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FINAL Report

Remediation and Final Status Survey Transonic Range Depleted Uranium Study Area - Structures

Aberdeen Proving Ground, Aberdeen, Maryland

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Executive Summary

Cabrera Services, Inc., under contract to the U.S. Army Field Support Command, performed remedial activities, characterization, and Final Status Surveys for the Transonic Range Depleted Uranium Study Area located at the Aberdeen Proving Ground, Maryland.

CABRERA conducted decommissioning activities in accordance with the approved U.S. Nuclear Regulatory Commission Decommissioning Plan prepared by Allied Technology Group, Inc. Deviations from the approved plan were provided to the U.S. Army Field Support Command and Aberdeen Proving Ground for coordination with the U.S. Nuclear Regulatory Commission.

The project had several major activities associated with the remediation and Final Status Survey including:

- Designation of the Transonic Range Depleted Uranium Study Area land areas into MARSSIM Class 1 and Class 2 divisions.
- Determination that the dose from residual contamination at the site is not greater than the release criterion for each survey unit.
- Remediation of soils, debris, and structures within the boundary of the Depleted Uranium Study Area located within the confines of the Transonic Range.
- Removal and shipment of remediated soils and debris to an U.S. Nuclear Regulatory Commission licensed disposal site.
- Final Status Survey of the Depleted Uranium Study Area soils and structures (i.e., Building A7 and Building X-Ray 2) located within the confines of the Transonic Range.

Final status surveys were performed on two structures remaining on the Range. This Final Status Survey Report addresses only these two structures; surveys performed on soils are addressed under separate cover.

The radiological contaminant of concern was depleted uranium. The derived concentration guideline for depleted uranium was determined to be 1,000 disintegrations per minute per 100 centimeters squared (dpm/100cm^2) for removable surface alpha contamination and 5,000 dpm/100cm^2 (average) for total alpha surface contamination.

The Final Status Survey established four Class 1 and three Class 2 survey units.

All scan survey measurements, smears, and integrated direct measurements are below the derived concentration guideline level for removable surficial contamination (1,000 dpm/100cm^2). The Final Status Survey data indicate that the two structures are suitable for release for unrestricted use, without regard to former operations with licensed radioactive material.

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ACRONYMS AND ABBREVIATIONS

AFSC	United States Army Field Support Command
ALARA	As Low As Reasonably Achievable
APG	Aberdeen Proving Ground
AR	Army Regulation
ARL	Army Research Laboratory
ATC	Aberdeen Test Center
ATG	Allied Technology Group, Inc.
α	Alpha
β	Beta
CABRERA	Cabrera Services, Inc.
cpm	Counts Per Minute
DCGL or DCGLw	Derived Concentration Guideline Level
dpm	Disintegrations Per Minute
dpm/100 cm^2	Disintegrations Per Minute per 100 Square Centimeters
DU	Depleted Uranium
DUSA	Depleted Uranium Study Area
FSS	Final Status Survey
LBGR	Lower Bound of the Grey Region
m	Meter
m^2	Square Meters
MARSSIM	Multi-Agency Radiation Survey And Site Investigation Manual

ACRONYMS AND ABBREVIATIONS

NAD	Normalized Absolute Difference
NIST	National Institute of Standards and Technology
NRC	United States Nuclear Regulatory Commission
QA	Quality Assurance
QC	Quality Control
ROPC	Radionuclide of Potential Concern
S/N	Serial Number
SU	Survey Unit
σ	Sigma
Transonic Range	Transonic Range Depleted Uranium Study Area
U.S.	United States

1.0 INTRODUCTION

Cabrera Services, Inc. (CABRERA) is under contract to the United States (U.S.) Army Field Support Command (AFSC) to provide support to the Aberdeen Test Center (ATC) at the Aberdeen Proving Ground (APG) in Aberdeen, Maryland. CABRERA performed radiological surveys of the Transonic Range Depleted Uranium Study Area (DUSA) (Transonic Range) to support consideration for unrestricted release.

The Transonic Range consists of approximately 53,000 square meters (m^2) of land and two remaining structures on the APG. For consistency with other decommissioning activities at APG, soils and structures are addressed separately. This document presents the Final Status Survey (FSS) activities for the two remaining structures on site – the A7 Building and the X-Ray 2 Building. The Final Status Survey conducted on soils is addressed in "*Radiological Final Status Survey, Transonic Range – Land Areas, Depleted Uranium Study Area*," (CABRERA, 2004).

This FSS was performed to demonstrate that residual radioactivity in each survey unit (SU) satisfies the release criteria for unrestricted use. The survey was designed in accordance with Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidance (U.S. Nuclear Regulatory Commission [NRC], 2000). Fundamental elements of this approach are organized into sections as summarized below:

- Section 2: Final Status Survey Design
- Section 3: Summary of Final Status Survey Results
- Section 4: Final Status Survey Instrument Quality Assurance and Quality Control
- Section 5: References

1.1 Site History

APG, located in Aberdeen, Maryland, is an active U.S. Army testing and research facility. The APG lies along the western shore of the Chesapeake Bay in Harford and Baltimore Counties, Maryland, approximately 15 miles northeast of Baltimore. The APG covers a total of approximately 73,000 acres (land and water) and consists of two distinct areas: the northern portion of APG, referred to as the Aberdeen Area; and the southern portion of APG, referred to as the Edgewood Area. The Aberdeen Area became a formal military post, designated as the APG, in 1917. Figure 1 presents an aerial view of the site.

The DUSA comprises approximately 12 acres on the southeast end of the Transonic Range. The DUSA can be described as a cleared relatively flat tract, surrounded by woods to the east, south, and west. Swampy areas are found behind the Transonic Range catch basin to the south, along the wooded areas to the west, and in the northeast section of the site.

The DUSA was used for DU testing from 1973 to 1979. Testing consisted of firing DU penetrator rounds from two locations on the northern portion of the site at targets mounted adjacent to the X-Ray units to the south. Stripper/deflector plates located between the launch or shooting locations were designed to strip or deflect the sabot away from the penetrator while in flight to the target. Penetrators were either stopped in the target or penetrated the target and were stopped by a backstop located a short distance behind the targets.

