area.

170 smears from the building were counted on the ARDEC Tennelec system. The highest removable activity was less than 50 picocuries. The system works great but cleaning the planchettes after counting is a chore. I priced planchettes at \$320/1000 from Oxford the new owners of Tennelec.

I met with Mr. Fabiano regarding a memo that he wrote to describe the project to this point. I only have one significant comment, we must be more attentive to our contact when we have an appointment for a meeting. Be sure to call at least three hours in advance of any meetings with customers.

We received the letter from Scienteck describing the ordinance found when we started the project. I put together a map from discussion with Don and Dave when they were here. This was given to Mr. Fabiano today.

Surveyed many items off the "open storage area" before coming across several metal pieces with contamination levels of up to 10,000 cpm. The contamination is fixed to the metal surface.

Progress: The storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (60%), the storage area in the building (35%), the DU firing range (40%), and the DU target room (20%). Gridding is complete for the outside survey, the entrance room and the instrument room. The instrument room characterization survey is 95% complete.

Day 10, Wednesday April 23, 1997

Arrived at the site at 0700. Upon arrival we noticed that a rodent had entered the count room and chewed up a filter that was prepared for the vacuum cleaner. The mess was then cleaned up.

We began to work primarily on the outside of the building focusing on the "outside storage area". Many pieces of steel (plates and items) were found to be contaminated in this area. Also, a box was found with significant contamination with evidence of a yellow flaking material in the bottom of the box. The count rate on this material was approximately 10,000 cpm. We controlled the material and followed the path of rain from the box and found fixed contamination above limits on the deck surface. Then the plywood section was removed from the deck and it was found that the material was also present in the cracks between the plywood. Some of this material was collected, bagged, and labeled. There is a lot of stuff under the open storage area floor, mostly wood. We had discussions with Mr. Fabiano about the activity found. I expect to meet with Mr. Fliszar, the base RPO in the morning.

At approximately 8:30 Mr. Fabiano, Ian Rosenblum (Chief of IH), and Pat Riley (Safety Specialist) came by to check out our operation. They toured the instrument room, non-DU firing room, DU firing room, DU target room and the exterior of the facility. Ian took some samples of the paint (to test for lead) and the floor tiles (to test for asbestos). The tour was satisfactory, no safety violations (or even recommendations for improvement).

During the characterization survey of the entryway, several tiles moved aside which caused increased count rates due to the collection of radioactive materials in the cracks between the tiles. It appears that most tiles in the typical walk path have this problem. The floor was not frequently washed and cannot simply be cleaned to remove the problem. A typical path of travel was surveyed and the instrument room floor, and outside on the pavement read greater than 1000 cpm. During the remediation this floor will have to be removed and decision made to find a suitable disposal site for that material.

With several outside sources found today, we have begun after several years of inoperation, to find the "hidden places" where contamination is present. The open storage area (gazebo) will generate more waste since it will need to be destroyed. The floor, pieces of beams under the floor, and any surface materials found to be contaminated.

At this point we have completed the 100% scan of the instrumentation room, all that remains is taking readings with the 2221 on all grids. We will train on the use of the 100 cm² probe during surveys of the grids. The initial survey for the building foyer is approximately 20% complete.

There has not been contact from EOD since last week. Several pieces of unexploded ordinance remain in the back yard.

Progress: The storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (80%), the storage area in the building (35%), the DU firing range (60%), and the DU target room (60%). Gridding is complete for the outside survey, the entrance room and the instrument room. The instrument room characterization survey is 98% complete, the survey for the foyer is approximately 20% complete. The open storage area has been cleared and survey is in progress.

Day 11: Thursday, April 24, 1997

Dixie Wells arrived last night and will be on-site today and tomorrow to audit our operations. Dixie may also be working in the count room to count smears and air samples.

Arrived at the site at 0700, continued removal of material from the non-DU tunnel. Activity was identified on several steel blocks in the end of the range. Several items were cleared and removed from the area.

The non-DU range was cleared of material by 1500 and gridding of the area was started. This area will be the main focus over the next few days in order to maximize the efficiency of the crew with Dixie Wells counting smears. By the end of the day, most of the gridding for this area was complete.

A spot was found when a rubber mat was moved from the non-DU entry way which caused a count rate of 20,000 cpm. The material was collected and controlled.

We are awaiting permission from the base IH (Ian Rosenblum) to remove the tile from several areas so that we can more accurately characterize the floor. All areas which were heavy traffic appear to have activity between the cracks greater than the limits.

More asbestos is suspected in the electrical wiring (very old stuff). Ian will be notified to collect samples of this as well.

The cap was removed from the UST pipe. A frisk of the inside of the pipe (on the threads) caused a net count rate of greater than 100 cpm. The frisker was then lowered into the pipe and at the full length of the cable the count rate was greater than 100 cpm. We lowered a weighted string into the tank and found that the bottom of the tank was approximately 7.5 feet below the top of the tank fill pipe. The water level in the tank is approximately 3 inches.

Ron and Dixie worked in the counting lab.

Still no radioactive material bags and no tags!

Progress: The storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (100%), the storage area in the building (35%), the DU firing range

(60%), and the DU target room (60%). The instrument room characterization survey is 98% complete, the survey for the foyer is approximately 90% complete. The open storage area has been cleared of material and the survey revealed several spots greater than 100 net cpm. Some spots were found in excess of 300 cpm.

Day 12, Friday, April 25, 1997

We arrived at the site at 0700. The primary focus for today will be gridding and survey of the non-DU range.

Gridding and smearing of the non-DU hallway was completed. This represents a significant effort and a large number of smears were collected - these are being counted by Dixie Wells.

Ian (IH) showed up and collected samples of the old wiring found on the heaters for asbestos. Also, Ian indicated that he sent an e-mail to Joe about us being able to remove the vinyl tile from the floor to assist our characterization.

Ron worked on clearing material from the storage area at the end of the DU tunnel. Most materials have now been cleared from the room and it has been vacuumed.

At the current time radioactive materials removed from the facility will fill about two B-25 boxes. This represents approximately 250 cubic feet of waste. Also, approximately 20 cubic yards (540 cubic feet) of material have been removed from the site and cleared. It is estimated that a maximum of four B-25 boxes could hold all of the waste from the remediation.

A brief survey of the HEPA system externals revealed fixed activity on the base of the system with count rates up to 500 cpm. The sealant which was used on some of the system components has count rates up to 300 cpm. We were told there were two fires in the system over the history of the site.

We got permission from the State of NJ to use LAS labs for the analysis of the soil samples as planned. All samples at the site have been taken except the background samples and boxed for shipment, we expect to do this on Monday.

Progress: The external (mobile) storage areas have been cleared (100%), the instrument room (100%), the foyer entrance to the firing areas (100%), the storage area in the building (95%), the DU firing range (60%), and the DU target room (60%). The instrument room characterization survey is 99% complete, the survey for the foyer is approximately 100% complete. The open storage area has been cleared of material and the survey revealed several spots greater than 100 net cpm, the area has been posted with caution tape and several pieces of plywood lifted from the floor. Some spots were found in excess of 300 net cpm. The characterization grids for the non-DU range are complete and smears of the non-DU range have been taken.

Day 13, Monday, April 28, 1997

We arrived at the site at 0700. A rainy day, relatively cold. Dave was sick today, we worked inside with our little heater warming the area. We continued to focus on the non-DU tunnel. We are approaching 30% on this.

I completed a scoping survey of the DU target room. This included GM probe evaluation, smears, and gamma scintillation detector response from all of the room's surfaces. The 100 cm² scintillator response remains here but with the extensive GM evaluation, only 2 readings per grid need to be evaluated.

Rich Fliszar showed up at the site in the afternoon. He toured the facility and I briefed him on the current status of the project. He had no comments on the tour I am sure this means that all is fine. Rich will be out of town till next Thursday. Andy will be acting in his place. Joe remains as our primary contact.

Dixie counted smears in the HP lab. We have completed smears for the non-DU tunnel, Instrument room, foyer, and smears for the DU target room were taken today. The DU tunnel will be gridded tomorrow to facilitate using Dixie to our full advantage. She will be here till Thursday.

After all of the smear surveys are complete, we will complete the inside characterization, then outside, then the HEPA storage area.

Day 14: Tuesday, April 29, 1997

Here's the latest score and how to keep track of things:

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	0%
Non-DU Tunnel	100%	100%	50%	100%	20%
DU Tunnel	100%	100%	0%	100%	0%
Inside Storage	95%	100%	0%	100%	0%
Open Storage	100%	100%	10%	0%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%

It was a nice day after the freezing cold morning. Temperatures actually may have exceeded 70 degrees (21 degrees C) and we could take off our coats. We all miss home.

The work focused on completion of all smears so that we could ensure that the counting lab was not needed any more. This was achieved.

After lunch the crew focused on paperwork to try to get caught up on surveys. Jimmy continued with 100 cm² readings with the 2221. The rough surfaces on the walls have made some small holes in the mylar, the problem was temporarily corrected with white-out.

Dixie analyzed the smears from the target room and found loose surface activity up to 30,000 dpm. This was expected to be high but not as high as reported. The remainder of the smears collected for the project have been passed to Dixie for counting.

I met with Joe at 12:20 to discuss the project thus far and to resolve some of the support issues needed to ensure success of the project. These included:

- 1) Meeting with the base EOD Sargent (Smith) who said they will not be removing any more materials from the site and we should stay away from flagged items when we do our work. Any further removal of EOD would require that the base get a contractor to clear the area on and under the surface. This would require that we leave until this could be done.

2) The list of materials that have been cleared thus far was faxed to Mr. Clune for removal of the items from the site. We will get a call just before they come to the site.

3) I met with Ted Gable, the environmental person in charge of reports. They would like us to follow their standard report format for characterization. I explained that I would attempt to keep to their format as much as practical but that my contract specifications did not include a report format and I must keep to a project schedule and cost.

In addition, we reviewed the report that was written last week for my concurrence with the status of the project. This was really to bring Joe up to speed on how we are doing. The following items were discussed:

- 1) Lab security and sound control.
- 2) We got our Rad bags (finally).
- 3) Details of the Daily Status report (this log).
- 4) Site safety.
- 5) Penetration to the area beyond the target room to seek a wayward bullet?

We purchased some more supplies, rubber gloves, duct tape, and markers.

At this point I can say that the degree of contamination is higher than expected and the degree of poor weather makes me want to retire to LV.

Tomorrow we will continue to focus on the 100 cm² survey of the non-DU range and frisking of the DU range.

Day 15: Wednesday, April 30, 1997

Once again, here's the latest score and how to keep track of things:

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	0%
Non-DU Tunnel	100%	100%	50%	100%	20%
DU Tunnel	100%	100%	50%	100%	0%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%

It was a nice day today. Temperatures exceeded 70 degrees.

The crew focused on paperwork to try to get caught up on surveys. Jimmy continued with 100 cm² readings with the 2221. Dave continued working on the DU hallway and made a major dent in the frisking of those surfaces.

Dixie analyzed the remainder of the smears from all areas. All smears have been completed.

People showed up to move the clean material from the site. Most of the clean storage area was emptied, they will be back to get more when we get our surveys to Mr. Fabiano.

Tomorrow we will continue to focus on the 100 cm² survey of the non-DU range and frisking of the DU range.

Day 16: Thursday, May 1, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	0%
Non-DU Tunnel	100%	100%	60%	100%	30%
DU Tunnel	100%	100%	70%	100%	0%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	0%	0%	0%	0%	0%

It rained and was cold today. The perdiem checks for next week have been passed out and the expense reports signed.