As a result of the testing, most of the DU physically combined with the target and backstops. However, small amounts of DU scattered onto the soils around the targets and the surrounding area. ATC test technicians wore protective clothing and dosimetry while in the test area and monitored activities for radioactive contamination. Targets and other designated materials were maintained on site in a radioactive materials storage area located to the east of the impact zone. While the targets and other designated materials had been remediated, recycled, and/or disposed of as radioactive waste, this site still contained radioactive materials.

After outdoor testing ceased, the Army Research Laboratory (ARL) health physicist conducted an initial site cleanup to reduce the radioactive waste inventory and to allow other non-radiological testing to be conducted on the site. ARL conducted soil sampling on the site as late as 1991 as a part of their environmental monitoring program. In 1995/96, General Physics Corporation characterized the site as a part of the preparations for decommissioning. The results of this characterization are found in "*Transonic Range Depleted Uranium Area Radiological Characterization Study Report*" (General Physics Corporation [GPC], 1996). These results are used as the radiological basis for the Decommissioning Plan.

1.2 Structure Description

Figure 2, located in the Figures section of this report, shows the relative locations of Building A7 and Building X-Ray 2 within the Transonic Range DUSA.

1.2.1 Building A7

Building A7 is a concrete structure located on the southeast side of the DUSA with a concrete floor having dimensions of approximately 4 meters (m) wide by 5.1 m long and 3 m high. The roof of Building A7 is covered with three-inch thick steel plates, approximately 1.8 m long and 1.0 m wide, held in place by anchor bolts imbedded in the concrete (Allied Technology Group, Inc. [ATG], 2000). The entrance is from the east and the area enclosed by the building is approximately 20.8 m^2.

Half of the west wall and the entire length of the north wall were initially covered with a soil berm. This soil was removed from the sides of the building using an excavator so that the exterior surfaces of the walls of the building could be surveyed. The west wall has an outer wall of three-inch steel plate attached to the concrete and a single metal box penetrating the wall. There are no known drains from the building and no ventilation system. The interior contains work tables and storage shelves. The installation used Building A7 to store electronics equipment (ATG, 2000). Pictures of Building A7 are provided in Appendix A.

1.2.2 Building X-Ray 2

Building X-Ray 2 is located on the southern portion of the DUSA and is constructed of welded steel plates. With an enclosed area of approximately 59 m^2, the structure contains a U.S. Army Field Electronics Trailer. The trailer is constructed of aluminum and rests on a raised platform (ATG, 2000). The walls of Building X-Ray 2 consist of 2.5-inch steel plate. The upper roof, over the trailer, is 1-inch thick steel. The lower roof, on the west side of the structure, consists of 2.5-inch steel plate. The west wall has a slit cut into it to allow for X-Ray passage (ATG, 2000).

The structure was constructed directly on soil with no floor. It is approximately 4 m high (except for the west wall which is 2 m high), and is trapezoid-shaped with the walls being: North 7.16 m wide, East 9.9 m long, South 7.32 m wide, and West 6.1 m long. The entrance is located in the southeast corner. There are no known drains associated with Building X-Ray 2. Pictures of Building X-Ray 2 are provided in Appendix A.

1.3 Radionuclides of Potential Concern

The Decommissioning Plan documented the review of available information and an assessment of historical site operations in an effort to determine the radionuclides of potential concern (ROPCs). Based on the results of previous surveys and analytical sampling data, ATG determined that, according to the isotopic distributions of ^{234}U, ^{235}U, and ^{238}U, the ROPCs are DU and all associated short-lived uranium progeny.

1.4 Derived Concentration Guideline Levels

As described by MARSSIM, a derived concentration guideline level (DCGL) is a derived radionuclide activity concentration within a SU that corresponds to a dose-based release criterion. The DCGL cleanup criteria for structure surface contamination were established by the approved Decommissioning Plan, Section 5.1 (ATG, 2000). The ATG Decommissioning Plan is provided in Appendix B for reference. These values are based on surface radioactivity criteria established by Army Regulation (AR) 11-9, "*The Army Radiation Safety Program*" (AR 11-9, 1999) and Engineer Manual (EM) EM 385-1-80, "*Radiation Protection Manual*" (EM 385-1-80, 1997). The DCGL values in Table 1-1 are adapted from the Decommissioning Plan, AR 11-9, and EM 385-1-80.

Table 1-1. DUSA Structural DCGLs

CONDITION	LIMIT	
Removable Surface Contamination	< 1,000 dpm/100 cm^{2}(1) (α)	$DCGL_L$
Total (Removable + Fixed) Contamination, Average	< 5,000 dpm/100 cm^2 (α)	$DCGL_W$
Total (Removable + Fixed) Contamination, Maximum	< 15,000 dpm/100 cm^2 (α)	$DCGL_{EMC}$

(1) dpm/100 cm^2 = disintegrations per minute per 100 square centimeters

2.0 FINAL STATUS SURVEY DESIGN

All aspects of the FSS performed at the Transonic site were designed in accordance with FSS guidance from MARSSIM (NRC, 2000). FSS activities consisted of scanning surveys over 100% of the reasonably accessible structure surfaces. Integrated direct (i.e., one-minute count) surface measurements were performed and biased smear samples were collected. The FSS was designed conservatively in that the radiological background present in the structure materials is neglected and the measure of total activity is used for statistical comparisons to the respective $DCGL_W$.

Field activities took place on four separate mobilizations between February and November 2003. Measurements at Building A7 and Building X-Ray 2 on the following dates:

- February 4 to February 10, 2003;
- April 8 to April 22, 2003;
- June 22 to July 2, 2003; and
- November 5 to November 25, 2003.

2.1 General Structure Classification Based on Contamination Potential and Survey Unit Identification

Using MARSSIM Section 5.3 as guidance, the two structures were subdivided into survey units and designated as Class 1, Class 2, or Class 3 survey units. The following subsections describe how each structure was subdivided and classified.

2.1.1 Building A7

Building A7 was divided into two SUs. The entire interior of the structure is considered as one Class 2 SU. The entire exterior of the building and those areas considered inaccessible during the characterization survey are designated as one Class 1 SU. Figures 3 and 4 present the Building A7 SU delineations and the reference coordinate system.

2.1.2 Building X-Ray 2

Building X-Ray 2 was divided into six SUs. The interior and exterior of the north wall and the east wall were each designated as a Class 2 SU. The interior and exterior of the south wall and the west wall were each designated as a Class 1 SU. The ceiling and roof are designated as one Class 1 SU. The dirt floor of Building X-Ray 2 was designated as "soil" and was covered under the parallel soils FSS and report. Figure 5 shows the plan view of the building. Figures 6 through 10 present the Building X-Ray 2 SU delineations and the reference coordinate systems.

Table 2-1 summarizes the designation of SUs for Buildings A7 and X-Ray 2.

Table 2-1. Structural Survey Units

Building	Survey Unit	Area (m^2)	Material	MARSSIM Survey Class
A7	All interior surfaces	56	Concrete and Steel Plate	2
A7	All exterior and inaccessible surfaces	74	Concrete and Steel Plate	1
X-Ray 2	South Wall – interior and exterior	51	Steel Plate	1
X-Ray 2	West Wall – interior and exterior	21.96	Steel Plate	1
X-Ray 2	North Wall – interior and exterior	47.6	Steel Plate	2
X-Ray 2	East Wall – interior and exterior	67.32	Steel Plate	2
X-Ray 2	Ceiling and Roof	117.4	Steel Plate	1

2.2 Direct Surface Alpha Radioactivity Scan Surveys and Integrated Direct Surface Alpha Radioactivity Measurements

Direct alpha scanning was performed to identify surface locations on structures where contaminant concentrations may exceed the criterion for unrestricted release. Integrated direct measurements (i.e., static measurements) of surface alpha radioactivity were performed during the FSS to compare contaminant concentrations at discrete sampling locations on building interior and exterior surfaces to the release criterion and to facilitate statistical testing.

Scanning and integrated direct surface measurements were performed using the instruments listed in Table 2-2.

Table 2-2. Instruments Used for Scanning and Integrated Direct Surface Measurements

Instrument Used (Meter and Probe)	Dates Used	Building Used
Ludlum Model 2224 portable alpha/beta scaler/ratemeter (serial number [S/N] 162425) with the Ludlum model 43-93 100 cm^2 alpha/beta detector (S/N 182403)	2/4/03	X-Ray 2
	11/5/03	X-Ray 2
	11/6/03	X-Ray 2
Ludlum Model 2224 portable alpha/beta scaler/ratemeter (S/N 162426) with the Ludlum model 43-93 100 cm^2 alpha/beta detector (S/N 192931)	2/10/03	A7
	4/11/03	X-Ray 2
	4/14/03	A7
	4/16/03	A7
	4/18/03	A7
	6/22/03	A7
	6/26/03	X-Ray 2

2.3 Smear Sample Collection and Analysis

Gross transferable alpha contamination was collected and analyzed to determine if transferable activity is less than or equal to 10% of total activity as assumed in the NUREG/CR-5512 document for screening level guidelines.

Smear samples were collected over approximately 100 cm^2 areas at systematic and biased locations identified during scanning activities. Smear samples were analyzed for alpha and beta radioactivity using a Ludlum Model 2929 alpha/beta scintillation counter. Three different units were used during the field activities, as summarized in Table 2-3.

Table 2-3. Alpha/Beta Scintillation Counters Used During Field Activities

Instrument Used (Meter and Probe)	Dates Used	Building Used
Ludlum Model 2929 alpha/beta scintillation counter (S/N 129566) with attached 43-10-1 probe (S/N 132720)	11/13/03	X-Ray 2
	11/13/03	A7
	11/21/03	X-Ray 2
	11/24/03	X-Ray 2
	11/25/03	X-Ray 2
Ludlum Model 2929 alpha/beta scintillation counter (S/N 163827) with attached 43-10-1 probe (S/N 171322)	6/26/03	X-Ray 2
	6/27/03	X-Ray 2
	6/30/03	X-Ray 2
	7/1/03	X-Ray 2, A7
	7/2/03	A7
Ludlum Model 2929 alpha/beta scintillation counter (S/N 171590) with attached 43-10-1 probe (S/N 174813)	4/8/03	X-Ray 2
	4/18/03	A7
	4/22/03	A7
	4/22/03	X-Ray 2

2.4 Number of Static Measurements

The approved Decommissioning Plan strictly followed MARSSIM guidance in determining the number of static measurements for soil survey units. However, the Plan deviated from MARSSIM in determining the number of static measurements per survey unit for structures. Instead, the Plan specified, in Section 5.1.2.2, that "a direct measurement will be obtained from each 1 meter square grid, at the point of the highest scan count rate…" (ATG, 2000). Therefore, CABRERA gridded each SU into 1-meter by 1-meter squares and obtained a 1-minute integrated direct measurement from each square at the area of highest count rate. Table 2-4 summarizes the SUs and number of static measurements obtained during the field effort. Appendix D contains the original worksheets used in the field. These worksheets document the grid spaces where static measurements and/or smears were not accessible.

Table 2-4. Summary of Survey Units and Static Measurements

Structure	Survey Unit	Area (m^2)	Number of Static Measurements (total)
Building A7	Interior Surfaces	56	56
Building A7	Exterior Surfaces	74	74
Building X-Ray 2	South Wall – interior and exterior	51	64
Building X-Ray 2	West Wall – interior and exterior	21.96	24
Building X-Ray 2	North Wall – interior and exterior	47.6	56
Building X-Ray 2	East Wall – interior and exterior	67.32	79
Building X-Ray 2	Ceiling and Roof	117.4	99

3.0 SUMMARY OF FINAL STATUS SURVEY RESULTS

All raw data collected on worksheets titled "Radiological Survey Maps" for each SU are provided in Appendix D. Scan survey results are provided graphically in Figures 4 through 10. Additional data for each SU include worksheets that convert the raw data (recorded in counts per minute) to dpm/100cm^2 for integrated direct measurements (integrated one-minute counts from each one-meter square grid with cross-reference to grid numbers) and 100 cm^2 smear results from each one-meter square grid with cross-reference to grid numbers. These worksheets are also provided in Appendix D.