The crew continued to focus on paperwork. Jimmy continued with 100 cm² readings with the 2221. Dave continued working on the DU hallway.

People showed up to move the clean material from the site. The clean storage area is now cleared out and the metal target plates have been removed from the site. A dumpster was left on site for our use.

The 100 cm² survey of the DU target room is complete. This completes the characterization of this room.

Tomorrow we will continue to focus on the 100 cm² survey of the non-DU range and frisking of the DU range.

Day 17: Friday, May 2, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	50%
Non-DU Tunnel	100%	100%	70%	100%	35%
DU Tunnel	100%	100%	70%	100%	20%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	0%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	(1)	0%	0%	0%	0%

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was cold today.

The crew continued to focus on paperwork. Jimmy and I continued with 100 cm² readings with the 2224 and 2221. Ron continued working on the non-DU hallway.

It's the week end!

Day 18: Monday, May 5, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	100%
Non-DU Tunnel	100%	100%	90%	100%	45%
DU Tunnel	100%	100%	80%	100%	40%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	30%	100%	10%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	(1)	NA	0%	0%	NA

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was a decent day for New Jersey.

The focus today was completion of paperwork and continue to plug away at the characterization readings. Documentation is complete for the last surveys.

We continued to work on frisk surveys and final survey for the DU and non-DU tunnels. This is taking the most time right now because of the higher amount of activity found than was indicated to be present.

We began detailed surveys of the open storage area to more accurately determine it's status. At the current time it looks like there is activity present on the open storage area structure (floor).

Since the structure of the open storage area is above fixed contamination limits, 10000 dpm/100 cm² the area around the open storage area must be surveyed as potentially affected, the base of wood should either be removed or covered and posted. I'm leaning toward removal of the floor and determination of what is under the floor of this structure. If tomorrow is a good day, we will probably focus outside.

Day 19: Tuesday, May 6, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey
Instrumentation	100%	100%	100%	100%	100%
Foyer	100%	100%	100%	100%	100%
Non-DU Tunnel	100%	100%	90%	100%	60%
DU Tunnel	100%	100%	80%	100%	60%
Inside Storage	100%	100%	0%	100%	0%
Open Storage	100%	100%	60%	100%	70%
Mobile Storage #1	100%	100%	100%	100%	0%
Mobile Storage #2	100%	100%	100%	100%	0%
Outside Grounds	NA	50%	NA	NA	0%
DU Target Room	100%	100%	100%	100%	100%
HEPA Ventilation	(1)	NA	0%	0%	NA

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was a disgusting day even for New Jersey, mostly rain and cold.

We continued to work on frisk surveys and final survey for the DU and non-DU tunnels. This is continues to take the most time.

Survey packages are beginning to come together for most areas.

We completed most of the grids outside on the open storage area, and posted the area for radioactive materials.

Day 20: Wednesday, May 7, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	90%	100%	80%	>1000 cpm
DU Tunnel	100%	100%	80%	100%	70%	>10000 cpm
Inside Storage	100%	100%	60%	100%	0%	>500 cpm
Open Storage	100%	100%	100%	100%	70%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	0%	NDA
Mobile Storage #2	100%	100%	100%	100%	0%	NDA
Outside Grounds	NA	50%	NA	NA	0%	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	0%	0%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

It was a cold and windy day but at least it wasn't raining. We focused on the outside work in anticipation of rain for the remainder of the week.

We continued to work on frisk surveys and final survey for the DU and non-DU tunnels.

Mr. Fabiano came to the work site for a tour around the facility during our work, no comments were provided. I also went to Mr. Fabiano's office to discuss the project log and some questions I had about control of the wood surface on the open storage area. We will recommend some type of semi-permanent control of the material such as painting the wood surface.

Day 21: Thursday, May 8, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	100%	100%	85%	>1000 cpm
DU Tunnel	100%	100%	85%	100%	80%	>10000 cpm
Inside Storage	100%	100%	100%	100%	40%	>500 cpm
Open Storage	100%	100%	100%	100%	70%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	0%	NDA (2)
Mobile Storage #2	100%	100%	100%	100%	0%	NDA
Outside Grounds	NA	50%	NA	NA	0%	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	100%	100%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

(2) NDA = No Detectable Activity, upon investigation there was no response of field instruments to these areas and laboratory instruments found no evidence of activity.

It was a nicer day and again it didn't rain. Continued frisking and large probe surveys.

The Open Storage Area surface where fixed contamination caused as much as 8000 cpm on the 100 cm² probe was sealed by painting with a latex covering. This will seal the activity from migration during the time between this characterization and remediation of the site.

The HEPA system was surveyed in depth today, some smearable activity was identified outside of the filter bank, this approaches the limits for surface contamination and indicates that activity has been released from this system by improper operation or by improper removal of filters or both. Only one filter was found in the system and the last stage filter has collected activity over the years of operation or as a result of the destruction of the first two stages in a fire. A smear at the outlet of the system indicates the presence of activity above background. This system is contained somewhat but personnel access to these spaces should be restricted.

Day 22: Friday, May 9, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	100%	100%	100%	>1000 cpm
DU Tunnel	100%	100%	100%	100%	80%	>10000 cpm
Inside Storage	100%	100%	100%	100%	40%	>500 cpm
Open Storage	100%	100%	100%	100%	100%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	100%	NDA (2)
Mobile Storage #2	100%	100%	100%	100%	0%	NDA
Outside Grounds	NA	100%	NA	NA	NA	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	100%	100%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

(2) NDA = No Detectable Activity, upon investigation there was no response of field instruments to these areas and laboratory instruments found no evidence of activity.

It rained again a cold wet breeze. We continued the survey of the inside storage area and various small surveys throughout the building. We received the employee manuals and the mylar windows, thanks.

Mr. Fabiano visited the site early today to review our progress and deliver the latest weekly report he prepares.

I spoke with Mike Styvaert, Rich Fliszar and Joe Fabiano yesterday. As a result of those conversations, we can keep our original copy of the counting data and the open storage area could be sealed with latex to prevent erosion of the activity from the wooden surface.

Documentation once again received a lot of attention. A lot of time was spent on organization of the data collected, all data to this point has been tracked and is filed by survey serial number.

Day 23: Monday, May 12, 1997

Room	Clearance	Gridding	Frisking	Smearing	Final Survey	Highest Response
Instrumentation	100%	100%	100%	100%	100%	300 cpm
Foyer	100%	100%	100%	100%	100%	500 cpm
Non-DU Tunnel	100%	100%	100%	100%	100%	>1000 cpm
DU Tunnel	100%	100%	100%	100%	100%	>10000 cpm
Inside Storage	100%	100%	100%	100%	100%	>500 cpm
Open Storage	100%	100%	100%	100%	100%	>5000 cpm
Mobile Storage #1	100%	100%	100%	100%	100%	NDA (2)
Mobile Storage #2	100%	100%	100%	100%	NA (3)	NDA
Outside Grounds	NA	100%	NA	NA	NA	12 ur/hr
DU Target Room	100%	100%	100%	100%	100%	>10000 cpm
HEPA Ventilation	(1)	NA	100%	100%	NA	>10000 cpm

(1) The system was opened on 5/2/97 and only the third stage filter is present. Readings on the filter are approximately 3000 cpm with areas of the housing inside reading up to 30000 cpm. The filter was left in place to provide a barrier to the environment.

(2) NDA = No Detectable Activity, upon investigation there was no response of field instruments to these areas and laboratory instruments found no evidence of activity.

(3) Mobile storage area #2 is used as a Radioactive Material Storage Area and a final release survey will not be done until after the remediation of the facility.

It was a beautiful day today, the sun shined through the clouds and it did not rain.

We continued the survey of the inside storage area and various small surveys throughout the building.

Mr. Eric Reber from the NRC visited the site today to conduct an inspection of our work in accordance with the guidelines of our work plan, H&S plan, etc. No violations were cited and no recommendations for improvement were even suggested by the inspector.

We are preparing to package everything and leave the site tomorrow.

Day 24: Tuesday, May 13, 1997

We arrived on site at the usual time, 0700 and packaged all material for shipment.

All surveys are now complete, and the materials which were released from the site have been taken to building 7 as directed by Mr. Fabiano.

We cleaned up the outside and inside of the structure preparing things to be secure until the remediation.. We met with Mr. Fabiano to discuss the project and our activities while we were on site.

Storage box number 2 is the designated radioactive material storage area and will remain on-site until removal of all material.

APPENDIX O

NRC LICENSE AND NRC CORRESPONDENCE

ARDEC Picatinny Arsenal
Building 611 B Characterization
NRC License and Correspondence

Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Las Vegas, NV 89106
702-647-5699

Gutierrez - Palmenberg, Inc.

333 North Rancho Drive, Suite 580
Las Vegas, Nevada 89106

April 11, 1997

Joe Fabiano
ARDEC
AMSTA-AR-QAS-R, Bldg 320
Picatinny, NJ 07806-5000

Dear Mr. Fabiano,

Based on your conversation with Thomas O'Dou, PM for the ARDEC characterization, this AM, I will attempt to respond to your concerns with regard to the Picatinny Arsenal-ARDEC Work Package.

The Work Package was submitted to the Walnut Creek Field Office of Region IV with a cover letter dated March 20, 1997. In accordance with License Condition 13 of NRC License # 29-27103-01, it was submitted at least two (2) weeks prior to the expected start date of the project. Both Mr. O'Dou and myself have discussed the Work Package with the Region IV NRC point of contact since that time.

I can, therefore, assure you that the complete Work Package has been received and is on file with the NRC in that office. I have talked to our NRC contact and you are free to call Ms. Beth Prange at 1-510-975-0250 if you have any further questions regarding our license or the submittal of the Work Package to them.

If you have any other questions or concerns, please call me at the Las Vegas office at 1-702-647-5699.

Thank you,

Dixie J. Wells
Radiation Safety Officer
GPI-Las Vegas

cc: Thomas O'Dou, PM
Walter Cunningham, VP
Beth Prange, NRC Region IV
File

Engineers

Consultants

Managers

Telephone: (702) 647-5699

24-Hour Telecopies: (702) 647-6180

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee		3. License Number	27-29103-01
1. Gutierrez-Palmenberg, Inc.		4. Expiration Date	December 31, 2001
2. 333 North Rancho Drive, Suite 580 Las Vegas, Nevada 89106		5. Docket or Reference No.	030-34257
6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License	
A. Any byproduct material with Atomic Nos. 1 through 83	A. Any	A. 100 curies	
B. Any byproduct material with Atomic Nos. 84 through 103	B. Any	B. 1 curie	
C. Any source material	C. Any	C. 10,000 kilograms	
D. Any special nuclear material	D. Any	D. 350 grams uranium 235, or 200 grams plutonium, or 200 grams uranium 233, or any combination of these provided the sum of the ratios of the quantities does not exceed unity	
9. Authorized use			
A. through D. For receipt, storage, use and or possession incidental to any activity as follows:			
(1) Decontamination of facilities, equipment and containers;			
(2) Solidification and treatment of wastes;			
(3) Packaging for transport;			
(4) Any activity related to site characterization; and			
(5) Transport in packages or containers approved for use under the provisions of 10 CFR 71, for transfer to licensees authorized to receive the materials, in accordance with the terms and conditions of licenses issued by the NRC or an Agreement State.			