3.1 Building A7

3.1.1 Survey Unit – Interior Surfaces, Class 2

3.1.1.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the interior surfaces of Building A7. Six one-meter grids were scanned on the north wall, six were scanned on the south wall, 10 were scanned on the east wall, 10 were scanned on the west wall, 12 were scanned on the floor, and 12 one-meter grids were scanned on the ceiling, totaling 56 one-meter grids. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.1.1.2, below). The maximum detection for alpha activity was 20 counts per minute (cpm); the minimum was zero cpm. The highest alpha activity was recorded from the floor of the building.

3.1.1.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from all six interior surfaces of Building A7. Twelve measurements were collected from the ceiling, 10 measurements were collected from the east wall, 12 measurements were collected from the floor, 6 measurements were collected from the north wall, 6 measurements were collected from the south wall, and ten were collected from the west wall, for a total of 56 interior measurements. The maximum detection for alpha activity was 78.1 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 5,000 dpm/100cm^2. The highest readings were recorded from the floor of the building.

3.1.1.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from all six interior surfaces of Building A7. Twelve smears were collected from the ceiling, 10 smears were collected from the east wall, 6 smears were collected from the north wall, 6 smears were collected from the south wall, and 10 were collected from the west wall, for a total of 56 smears. The maximum detection for alpha activity was 3.5 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. The highest readings were recorded from the east wall of the building.

3.1.1.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at Aberdeen Proving Ground, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Interior Surfaces of Building A7 are recommended for unrestricted release.

3.1.2 Survey Unit – Exterior Surfaces and Inaccessible Surfaces, Class 1

3.1.2.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the exterior surfaces of Building A7. Twelve one-meter grids were scanned on the north wall, 12 were scanned on the south wall, 15 were scanned on the east wall, 15 were scanned on the west wall, and 20 one-meter grids were scanned on the roof, totaling 74 one-meter grids. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.1.2.2, below). The maximum detection for alpha activity was 5 cpm; the minimum was zero cpm. The highest alpha activity was recorded from the north and west walls of the building.

3.1.2.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from all five exterior surfaces of Building A7. Twenty measurements were collected from the roof, 15 measurements were collected from the east wall, 12 measurements were collected from the north wall, 12 measurements were collected from the south wall, and 15 were collected from the west wall, for a total of 74 exterior measurements. The maximum detection for alpha activity was 291.7 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 5,000 dpm/100cm^2. The highest readings were recorded from the south wall of the building.

3.1.2.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from all five exterior surfaces of Building A7. Twenty smears were collected from the roof, 15 smears were collected from the east wall, 12 smears were collected from the north wall, 12 smears were collected from the south wall, and 15 were collected from the west wall, for a total of 74 smears. The maximum detection for alpha activity was 3.6 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. It should be noted that the highest readings were recorded from the south wall and roof of the building.

3.1.2.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at Aberdeen Proving Ground, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Exterior Surfaces of Building A7 are recommended for unrestricted release.

3.2 Building X-Ray 2

3.2.1 Survey Unit – South Wall, Interior and Exterior Surfaces, Class 1

3.2.1.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the interior and exterior surfaces of the south wall of Building X-Ray 2. Thirty-two one-meter grids were scanned on each side of the wall, totaling 64. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.2.1.2, below). The maximum detection for alpha activity was 2 cpm; the minimum was zero cpm. The highest alpha readings were recorded from the exterior of the south wall.

3.2.1.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from the interior and exterior surfaces of the south wall of Building X-Ray 2. Thirty-two measurements were collected on each side of the wall, totaling 64 measurements. The maximum detection for alpha activity was 8.7 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 5,000 dpm/100cm^2. The highest alpha readings were recorded from the interior of the south wall.

3.2.1.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from the interior and exterior surfaces of the south wall of Building X-Ray 2. Thirty-two smears were collected on each side of the wall, totaling 64 smears. The maximum detection for alpha activity was 3.8 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. The highest alpha readings were recorded from the interior of the south wall.

3.2.1.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at Aberdeen Proving Ground, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Interior and Exterior Surfaces of the South Wall of Building X-Ray 2 are recommended for unrestricted release.

3.2.2 Survey Unit – West Wall, Interior and Exterior Surfaces, Class 1

3.2.2.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the interior and exterior surfaces of the east wall of Building X-Ray 2. Twelve one-meter grids were scanned on each side of the wall, totaling 24. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.2.2.2, below). The maximum detection for alpha activity was 1 cpm; the minimum was zero cpm. The highest alpha readings were recorded from the exterior of the west wall.

3.2.2.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from the interior and exterior surfaces of the west wall of Building X-Ray 2. Twelve measurements were collected each side of the wall, totaling 24 measurements. The maximum detection for alpha activity was 8.7 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL 5,000 dpm/100cm^2. The highest alpha readings were recorded from both the interior and exterior of the west wall.

3.2.2.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from the interior and exterior surfaces of the west wall of Building X-Ray 2. Twelve smears were collected on each side of the wall, totaling 24 smears. The maximum detection for alpha activity was 1.7 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. The highest alpha readings were recorded from the exterior of the west wall.

3.2.2.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at Aberdeen Proving Ground, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Interior and Exterior Surfaces of the West Wall of Building X-Ray 2 are recommended for unrestricted release.

3.2.3 Survey Unit – North Wall, Interior and Exterior Surfaces, Class 2

3.2.3.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the interior and exterior surfaces of the north wall of Building X-Ray 2. Twenty-four one-meter grids were scanned on the interior of the north wall, and 32 were scanned on the exterior of the north wall, totaling 56 one-meter grids. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.2.3.2, below). The maximum detection for alpha activity was 4 cpm; the minimum was zero cpm. The highest alpha readings were recorded from the exterior of the north wall.

3.2.3.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from the interior and exterior surfaces of the north wall of Building X-Ray 2. Twenty-four measurements were collected from the interior of the north wall, and 32 measurements were collected from the exterior of the north wall, totaling 56 measurements. The maximum detection for alpha activity was 109.4 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 5,000 dpm/100cm^2. The highest alpha readings were recorded from the exterior of the north wall.