**MATERIALS LICENSE
SUPPLEMENTARY SHEET**

License Number

27-29103-01

Docket or Reference Number

030-34257

CONDITIONS

10. Licensed materials shall be used only at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material. Except for calibration sources, reference standards, and radioactively contaminated equipment owned by the licensee, possession of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site after licensee activities are completed.
11. A. Licensed material shall be used by, or under the supervision of, individuals designated in writing by the Radiation Safety Committee, Thomas J. O'Dou, Chairperson.
- B. The Radiation Safety Officer for this license is Dixie J. Wells.
12. In addition to the possession limits in Item 8, the licensee shall further restrict the possession of licensed material to quantities below the limits specified in 10 CFR 30.72 which require consideration of the need for an emergency plan for responding to a release of licensed material.
13. The licensee shall notify the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011, ATTN: Director, Division of Nuclear Material Safety, in writing at least 14 days before initiating activities under this license at a temporary job site. This notification shall include:
- A. The estimated type, quantity, and physical/chemical forms of licensed material to be used
 - B. The specific site location
 - C. A description of planned activities including waste management and disposition
 - D. The estimated start date and completion date for the job, and
 - E. The name and title of a point of contact for the job, including information on how to contact the individual.
14. This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by a customer's license. If a customer also holds a license issued by the NRC or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensee activities shall be performed under the customer's license and supervision,

**MATERIALS LICENSE
SUPPLEMENTARY SHEET**

License Number

27-29103-01

Docket or Reference Number

030-34257

14. (Continued)

and which licensee activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall include a commitment by the licensee and the customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of this agreement shall be included in the notification required by License Condition 13.

15. The licensee shall maintain records of information important to decommissioning each temporary job site at the applicable job site pursuant to 10 CFR 30.35(g), 40.36(f), and 70.25(g). The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.
16. Pursuant to 10 CFR 30.11, 40.14, and License Condition 10., the licensee is exempted from the requirements of 10 CFR 30.35, 40.36, and 70.25 to establish decommissioning financial assurance.
17. If approved by a Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when the action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the NRC before, if practicable, and in any case immediately after taking such emergency action using the reporting procedure specified in 10 CFR 30.50(c).
18. Within 30 days of completing activities at each job site location, the licensee shall notify the Regional Administrator, U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76019, ATTN: Director, Division of Nuclear Material Safety, in writing of the temporary job site status and the disposition of any licensed material used.
19. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.
20.
 - A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as specified by the certificate of registration referred to in 10 CFR 32.210.
 - B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

**MATERIALS LICENSE
SUPPLEMENTARY SHEET**

License Number

27-29103-01

Docket or Reference Number

030-34257

20. (Continued)

- C. In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.
- D. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.
- E. Sealed sources need not be leak tested if:
- (i) they contain only hydrogen-3; or
 - (ii) they contain only a radioactive gas; or
 - (iii) the half-life of the isotope is 30 days or less; or
 - (iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or
 - (v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.
- F. The leak test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(b)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region IV, 611 Ryan Plaza Drive, Suite 400, Arlington, Texas 76011, ATTN: Director, Division of Nuclear Materials Safety. The report shall specify the source involved, the test results, and corrective action taken.
- G. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to perform such services.
21. The licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under the license.

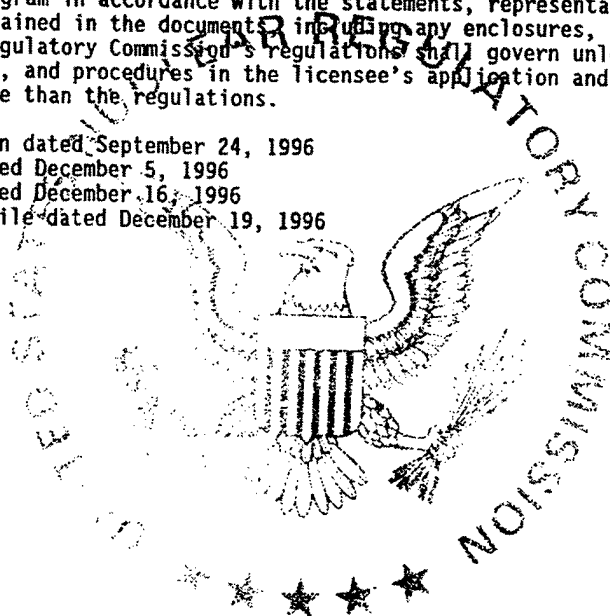
**MATERIALS LICENSE
SUPPLEMENTARY SHEET**

License Number

27-29103-01

Docket or Reference Number
030-34257

22. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."
23. This license does not authorize the import of byproduct material wastes.
24. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.
 - A. Application dated September 24, 1996
 - B. Letter dated December 5, 1996
 - C. Letter dated December 16, 1996
 - D. Telefacsimile dated December 19, 1996



FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date **DEC 19 1996**

By Materials Branch
Region IV, WCFO
Walnut Creek, California 94596

APPENDIX P
RADIATION WORK PERMITS (GPI AND ARDEC)

ARDEC Picatinny Arsenal
Building 611B Characterization
Radiation Work Permits

Notes

1. This information describes the requirements imposed by GPI and ARDEC - Picatinny Arsenal on the site work.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

RADIATION WORK PERMIT w SUPPLEMENT No. 97-7
(for operations not covered by SOP)

PART I. Request for Work Permit (triplicate)

Type of Radiation: Alpha, Beta, Gamma

Location: Building Number 611B and Associated Structures and Grounds Date: 11 April 1997

Description of Operation: HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

Name	TLD#	Exposure Dose (R)	Name	TLD#	Exposure Dose (R)
See Supplement					

Printed Name and Title of Supervisor <u>Jimmy Maffessanti, Project Supervisor</u>	Signature of Supervisor <u>[Signature]</u>
--	---

PART II. Radiation Protection Officer (RPO) Approval/Disapproval

☒ Approved ☐ Disapproved The RPO will be notified prior to commencement and upon termination of operation. Protective Clothing and Equipment Requirements, and Special Instructions are:

Protective Clothing and Equipment PER GPI HEA & SAF PLAN			
☐ Coveralls	☐ Pants	☐ Safety shoes	☐ Eye protection
☐ Lab coats	☐ Gloves	☐ Shoe covers	☐ Ear protection
☐ Other		☐ Respirator	☐ Head covering
Special Instructions SEE SUPPLEMENT			
☒ Personnel monitoring required before leaving area.			
☒ Tool monitoring required at completion of work.			
☒ No cuts or abrasions permitted on hands or forearms.			
☒ Air monitoring: Breathing Zone	☐ Personal	☐ General	☐ Process--
☒ *Personnel Dosimetry: Whole Body	☒ Hand & fingers		

IAW
GPI
PROC

*ARDEC

Date: 4-14-97

Signature of RPO: _____

PART III: Work Termination Statement

☐ Request RWP be extended to _____.

☐ Work was completed on _____.

Date: _____

Signature of Supervisor: _____

PART IV: RPO Review

☐ Area has been decontaminated to appropriate levels.

☐ No internal radiation exposures >5% MPD.

☐ Comments: _____

Date: _____

Signature of RPO: _____

SUPPLEMENT TO RADIATION WORK PERMIT NUMBER 97-7

HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

1. Prerequisites and Precautions:

- a. ARDEC Radiation Work Permit (RWP) approved and conspicuously posted at the site. All radiological work shall be controlled through the implementation of this Radiological Work Permit.
- b. Feedback information meetings will be held weekly between the Radiation Protection Office and GPI to discuss the previous weeks findings.
- c. Characterization of DU contamination at the 611B site will be done under Gutierrez - Palmenberg, Inc. US NRC license Number 27-29103-01, Reference No. 030-34257.
- d. Radiological controls will be in effect for all work within Radiologically Controlled Work Zones.
- e. All project personnel will understand and comply with the contents of the ARDEC RWP and Updated GPI Characterization Work Plan, Quality Assurance Plan and Health and Safety Plan.
- f. No matches, lighters or cameras within the enclosure without special permission.
- g. No smoking, eating, drinking in controlled radiation areas.
- h. All emergency calls are to be directed to 201 724 6666.
- i. GPI will sweep for Unexploded surface and subsurface Ordnance around Building 611B evaluating and identifying "ring offs" prior to characterization.
- j. Pre and Post Depleted Uranium Bioassays are required. Specimens and confirmatory samples must be sent to a New Jersey Certified Laboratory such as Teledyne Isotopes, Westwood, NJ.
- k. Personnel protective equipment or engineering devices must be used to protect individuals and clothing from radioactive contamination during characterization efforts.
- l. ARDEC issued dosimeters are to be worn in all radiologically controlled areas including the Health Physics laboratories in Building 320 by crew and visitors.
- m. Portable instruments must have current calibration labels such as for the Model 3 with Model 44-9 pancake G-M probe and 44-X (100sqcm beta scintillator probe) for beta and gamma detection, the Ludlum Model 19 (micro R-meter) (Sodium Iodide detector) for gamma and x-ray detection, and the Ludlum 2224 or 2221 countrate meter/scaler (100sqcm alpha/beta scintillation probes) for beta emissions from large surfaces.
- n. Low Volume Air Samplers will be used for ambient air samples, HEPA vacuum for removing loose dust, concrete chips, etc. magnetic locator from the Shonstend Instrument Company for detecting unexploded ordnance.
- o. Sampling grids will be constructed/established for each affected area in accordance with NUREG/CR-5849 and guidance from the Industrial Operations Command such as 1 m grids inside known areas of contamination, 3 m grids in adjacent areas and 10m grids on the outskirts of the facility.

SUPPLEMENT TO RADIATION WORK PERMIT NUMBER 97-7 CONTINUED

HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

- p. Electrical, water, and telephone utilities servicing the building will be located, verified, and isolated by GPI.
 - q. GPI is to supply planchets and cloth smears for collecting samples especially over rough surfaces.
 - r. Under no circumstances will radioactively contaminated items be free released from any work location. Tools, equipment, etc. will be frisked prior to release.
 - s. Bottoms of shoes and hands will be frisked upon leaving the radiologically controlled areas and the laboratories in Building Number 320.
 - t. Soil remediation levels for Depleted Uranium are to be in accordance with the New Jersey Department of Environmental Protection Agency for unrestricted, non-residential (industrial) use i.e. 35 pCi/g above background and consistent with NRC requirements
 - u. Practice good personal hygiene and wash hands after activities involving radiological work.
 - v. GPI should avoid conducting outdoor radiological activities during inclement weather.
 - w. GPI will carry swipes in strong, tight, appropriately lined/labeled carrying cases, load smear samples onto planchets/carriers/equipment, unload and dispose of planchets/swipes using good health physics practices.
 - x. Copies of reports, records or correspondence will be maintained at a location on post selected by GPI for review by government agencies.
 - y. All GPI postings, materials and equipment will be removed from the "clean" areas and the grounds left in swept/raked condition at the completion of work.
 - z. No deviations from this permit are permitted without the approval of the ARDEC Radiation Protection Office.
2. Personnel identified below shall participate in the Phase I Characterization of Building Number 611B and associated grounds.
- a. Tom O'Dou (Certified Health Physicist, Project Manager, PM)
 - b. Jimmy Maffessanti (Project Supervisor, PS)
 - c. J.R. Ruprecht (Senior Technician, RPS)
 - d. Dave Davis (Senior Technician)
 - e. Chuck White (Senior Technician)
 - f. Ron Grosjean (Junior Technician)
 - g. Tony Mason (Senior Health Physicist)
 - h. Dixie Wells (Radiation Safety Officer)
 - i. Roger Palmenberg (GPI Vice President)
 - j. Gilbert Gutierrez (GPI President)
 - k. David Lindsey (UXO expert)
 - l. Donald Ebersole (UXO expert)

SUPPLEMENT TO RADIATION WORK PERMIT NUMBER 97-7

HQ USA PROJECT #96-108 PHASE I-CHARACTERIZATION

3. This permit authorizes:

- a. Pre-work receipt of supplies and setting up a work area.**
 - b. Signing out the keys from the Radiation Protection Office for Bldg. No. 611B, the storage room, and outside shelters and returning them at the end of Phase I to the Radiation Protection Office.**
 - c. Sweeping areas for unexploded ordnance.**
 - d. Setting up a grid system**
 - e. Segregating contaminated from non-contaminated items for processing.**
 - f. Characterizing the 611B site, including the mound of dirt behind the target room storage area and the underground storage tank.**
 - g. Utilizing the Health Physics Laboratory Gas Flow Proportional Counter in Building Number 320 for counting swipe samples and air samples.**
 - h. Use of facilities and office supplies in Buildings Numbered 320, 617 and/or 7 on an "as needed" basis.**
 - i. Gathering the data required for developing a decommissioning plan.**
- 5. The POC for this action is the undersigned.**

**JOSEPH A. FABIANO
HEALTH PHYSICIST
14 APRIL 1997**

Gutierrez-Palmenberg, Inc.