3.2.3.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from the interior and exterior surfaces of the north wall of Building X-Ray 2. Twenty-four smears were collected from the interior of the north wall, and 32 smears were collected from the exterior of the north wall, totaling 56 smears. The maximum detection for alpha activity was 4.0 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. The highest alpha readings were recorded from the interior of the north wall.

3.2.3.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at Aberdeen Proving Ground, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Interior and Exterior Surfaces of the North Wall of Building X-Ray 2 are recommended for unrestricted release.

3.2.4 Survey Unit – East Wall, Interior and Exterior Surfaces, Class 2

3.2.4.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the interior and exterior surfaces of the east wall of Building X-Ray 2. Forty one-meter grids were scanned on the exterior side of the east wall and 39 one-meter grids were scanned on the interior side of the wall, totaling 79. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.2.4.2, below). The maximum detection for alpha activity was 8 cpm; the minimum was zero cpm. The highest alpha readings were recorded from the exterior of the east wall.

3.2.4.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from the interior and exterior surfaces of the east wall of Building X-Ray 2. Forty measurements were collected on the exterior side of the East Wall and 39 measurements were collected on the interior side of the wall, totaling 79. The maximum detection for alpha activity was 53.8 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 5,000 dpm/100cm^2. The highest alpha readings were recorded from the exterior of the east wall

3.2.4.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from the interior and exterior surfaces of the north wall of Building X-Ray 2. Forty smears were collected on the exterior side of the East Wall and 39 smears were collected on the interior side of the wall, totaling 79. The maximum detection for alpha activity was 3.5 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. The highest alpha readings were recorded from the interior of the east wall.

3.2.4.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at Aberdeen Proving Ground, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Interior and Exterior Surfaces of the East Wall of Building X-Ray 2 are recommended for unrestricted release.

3.2.5 Survey Unit – Ceiling and Roof Surfaces and Inaccessible Areas, Class 1

3.2.5.1 Surface Alpha Radioactivity Scan Surveys

Scan survey measurements were collected from the ceiling and roof surfaces of Building X-Ray 2. Sixty one-meter grids were scanned on the roof and 39 one-meter grids were scanned on the ceiling, totaling 99 one-meter grids. Inaccessible areas or grids on the roof surface were due to these areas being covered with plastic. The area within each one-meter grid with the highest alpha activity was noted, and these were the locations where integrated direct measurements were taken (Section 3.2.5.2, below). The maximum detection for alpha activity was 100 cpm; the minimum was zero cpm. The highest alpha readings were recorded from the roof surfaces of Building X-Ray 2.

3.2.5.2 Integrated Direct Surface Alpha Radioactivity Measurements

Fixed measurements were collected from the ceiling and roof surfaces of Building X-Ray 2. Sixty measurements were collected on the roof and 39 measurements were collected on the ceiling, totaling 99. The maximum detection for alpha activity was 479.2 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 5,000 dpm/100cm^2. The highest alpha readings were recorded from the roof surfaces of Building X-Ray 2.

3.2.5.3 Smear Sample Collection and Analysis

Smear samples for removable surface activity were collected from the ceiling and roof surfaces of Building X-Ray 2. Sixty smears were collected on the roof and 39 smears were collected on the ceiling, totaling 99. The maximum detection for alpha activity was 5.4 dpm/100 cm^2; the minimum was zero dpm/100 cm^2. No detections exceeded the DUSA structural DCGL of 1,000 dpm/100cm^2 for removable surface activity. The highest alpha readings were recorded from the roof surfaces of Building X-Ray 2.

3.2.5.4 Recommendation

The Decommissioning Plan did not specify the exact terms under which a survey unit could be recommended for unrestricted release. In order to be consistent with the intent of AR 11-9 and other FSS Reports submitted for structures at APG, a SU can be cleared for release where all scans and integrated direct measurements are below the DCGL of 5,000 dpm/100cm^2 and all smear measurements are less than the DCGL of 1,000 dpm/100cm^2. Therefore, the Ceiling and Roof surfaces of Building X-Ray 2 are recommended for unrestricted release.

4.0 FINAL STATUS SURVEY INSTRUMENT QUALITY ASSURANCE AND QUALITY CONTROL

The purpose of this section is to document the calibration of the radiological survey instruments used during the FSS, and the quality control tracking of each instrument as specified in the Work Plan (as documented in Appendix B). Data collection activities were performed in accordance with written procedures and/or protocols in order to ensure consistent, repeatable results. The Project Engineer ensured that individuals were appropriately trained to use project instrumentation and other equipment, and that instrumentation met the required detection sensitivities.

Scanning and integrated direct measurements were performed to measure surface radioactivity levels for total uranium. These measurements were based solely on alpha emissions due to high specificity and sensitivity, and low background interference. For smear measurements, beta measurements were collected in tandem with alpha measurements as a qualitative assessment to confirm survey assumptions. Prior to the initiation of alpha survey activities, surfaces of interest were cleaned to remove dirt that could shield alpha emissions from detection.

Current calibration/maintenance records were kept on site during work activities for review and inspection (included in Appendix C). The records include, at a minimum, the following:

- name of the equipment
- equipment identification (model and serial number)
- manufacturer
- date of calibration
- calibration due date

Instrumentation was maintained and calibrated to manufacturers' specifications to ensure that required traceability, sensitivity, accuracy and precision of the equipment/instruments were maintained. Instruments were calibrated at a facility possessing appropriate NRC and/or Agreement State licenses for performing calibrations using National Institute of Standards and Technology (NIST) traceable sources. Copies of the calibration certificates for the sources are also provided in Appendix C.