Las Vegas, NV & Phoenix, AZ

RADIOLOGICAL WORK PERMIT

RSO USE ONLY	
Permit Number	AR-1
Effective Date	4/01/1997
Expiration Date	5/25/1997

GENERAL INFORMATION (to be completed by the requester)					
Requested by Thomas J. O'Dou	Request Number 3	ID Number AR-1	Group PM	Phone No. 7-5699	Mail Stop 580
Work Location ARDEC - Picatinny Arsenal	Technical Area SEC	Building 611B	Substructure In And Out	Room No. All	
SOP Number WORK PLAN	Small Job Ticket No. H&S PLAN	Work Order No.	Requested Start Date 4/15/1997	Expected End Date 5/16/1997	
Work to be performed (add attachment if necessary) ☒ RSO review is needed ☐ RSO review is attached					
Characterize building 611B and grounds for DU contamination resulting from firing DU rounds inside the building 611B firing range into the target room. Areas of primary concern for contamination control are: 1) The target room 2) The firing room 3) The HEPA ventilation system Contamination controls shall be used for sampling of the UST outside building 611B. The sink and piping in the instrumentation room shall be considered potentially contaminated prior to removal.					
PRE-JOB RADIOLOGICAL CONDITIONS (to be completed by the RCT/HPT)					
☒ Anticipated radiological conditions (Enter anticipated conditions if a survey cannot be performed before work begins), or ☐ Measured radiological conditions (Record all readings as highest / general area.) ☐ See attached map					
Surface Contamination (dpm/100 sq cm) External Dose Rate (mrem/hr in work area)					
Alpha	Direct ND	Smear ND	LAS (large area swipe) ND	Beta + gamma	.1
Beta/gamma	10000	1200	ND	Neutron	0
Tritium		ND		Total (b + g + n)	.1
Identify anticipated radionuclides: U-238 TH-234 U-234 PA-234 PA-234M		Airborne Radioactivity Isotope U-238 DAC 0.001		☒ Anticipated or ☐ Measured	
Identify any contamination under paint or on inaccessible surfaces: Not anticipated - possibly in target room					
Completed by RCT / HPT ☒ Completed		Name Thomas J. O'Dou		Signature [Signature]	Date 1/09/1997

Radiological Work Permit

AR-1

ALARA/RADIOLOGICAL PROTECTION REQUIREMENTS (to be completed by RCT)				
Protective Clothing Requirements ☐ None ☒ Level I (Coveralls, 2 pair surgeon's gloves, and booties) ☐ Lab coat ☐ Skull cap ☐ Hood ☐ Level II (2 Coveralls, 2 pair surgeon's gloves, and 2 pair booties) ☒ Gloves ☒ Booties ☐ Tapes openings ☒ Other: Only required in contaminated areas				
Respiratory Requirements ☒ None ☐ Respirator fit test card ☐ SCBA* ☐ Full-face respirator ☐ Ventilation ☐ Combination cartridge* ☐ Supplied air mask* ☐ Particulate cartridge ☐ Chemical cartridge* ☐ Supplied air suit* ☐ Job-specific air monitoring <i>*Requires RSO or CHP approval</i> ☒ Other: Unless indicated otherwise at job site.				
Dosimetry Requirements ☐ None ☒ WB dosimeter ☐ Supplemental dosimeter ☐ TLD finger rings ☐ Special neutron dosimetry ☐ Pu access list ☐ Alarming dosimeter ☒ Special unanalysis ☐ Whole-body count ☐ Accident Dosimeter ☐ Nasal swipes ☐ Other:				
Monitoring Requirements ☐ None ☐ Notify RCT before job starts @ ☐ Intermittent coverage ☒ Personnel before leaving job ☐ Notify RCT at job end ☐ Continuous coverage ☐ RCT monitor doffing of anti-Cs ☒ Equipment and tools before removal ☒ Self-frisking ☒ Other: Only from contaminated areas.				
Training Requirements ☐ RW I ☐ RW II ☒ Other: As required by GPI License & OSHA 40 hr				
Additional ALARA Requirements ☒ None ☐ ALARA pre-job briefing ☐ ALARA review (see attachment)				
Completed by RCT Name Signature ID Number Date ☒ Completed Thomas J. O'Dou <i>[Signature]</i> PM-1 1/09/1997				
HOLD POINTS / SPECIAL INSTRUCTIONS (to be completed by the RCT)				
Hold Points or Special Instructions: Protective clothing required in firing rooms (booties and gloves), in target room (tyveks, booties, gloves, taped), and when accessing HEPA filter bank internals (tyvek, booties, gloves, taped openings). HEPA system to be bagged prior to opening. Floor outside HEPA banks to be covered with plastic prior to removal of HEPA filters. HEPA bank to be emptied for characterization. New HEPA filters may be installed at discretion of ARDEC (Fabiano), or HEPA system to be disabled with plastic seal and electrically disabled. Areas of loose surface contamination above limits or near limits will be posted during the characterization.				
Completed by RCT Name Signature ID Number Date ☒ Completed Thomas J. O'Dou <i>[Signature]</i> PM-1 1/09/1997				

Form GPI-RWP

Page 2 of 3

Radiological Work Permit

AR-1

APPROVALS

	Name	Signature	ID Number	Group	Date
1. Line Manager ☒ Approved	Thomas J. O'Dou		PM-1	VEGAS	1/09/1997
2. RCT Supervisor ☒ Approved	Dixie J. Wells		RSO-1	RSO	1/14/1997
3. Facility Manager ☒ Approved	Thomas J. O'Dou		PM-1	VEGAS	3/24/1997
4. Other ☐ Approved	Name	Signature	ID Number	Group	Date

POST-JOB RADIOLOGICAL CONDITIONS (to be completed by the RCT/HPT)

Measured Radiological Conditions (Record all readings as highest / general area.)

☐ See attached map

Surface Contamination (dpm/100 sq cm)			External Dose Rate (mrem/hr in work area)	
Direct	Smear	LAS (large area swipe)	Beta + gamma	Neutron
Alpha				
Beta/gamma				
Tritium			Total (b + g + n)	

Airborne Radioactivity

DAC _____ ☐ Estimated or
Isotope _____ ☐ Measured

Survey of Personnel Leaving Job Site

☐ Personnel contaminated above applicable limits
(If yes, attach the Radiological Incident Report.)

Completed by RCT / HPT) Name _____ Signature _____ Z Number _____ Date _____
☐ Completed

REVIEW

Associated reports for this job (indicate the ones that apply):

- | | | |
|--|---|--|
| ☐ CAM results | ☐ Nasal swipe data | ☐ RWP acknowledgment log |
| ☐ Job-specific air monitoring | ☐ Urinalysis report | ☐ Dose tracking report |
| ☐ Pre-job survey data | ☐ Whole-body count | ☐ Radiological occurrence/incident report |
| ☐ Post-job survey data | ☐ Wound count | ☐ Changes in ALARA/rad protection reqs |
| ☐ Finger-ring data | ☐ Skin contamination | ☐ ALARA pre-job briefing |
| ☐ Special dosimetry results | ☐ Personal clothing survey | ☐ Formal ALARA review |
| ☐ Other: _____ | | |

☐ Lessons learned (If Yes, then briefly explain. Add attachment if necessary.)

Reviewed by RCT ☐ Reviewed	Name	Signature	ID Number	Date
Reviewed by RCT Supervisor ☐ Reviewed	Name	Signature	ID Number	Date

RWP Access Log

RWP No: AR-1 Revision No: 1 Date: 4/15/97

Work Location: AREEC Picatinny Arsenal bldg 8 Start Date: 4/15/97 End Date: _____

Date	Name	SSN/IDN	Badge/ID	PIC/SRD	Time In	Dose In	Time Out	Dose Out	T/Dose	Resp. (%)
4/15	T. O'Don	016-44-6745	31039 0171068	NA	NA	NA	NA	NA		NA
	J. Maffessanti	161-40-8727	3103906 0053114							
	R. Grosjean	273 78-2957	21039 0037719							
	D. Davis	260-25-4007	31039-003 8062465							
	C. White	535-98-8444	31039-003 8061999							
	R. Ruprecht	022-46-2602	31039 0040631							
4/16	D. Lindberg									
	D. Zwersole									
4/24	D. Wells	485-90-8169	0069182							

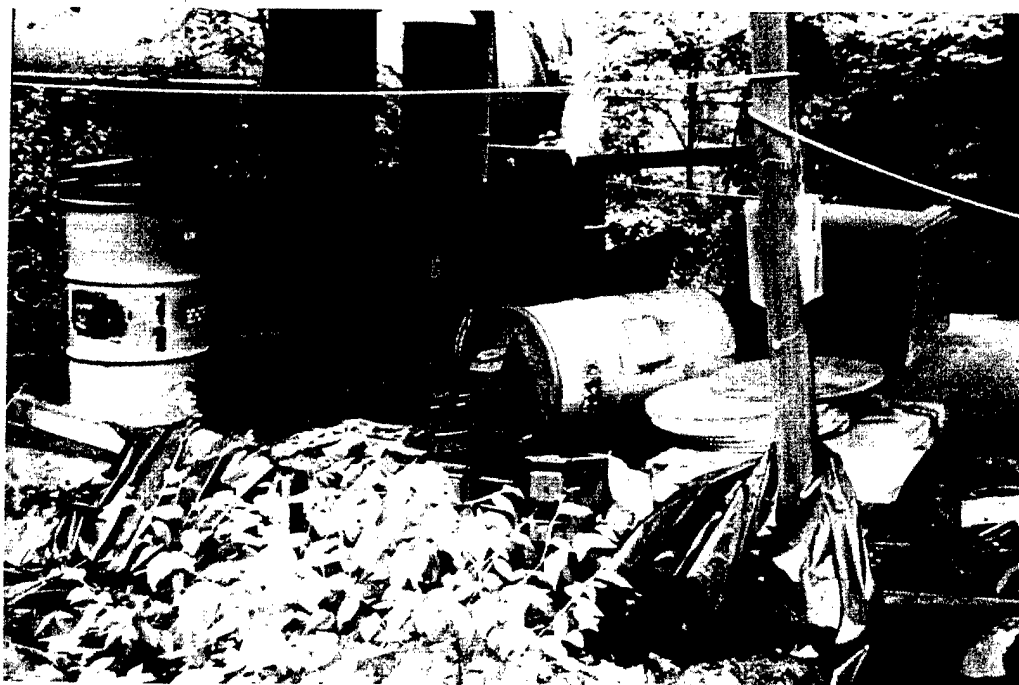
APPENDIX Q
SITE PHOTOGRAPHS BEFORE CHARACTERIZATION

ARDEC Picatinny Arsenal
Building 611 B Characterization
Site Photographs After Characterization

Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Las Vegas, NV 89106
702-647-5699



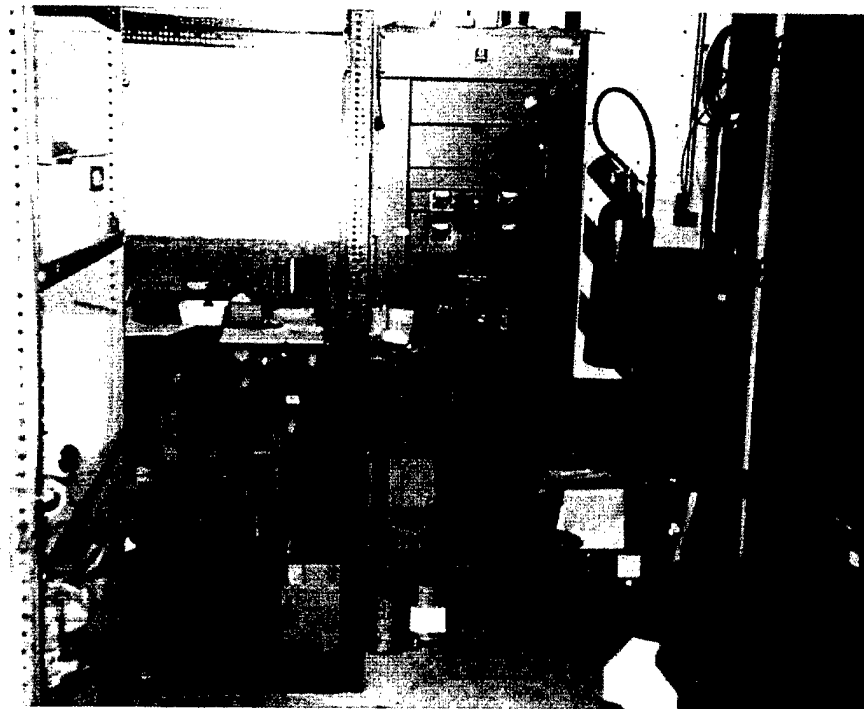
DU Target Room before characterization in foreground.



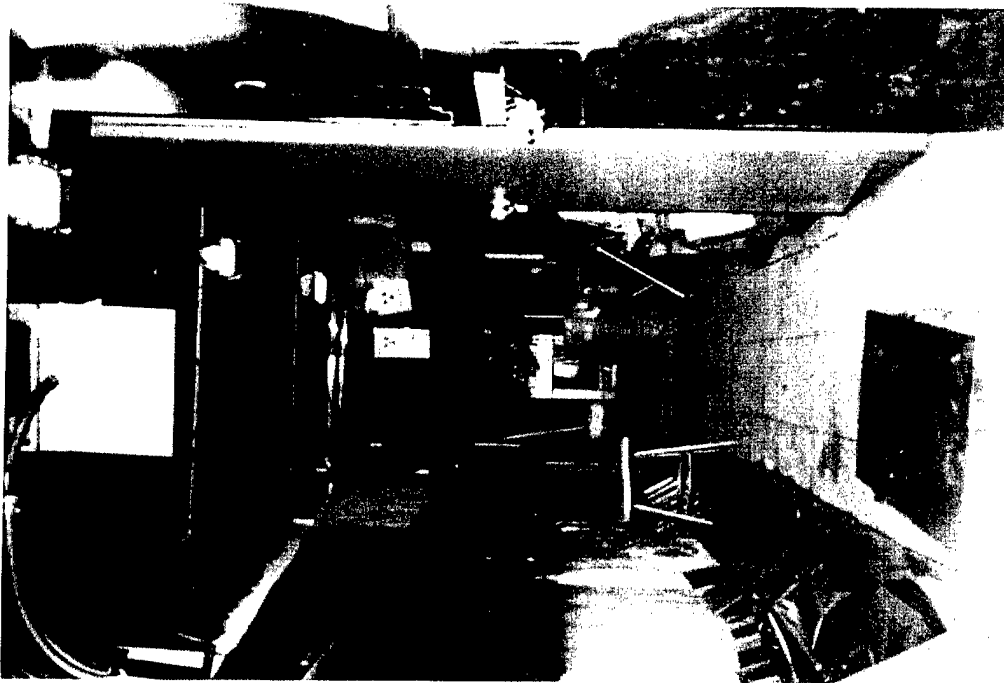
Open Storage Area before characterization.



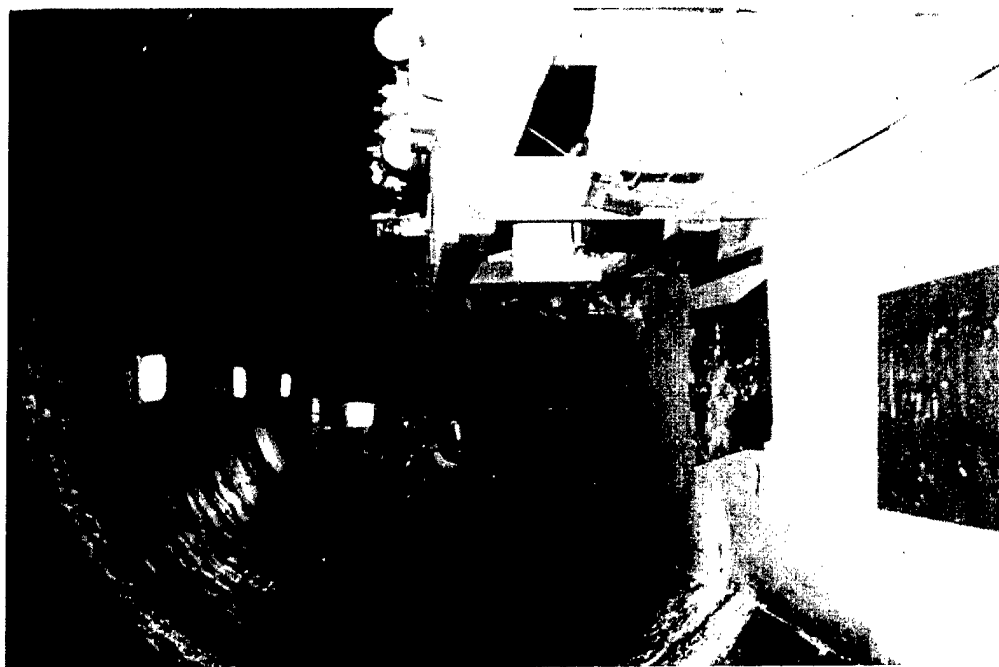
DU Tunnel from Target Room before characterization



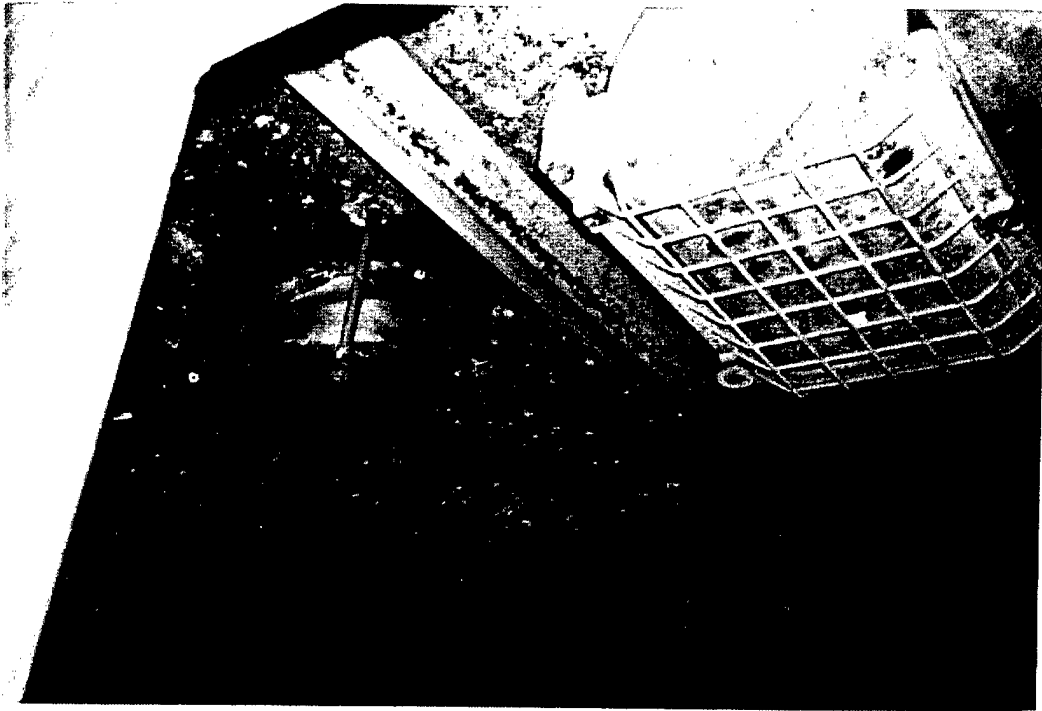
Instrument Room before characterization.



Non-DU tunnel from entrance before
characterization.



DU tunnel from entrance at the intersection with the
non-DU tunnel before characterization.

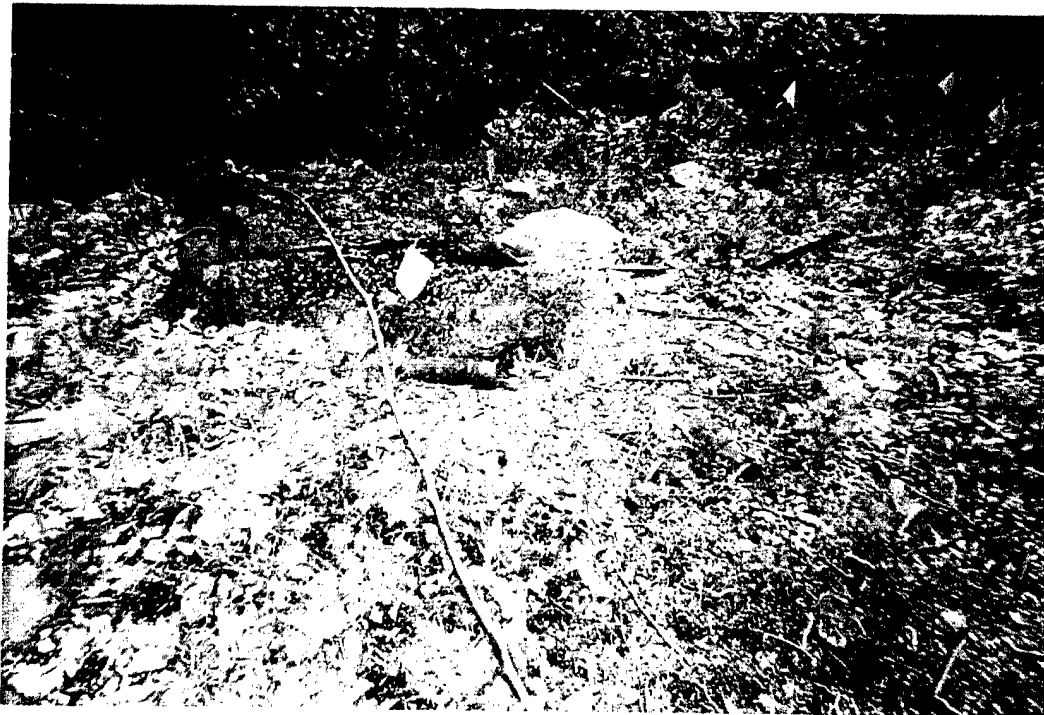


DU Target room ceiling with light fixture and duct to HEPA ventilation before characterization.

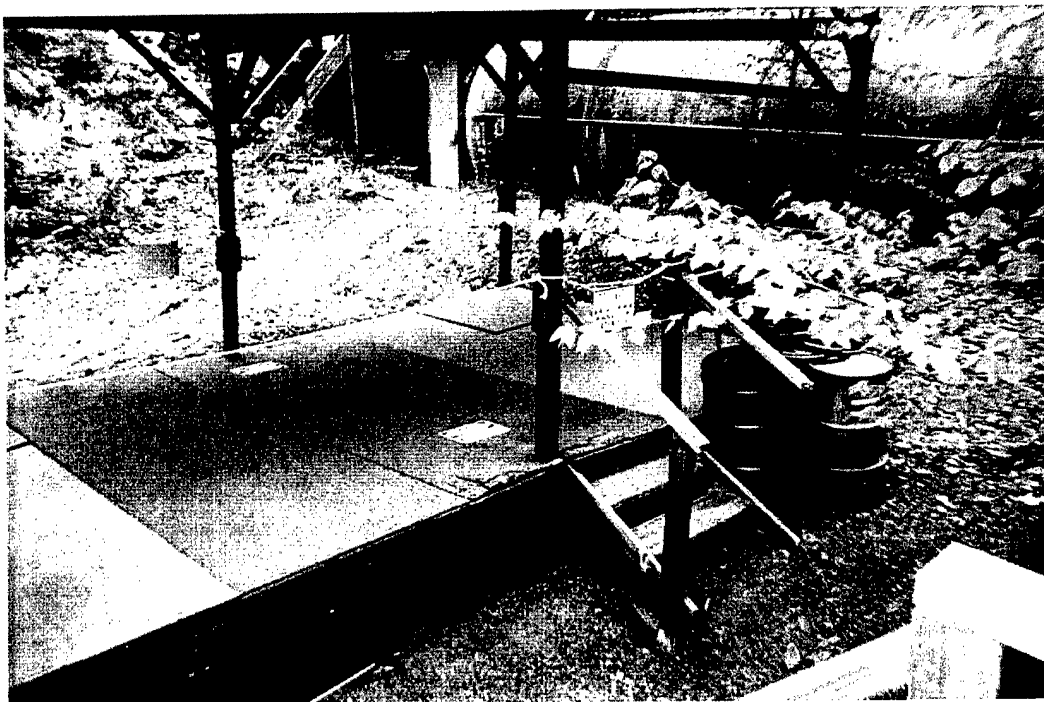
APPENDIX R
SITE PHOTOGRAPHS AFTER CHARACTERIZATION

ARDEC Picatinny Arsenal
Building 611 B Characterization
Site Photographs Before Characterization

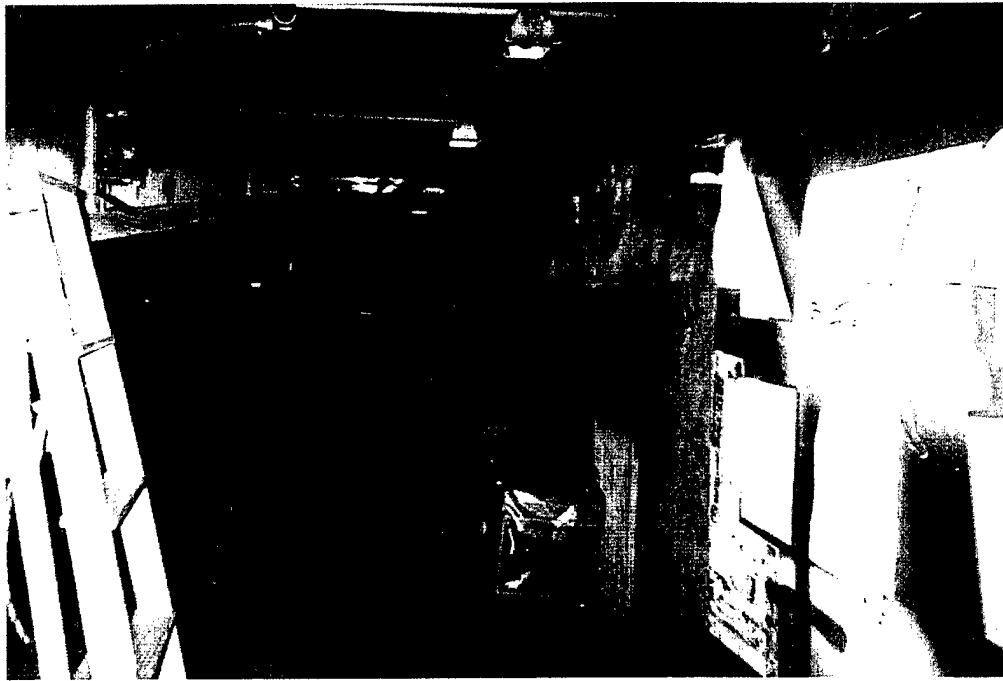
Gutierrez-Palmenberg, Inc.
333 N. Rancho Dr.
Las Vegas, NV 89106
702-647-5699



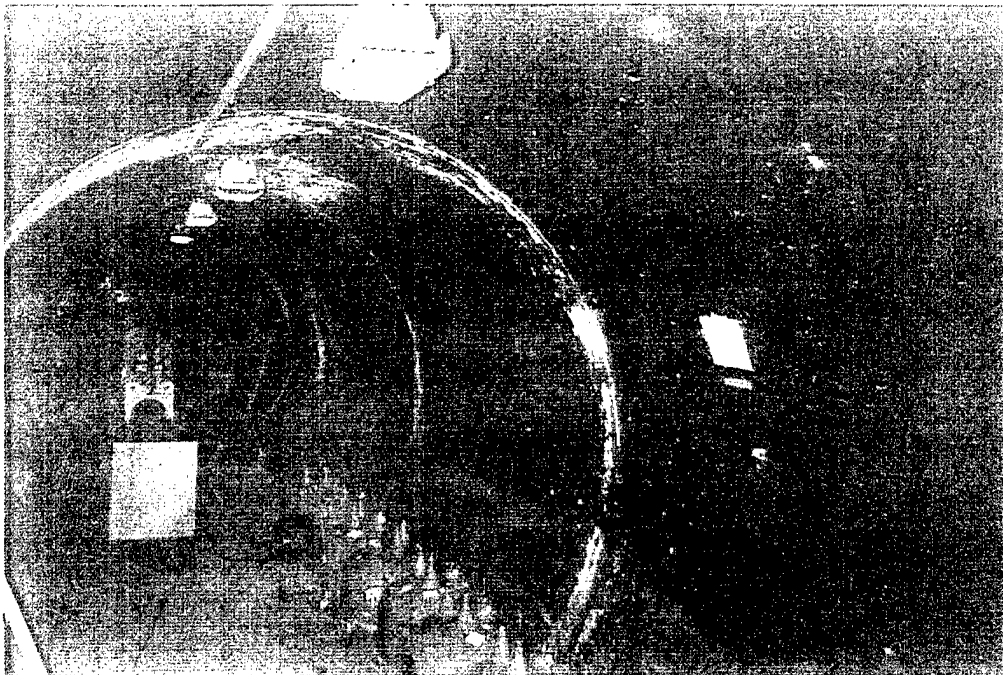
Unexploded ordinance locations adjacent to the brook at the side of the non-DU range.



The outside storage area after sealing the floor with latex paint.



The non-DU firing range from it's entry. The entry to the DU range is on the left side of the tunnel.



Inside the DU firing range facing the target room. Note the firing table on the left.



Inside the non-DU firing range facing the steel catch box.



The back yard showing the grounds and locations of unexploded ordinance. The large metal shield and the inside storage area.



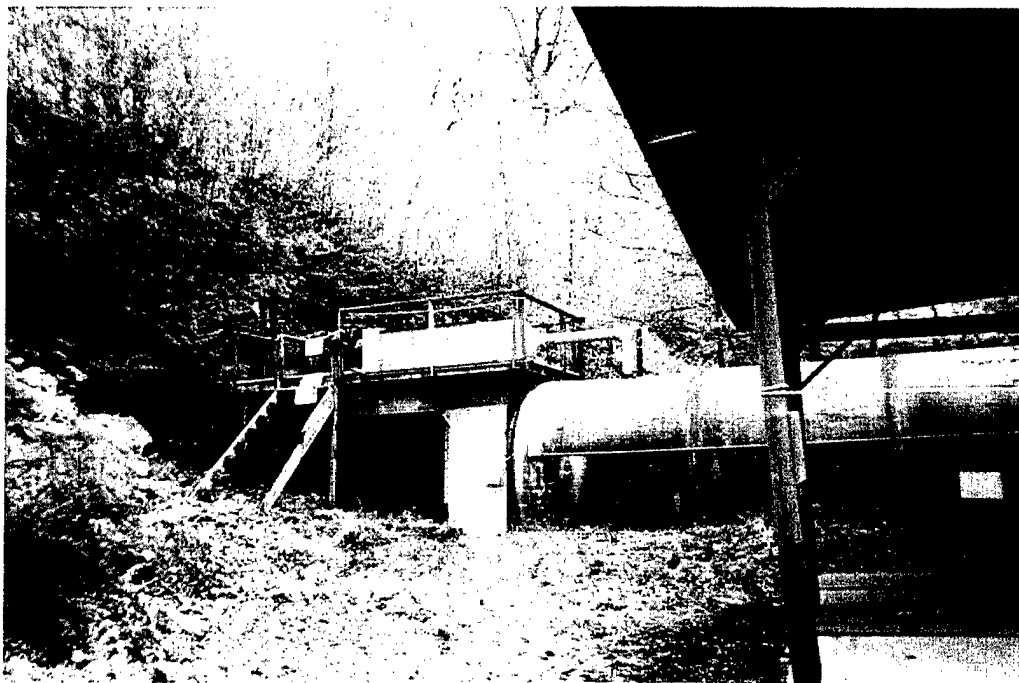
The back yard area showing the place where a building existed behind the non-DU tunnel.



The "back yard" of the facility showing the connection of the DU and non-DU tunnels.



The backside of the non-DU tunnel showing the brook and marked unexploded ordinance.



The inside storage area and HEPA filter system and grounds.



The outside storage area with the DU tunnel in the background. The inside storage area and HEPA area at the left side.



Building 611B entrance showing the connection to the non-DU tunnel. The outside storage area after characterization is at the left.