QC measurements were performed on all deployed field instruments each day, before and after each use at a minimum. A controlled area was used to perform these checks. The QC investigation levels for Ludlum model 2929 count rate instruments used during the FSS were ±2-sigma (2σ) (warning) and $\pm 3\sigma$ (fail). Exposure rate and other radiation detection instruments were evaluated using a qualitative ±20% against the indicated check source response on the meter. If any single measurement was found to be outside of its investigation level, the measurement was repeated. If the second count was also found to be outside of this criterion, the instrument was investigated to assess whether any external biases or instrument physical damage was present. If response checks were found to be outside of $\pm 3\sigma$, the instrument was taken out of service unless evaluated and approved by the Field Radiological Engineer or the Project

Manager. Control charts for check source response, background count rates (where applicable), and copies of the daily check source logs for all instruments are provided in Appendix D.

Gross transferable alpha contamination was collected and analyzed to determine that transferable activity was less than or equal to 10% of total activity as assumed in the NUREG/CR-5512 and NUREG 1757 documents for screening level guidelines.

Smear samples were collected over approximately 100 cm^2 areas at systematic and biased locations identified during scanning activities. Smear samples were analyzed for alpha and beta radioactivity using a Ludlum Model 2929 alpha/beta scintillation counter.

Control charts for check source response, background count rates (where applicable), and copies of the daily check source logs for all instruments are provided in Appendix D.

5.0 REFERENCES

(AR 11-9, 1999) Army Regulation 11-9, Army Programs, "*The Army Radiation Safety Program*", Headquarters, Department of the Army, Washington DC, dated May 28, 1999.

(ATG, 2000) Allied Technology Group, "*Aberdeen Proving Ground, Transonic Range Depleted Uranium Study Area, Decommissioning Plan*", Rev 1, dated March 1, 2000.

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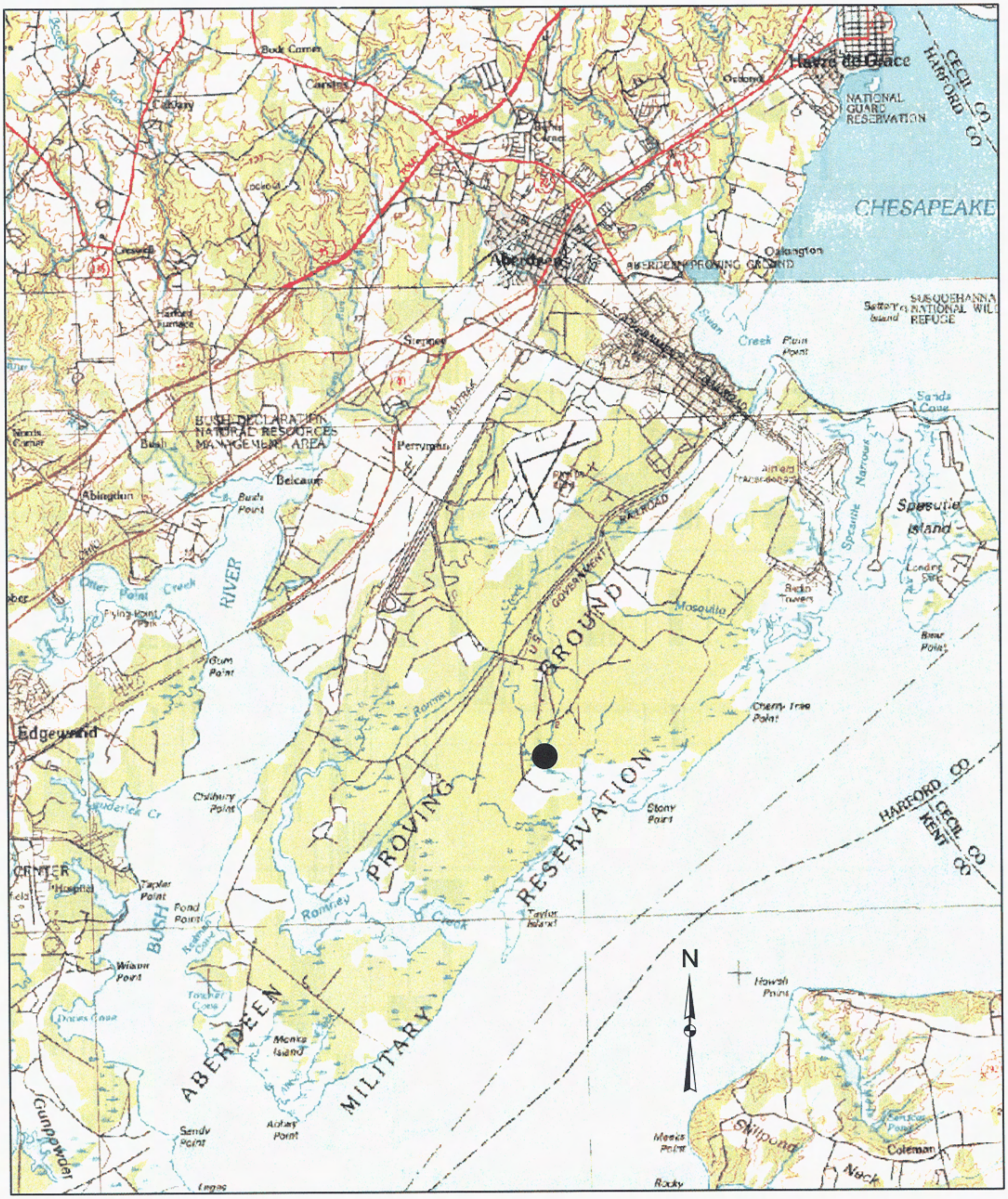
(GPC, 1996) General Physics Corporation, "*Transonic Range Depleted Uranium Study Area Radiological Characterization Report,*" October, 1996.

(NRC, 1999) NUREG/CR-5512, Volume 3 Residual Radioactive Contamination from Decommissioning, Parameter Analysis, Draft Report for Comment, U.S. Nuclear Regulatory Commission, dated October, 1999.

(NRC, 2000) NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), U.S. Nuclear Regulatory Commission, dated August, 2000.