Building 611B entrance showing the building foyer. The UST is at right center. The instrument room is at the back of the entry way.

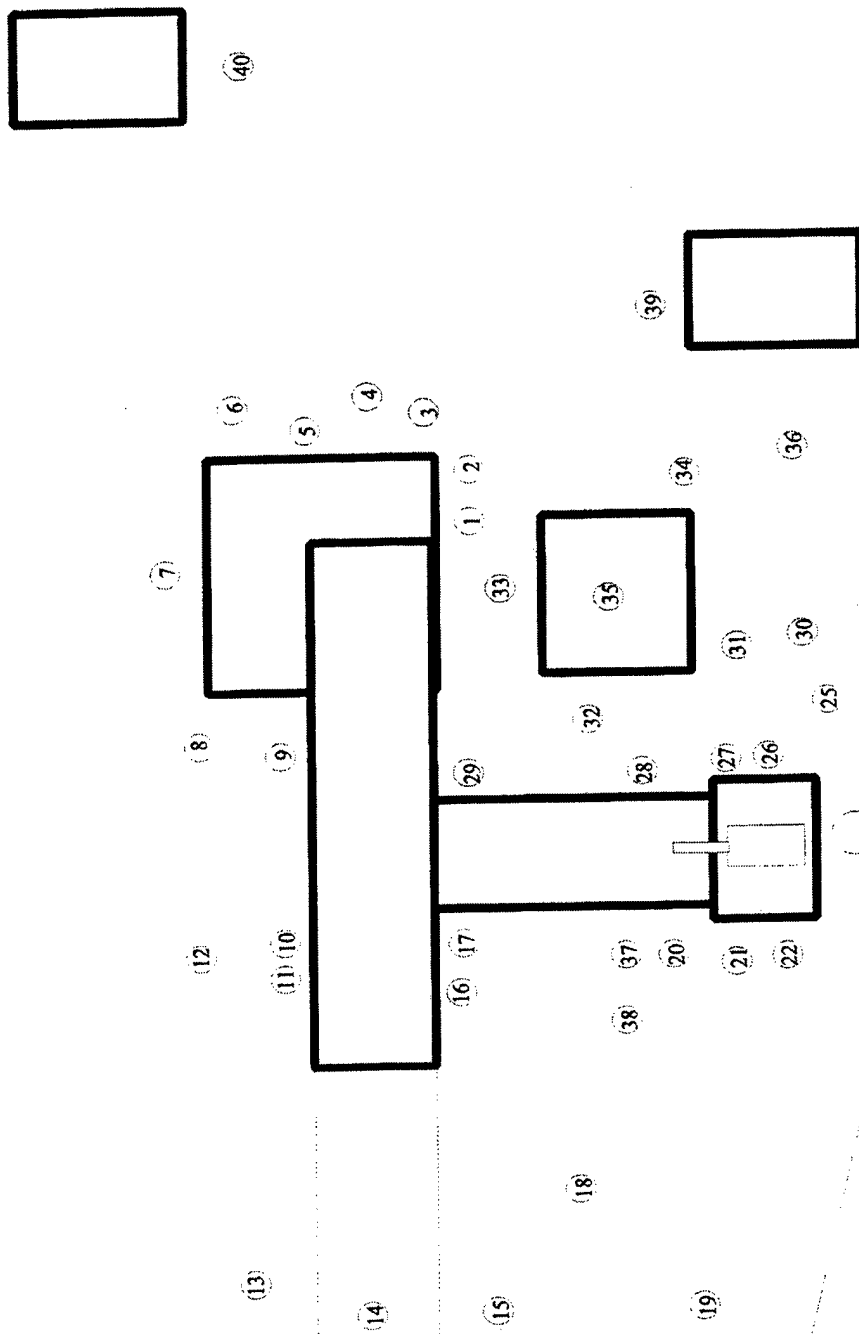
APPENDIX S
SOIL SAMPLE RESULTS

ARDEC Picatinny Arsenal
Building 611B Characterization
Soil Sample Results

Notes

1. Sample results are reported as DU activity based on the activity concentration of ^{234}Th .
2. Sample results reported above the MDA value are reported as the activity (pCi/g) +/- the uncertainty (pCi/g) associated with the analysis.
3. Sample results reported below the MDA value are indicated as NDA with the MDA value in parentheses.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699



41-44 Under stairway entrance to 611B
45 - 50 Background adjacent health Physics building

Figure 3
Actual Soil Sample Locations
Gutierrez-Palmenberg, Inc.
ARDEC - Picatinny Arsenal
Building 611B Area

Sample ID Number	ARDEC - Picatinny Arsenal Soil Sample Results Gutierrez-Palmenberg, Inc. - April 1997 Sample Locations - Building 611B		Activity Concentration (pCi/g) +/- (pCi/g) or NDA (MDA)
GPI-AR-1	At base of stairs leading to the foyer		5.26 +/- .63
GPI-AR-2	At base of stairs leading to the foyer		20.1 +/- 1.9
GPI-AR-3	Above the UST		8.85 +/- .84
GPI-AR-4	Above the UST		1.57 +/- .47
GPI-AR-5	Above the UST		2.21 +/- .52
GPI-AR-6	Aside the UST toward the brook		NDA (1.6)
GPI-AR-7	Back side of the instrument room		NDA (1.2)
GPI-AR-8	Back side of the non-DU tunnel		NDA (1.2)
GPI-AR-9	Back side of the non-DU tunnel		NDA (1.2)
GPI-AR-10	Outside window of non-DU Tunnel at back of structure		NDA (1.6)
GPI-AR-11	Outside window of non-DU Tunnel at back of structure		1.57 +/- .47
GPI-AR-12	Aside of brook adjacent to non-DU tunnel		NDA (1.7)
GPI-AR-13	Aside of open area at end of non-DU tunnel		NDA (3.3)
GPI-AR-14	In open area at end of non-DU tunnel		NDA (0.9)
GPI-AR-15	Aside of open area at end of DU tunnel in back yard		NDA (1.1)
GPI-AR-16	Outside window of non-DU tunnel in back yard		NDA (1.1)
GPI-AR-17	Outside window of non-DU tunnel in back yard		NDA (0.95)
GPI-AR-18	In back yard area		NDA (1.5)
GPI-AR-19	In back yard area		NDA (1.5)
GPI-AR-20	In back yard area adjacent DU target room		NDA (0.94)
GPI-AR-21	In back yard area adjacent inside storage room		2.9 +/- 1.1
GPI-AR-22	In back yard area adjacent inside storage room		10.9 +/- 2.0
GPI-AR-23	At the end of the DU range		NDA (5.5)
GPI-AR-24	At the end of the DU range		2.25 +/- 0.64
GPI-AR-25	At base of stairs from HEPA system platform		NDA (4.3)

Sample ID Number	ARDEC - Picatinny Arsenal Soil Sample Results	
	Gutierrez-Palmenberg, Inc. - April 1997 Location - Building 611B	
		Activity Concentration (pCi/g) +/- (pCi/g) or NDA (MDA)
GPI-AR-26	At the entrance to the inside storage area	69.8 +/- 5.1
GPI-AR-27	At the entrance to the inside storage area	12.5 +/- 1.1
GPI-AR-28	Adjacent to the DU firing room near open storage area	5.59 +/- 0.65
GPI-AR-29	Adjacent to the DU firing room near the non-DU range	3.1 +/- 0.59
GPI-AR-30	Adjacent to the open storage area near the covered metal	3.9 +/- 1.6
GPI-AR-31	Adjacent to the open storage area near open storage area	2.57 +/- 0.46
GPI-AR-32	Adjacent to the open storage area near DU storage area	1.09 +/- 0.37
GPI-AR-33	Adjacent to the open storage area near the entrance stairs	2.45 +/- 0.49
GPI-AR-34	Adjacent to the open storage area near the driveway	NDA (5.9)
GPI-AR-35	Under the center of the open storage area	NDA (0.96)
GPI-AR-36	Under metal pile adjacent to the storage box number 2	2.82 +/- 0.73
GPI-AR-37	Adjacent to the DU range in the back yard	NDA (1.1)
GPI-AR-38	Adjacent to the DU range in the back yard	NDA (1.5)
GPI-AR-39	At the entrance to the portable storage area #2	NDA (1.2)
GPI-AR-40	At the entrance to the portable storage area #2	NDA (1.2)
GPI-AR-41	Under stairway entrance to foyer in rain trough	78.9 +/- 6.3
GPI-AR-42	Under stairway entrance to foyer in rain trough	43.9 +/- 3.3
GPI-AR-43	Under stairway entrance to foyer in rain trough	106.7 +/- 7.8
GPI-AR-44	Under stairway entrance to foyer in rain trough	17.0 +/- 1.5
GPI-AR-45	Background sample adjacent to Health Physics Laboratory	NDA (1.4)
GPI-AR-46	Background sample adjacent to Health Physics Laboratory	NDA (1.4)
GPI-AR-47	Background sample adjacent to Health Physics Laboratory	NDA (1.8)
GPI-AR-48	Background sample adjacent to Health Physics Laboratory	NDA (1.1)
GPI-AR-49	Background sample adjacent to Health Physics Laboratory	3.2 +/- 1.5
GPI-AR-50	Background sample adjacent to Health Physics Laboratory	1.99 +/- 0.54

APPENDIX T
LABORATORY SPECIFICATION

ARDEC Picatinny Arsenal
Building 611B Characterization
Laboratory Specifications

Notes

1. This information describes the qualifications of LAS laboratories to analyze soil samples.
2. All soil samples are analyzed for depleted uranium by gamma spectroscopy in a New Jersey approved laboratory.

Gutierrez-Palmenberg, Inc.
333 North Rancho Drive
Las Vegas, NV 89106
702-647-5699

Gutierrez - Palmenberg, Inc.

333 North Rancho Drive, Suite 580
Las Vegas, Nevada 89106

Mr. Gregory Zalaskus, NJDEP
DRPSR
Bureau of Federal Case Management
401 E. State St.
CN 128
Trenton, NJ 08625-0028

RE: NJ Approved Laboratory Analysis of Soil Samples

This letter serves to confirm our telecon of April 25, 1997. Our discussion was in regard to any change(s) that may have occurred in New Jersey Department of Environmental Protection (NJDEP) regulations since the issuance of the referenced letter. This letter specified NJDEP policy regarding laboratory certification for the analysis of Depleted Uranium (DU), Strontium 90 (^{90}Sr), and Radium 226 (^{226}Ra) in soils.

In specific questioning, you were informed that Gutierrez-Palmenberg, Inc (GPI) is presently characterizing Building 611B. This building is within the confines of the Picatinny Arsenal at or near Dover, NJ. Among the characterization methodologies, several types of samples will be taken - including soils which will be analyzed for the presence of DU.

You confirmed that no changes have occurred in NJDEP regulations with regard to soil analysis since your letter of October 1995 and that that letter remains as the NJDEP policy and/or position on soil analyses. In this matter, the letter states, *Analysis of these elements in soils will be considered as acceptable to the Department provided that the laboratory has participated and passed the Laboratory Intercomparisons for Soil program administered by the U.S. Department of Energy, Environmental Measurements Laboratory and/or the International Atomic Energy Association.*

GPI has contracted with LAS laboratory in Las Vegas, NV for analysis for DU. LAS has presented GPI with documentation that meets the NJDEP requirements. Therefore, for GPI's analysis of interest, LAS is qualified to analyze the soil samples taken at Picatinny Arsenal.

Thank you for your patience and cooperation in resolving this issue raised by Arsenal personnel. If you have any questions regarding these issues, feel free to contact; for GPI, myself or Thomas O'Dou at 702-647-5699, for LAS laboratory, Erin Hall-Meade at 800-582-7605, Mary Ford at 702-361-0220, for IOC, Mike Styveart at 309-782-0880, and for the Arsenal, Ted Gabel or Joe Fabiano at 201-724-3742.

Sincerely,

Dixie Wells, RSO
GPI-Las Vegas Operations

Reference: Letter from Gregory C. Zalaskus to Ted Gabel, fax dated 10/6/95

cc: Robert Stern, Chief, BER
Erin Hall-Meade, Northern Pac Region, LAS
Dr. Charles Carter, Lab Director, LAS
Mary Ford, Project Manager, LAS
Thomas O'Dou, Program Manager, GPI
Walter C Cunningham, Vice President, GPI
Mike Styveart, Contracting POC, IOC
Ted Gabel, PM for Site Remed., ARDEC
Joe Fabiano, RW-POC, ARDEC
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Telephone: (702) 647-5699

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State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection

Robert C. Shinn, Jr.
Commissioner

Mr. Ted Gable
Project Manager for Site Restoration
U.S. Army Tank-Automotive and Armaments Command
Army Research, Development and Engineering Center
Picatinny Arsenal, New Jersey 07806-5000

OCT 06 1995

RE: Laboratory Certifications for
Radionuclide Contamination in Soils
Picatinny Arsenal, Morris County

Dear Mr. Gable:

This letter serves to confirm our 5 October, 1995 telephone conversation regarding the above referenced matter. The New Jersey Department of Environmental Protection (Department) has no laboratory quality certification procedures for analysis of Depleted Uranium, Strontium 90 and, Radium 226 in soils. Analysis of these elements in soils will be considered as acceptable to the Department provided that the laboratory has participated and passed the Laboratory Intercomparisons for Soil program administered by the U.S. Department of Energy, Environmental Measurements Laboratory and/or the International Atomic Energy Association.

If you have any questions regarding this matter, please call at 609-633-1455.

Sincerely,

Gregory C. Zalaskus, Case Manager
Bureau of Federal Case Management

c: Joe Marchesani, BGWPA
Jim Kealy, BEERA
Bill Roach, USEPA
Robert Stern, Chief, BER

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Commissioner

Mr. Ted Gable
Project Manager for Site Restoration
U.S. Army Tank-Automotive and Armaments Command
Army Research, Development and Engineering Center
Picatinny Arsenal, New Jersey 07806-5000

OCT 06 1995

RE: Laboratory Certifications for
Radionuclide Contamination in Soils
Picatinny Arsenal, Morris County

Dear Mr. Gable:

This letter serves to confirm our 5 October, 1995 telephone conversation regarding the above referenced matter. The New Jersey Department of Environmental Protection (Department) has no laboratory quality certification procedures for analysis of Depleted Uranium, Strontium 90 and, Radium 226 in soils. Analysis of these elements in soils will be considered as acceptable to the Department provided that the laboratory has participated and passed the Laboratory Intercomparisons for Soil program administered by the U.S. Department of Energy, Environmental Measurements Laboratory and/or the International Atomic Energy Association.

If you have any questions regarding this matter, please call at 609-633-1455.

Sincerely,

Gregory C. Zalaskus, Case Manager
Bureau of Federal Case Management

c: Joe Marchesani, BGWPA
Jim Kealy, BEERA
Bill Roach, USEPA
Robert Stern, Chief, BER

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Sample Chain of Custody Record

Document No. ARDEC-SC-1Page 1 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108Project Name ARDEC CharacterizationProject Manager Thomas J. O'DonProject Phone ARDEC X 43685

Project Fax _____

Reqd Report Date 10/1/97

Lab Contact _____

Lab Phone _____

Please send report to:

10/1/97 5/13/97

THOMAS J. O'DON
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-1	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
2	GPI-AR-2	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
3	GPI-AR-3	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
4	GPI-AR-4	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
5	GPI-AR-5	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
6	GPI-AR-6	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
7	GPI-AR-7	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
8	GPI-AR-8	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
9	GPI-AR-9	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
10	GPI-AR-10	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	

Initial Sample Custodian: THOMAS J. O'DonNotes: Interested in DU Activity

SAMPLE CHARACTERISTICS

☐ Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____
☐ Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

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 2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____
 3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 1105

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-562A
Page 2 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108
Project Name ARDEC Characterization
Project Manager Thomas J. O'Don
Project Phone ARDEC X 43685Project Fax _____
Please send report to: _____
Reqd Report Date 4/24/97 5/13/97
Lab Contact _____
Lab Phone _____Thomas J. O'Don
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-11	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
2	GPI-AR-12	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
3	GPI-AR-13	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
4	GPI-AR-14	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
5	GPI-AR-15	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
6	GPI-AR-16	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
7	GPI-AR-17	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
8	GPI-AR-18	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
9	GPI-AR-19	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
10	GPI-AR-20	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	

Initial Sample Custodian: Thomas J. O'Don Notes: INTERESTED IN DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

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2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____

3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 1105

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Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-55-1
Page 3 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108Project Name ARDEC CharacterizationProject Manager Thomas J. O'DonProject Phone ARDEC X43685

Project Fax _____

Reqd Report Date 4/29/97

Lab Contact _____

Lab Phone _____

Please send report to:

4/29/97 5/13/97

Thomas J. O'Don
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-21	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
2	GPI-AR-22	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
3	GPI-AR-23	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
4	GPI-AR-24	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
5	GPI-AR-25	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
6	GPI-AR-26	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
7	GPI-AR-27	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
8	GPI-AR-28	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
9	GPI-AR-29	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	
10	GPI-AR-30	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4-17-97	

Initial Sample Custodian: Thomas J. O'DonNotes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ Biphasic ☐ Sp. Grav. _____ Color _____

Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

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Sample Chain of Custody Record

Document No. ARDEC-5C-1
Page 1 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108
Project Name ARDEC Characterization
Project Manager Thomas J. O'Don
Project Phone ARDEC 143615Project Fax _____
Reqd Report Date 4/29/97 5/13/97
Lab Contact _____
Lab Phone _____

Please send report to:

THOMAS J. O'DON
333 N. RANCHO DRIVE
SUITE 580
LAS VEGAS, NV 89106

Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPE-AR-31	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
2	GPE-AR-32	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
3	GPE-AR-33	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
4	GPE-AR-34	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
5	GPE-AR-35	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
6	GPE-AR-36	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
7	GPE-AR-37	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
8	GPE-AR-38	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
9	GPE-AR-39	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	
10	GPE-AR-40	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/17/97	

Initial Sample Custodian: THOMAS J. O'DONNotes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____
 Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian Date: 4/21/97 Time: 1300 Received By: _____ Date: _____ Time: _____
 2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____
 3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/12 Time: 1105

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-55-1
Page 5 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108
Project Name ARDEC Characterization
Project Manager Thomas J. O'Don
Project Phone ARDEC X 43685

Project Fax _____
Reqd Report Date 4/29/97
Lab Contact _____
Lab Phone _____

Please send report to:

Thomas J. O'Don
333 N. Rancho Drive
Suite 580
Las Vegas, NV 89106

Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1	GPI-AR-41	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
2	GPI-AR-42	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
3	GPI-AR-43	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
4	GPI-AR-44	Plastic Bag	2 Liters	None	Gamma Spectroscopy	4/24/97		
5		Plastic Bag	2 Liters	None	Gamma Spectroscopy			
6		Plastic Bag	2 Liters	None	Gamma Spectroscopy			
7	N/A	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
8		Plastic Bag	2 Liters	None	Gamma Spectroscopy			
9		Plastic Bag	2 Liters	None	Gamma Spectroscopy			
10		Plastic Bag	2 Liters	None	Gamma Spectroscopy			

Initial Sample Custodian: Thomas J. O'Don Notes: Interested in PK Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ Sp. Grav. _____ Color _____
Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian Date: 4/24/97 Time: 1300 Received By: _____ Date: _____ Time: _____
2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____
3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 163

GPI

Gutierrez-Palmenberg, Inc.

Sample Chain of Custody Record

Document No. ARDEC-38-1Page 6 of 6

ADMINISTRATIVE DATA

Project Number USA 96-108Project Name ARDEC CharacterizationProject Manager Thomas J. O'DouProject Phone ARDEC X43685

Project Fax _____

Reqd Report Date 5/13/97

Lab Contact _____

Lab Phone _____

Please send report to:

Sample ID#	Type	Container	Volume	Preservative	Analysis	Date Sampled	Notes	Lab ID#
1 <u>GPI-AR-45</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	<u>4/29/97</u>		
2 <u>GPI-AR-46</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	<u>4/29/97</u>		
3 <u>GPI-AR-47</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	<u>4/29/97</u>		
4 <u>GPI-AR-48</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	<u>4/29/97</u>		
5 <u>GPI-AR-49</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	<u>4/19/97</u>		
6 <u>GPI-AR-50</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy	<u>4/29/97</u>		
7 <u>NA</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
8 <u>NA</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
9 <u>NA</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			
10 <u>NA</u>	Soil	Plastic Bag	2 Liters	None	Gamma Spectroscopy			

Initial Sample Custodian: Thomas J. O'DouNotes: Interested in DU Activity

SAMPLE CHARACTERISTICS

Flammable ☐ Hazardous ☐ Gas ☐ Liquid ☐ BiPhase ☐ Sp. Grav. _____ Color _____
 Corrosive ☐ Radioactive ☒ Solid ☒ Sludge ☐ TriPhase ☐ Flash Pt. _____ °F Odor _____

CUSTODY TRACKING

1) Relinquished By Initial Custodian Date: 4/21/97 Time: 1300 Received By: _____ Date: _____ Time: _____
 2) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: _____ Time: _____
 3) Relinquished By: _____ Date: _____ Time: _____ Received By: _____ Date: 5/6/97 Time: 1105

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AMSTA-AR-PSS, O. Perry

Picatinny, NJ 07806-5000

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Aberdeen Proving Ground, MD 21005-5071

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Aberdeen Proving Ground, MD 21010-5423

Director

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ATTN: AMSRL-CI-LP, Technical Library

Bldg. 4600

Aberdeen Proving Ground, MD 21005-5066

Chief

Benet Weapons Laboratory, CCAC

U.S. Army Research, Development and Engineering Command

Armament Research, Development and Engineering Center

ATTN: AMSTA-AR-CCB-TL

Watervliet, NY 12189-5000

Director
U.S. Army TRADOC Analysis Center-WSMR
ATTN: ATRC-WSS-R
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Naval Air Warfare Center Weapons Division
1 Administration Circle
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China Lake, CA 93555-6001

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ATTN: Accessions
10630 Little Patuxent Parkway, Suite 202
Columbia, MD 21044-3204

GIDEP Operations Center
P.O. Box 8000
Corona, CA 91718-8000

U.S. Army Tank-automotive and Armaments Command
ATTN: AMSTA-CS-CZR, M. Styvaert (3)
Rock Island, IL 61299-7630

USACE, Baltimore District
ATTN: CENAB-EN-HI, H. Honerlah
C. Hallam
10 South Howard St.
Baltimore, MD 21201

Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
U.S. Nuclear Regulatory Commission
ATTN: Ms Betsy Ulrich
Region I
475 Allendale Road
King of Prussia, PA 19406-1415