Figures



0 1,000 2,000 4,000 6,000
Meters

● Transonic Range Location

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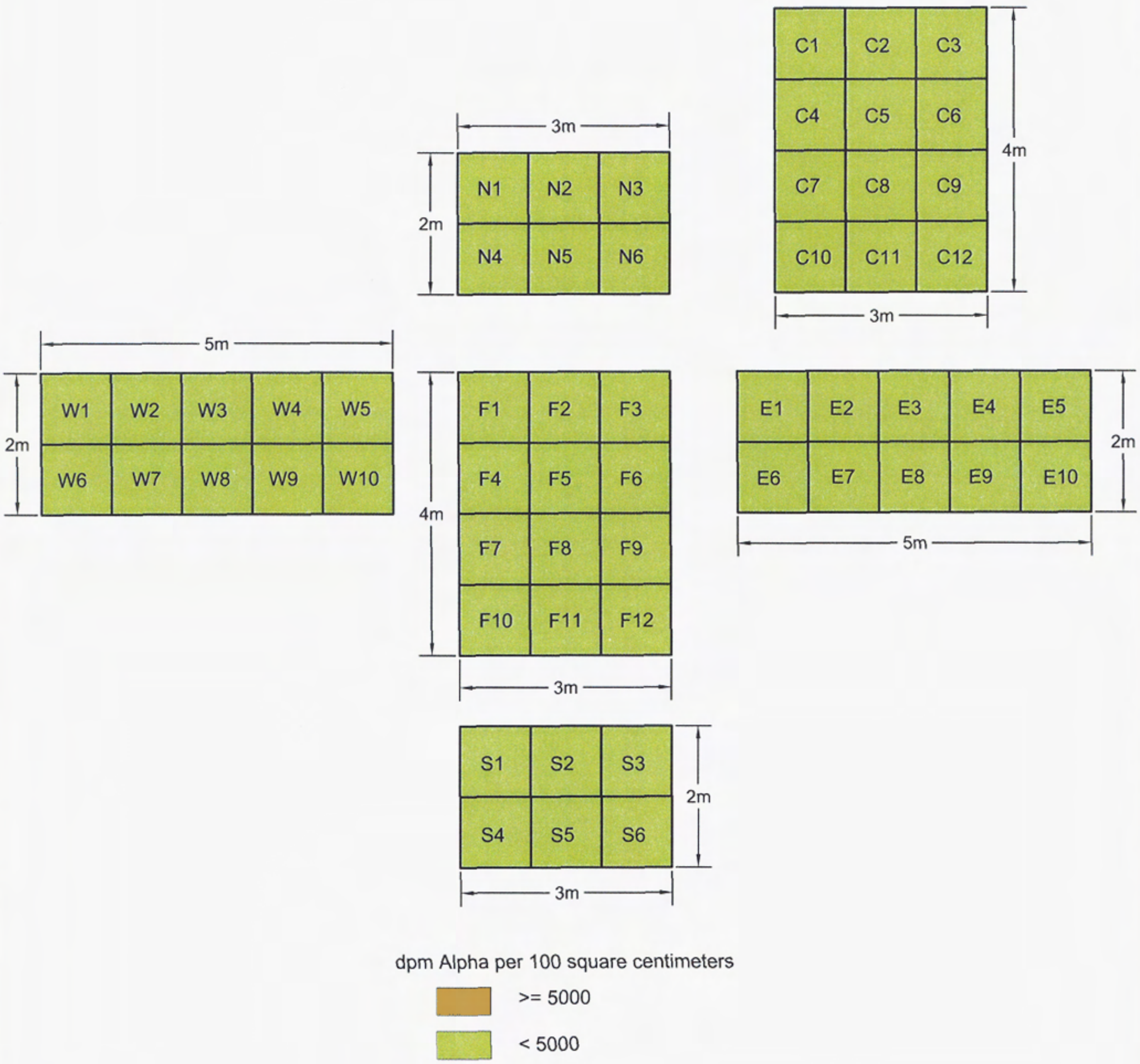
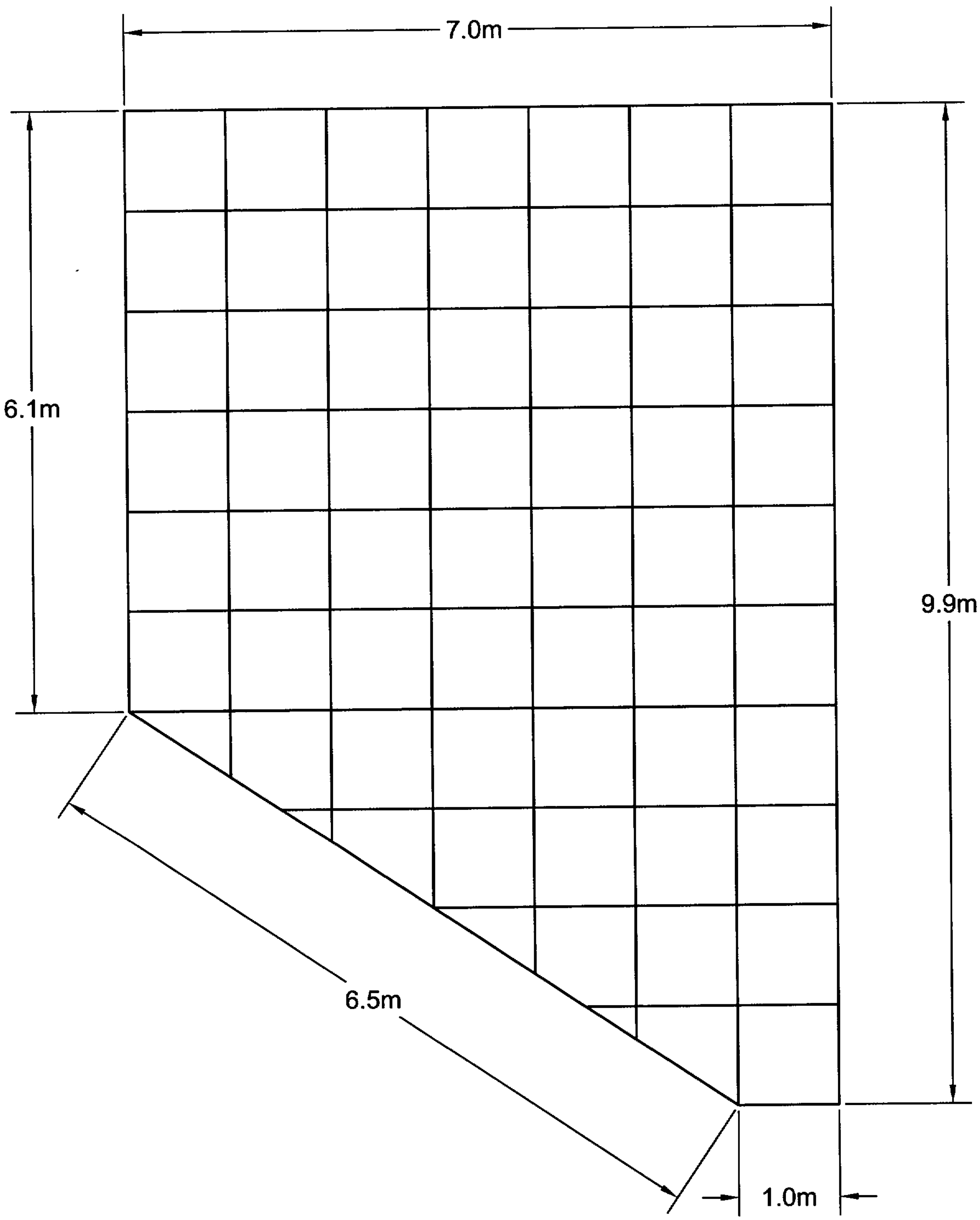
Location of Transonic Range	Date: December 2004		**Figure**
	Project #: 03-3004.00		**1**
Transonic Final Status Survey Report - Structures	File Name: Figure1_FSS_SiteLocation		
	Prepared By: JTM		

CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	Location of Buildings A7 and X-Ray 2 Transonic Final Status Survey Report - Structures	Date: December 2004 Project #: 03-3004.00 File Name: Fig2_BuildingLocations Prepared By: JTM	**Figure 2**



CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	A7 Interior Survey Unit and Scan Results	Date: December 2004 Project #: 03-3004.00	Figure: 3
	Transonic Final Status Survey Report - Structures	File Name: A7_Interior Prepared By: JTM	

CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	A7 Exterior Survey Unit and Scan Results Transonic Final Status Survey Report - Structures	Date: December 2004 Project #: 03-3004.00 File Name: A7_Exterior Prepared By: JTM	Figure: 4



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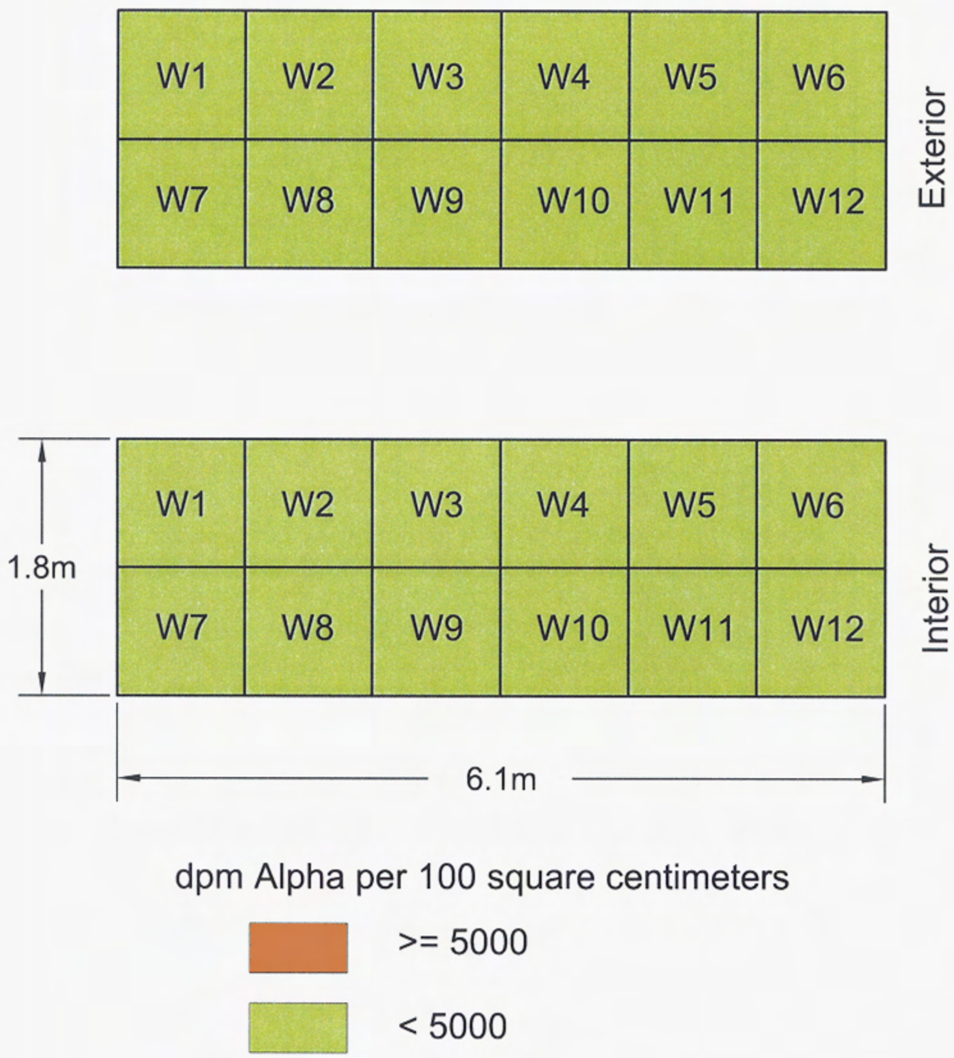
X-Ray 2, Plan View

Transonic Final Status Survey Report - Structures

Date: December 2004
Project #: 03-3004.00
File Name: X-Ray 2_PlanView
Prepared By: JTM

Figure: 5

CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	X-Ray 2 South Wall Survey Unit and Scan Results Transonic Final Status Survey Report - Structures	Date: December 2004 Project #: 03-3004.00 File Name: X-Ray 2_SouthWall Prepared By: JTM	Figure: 6



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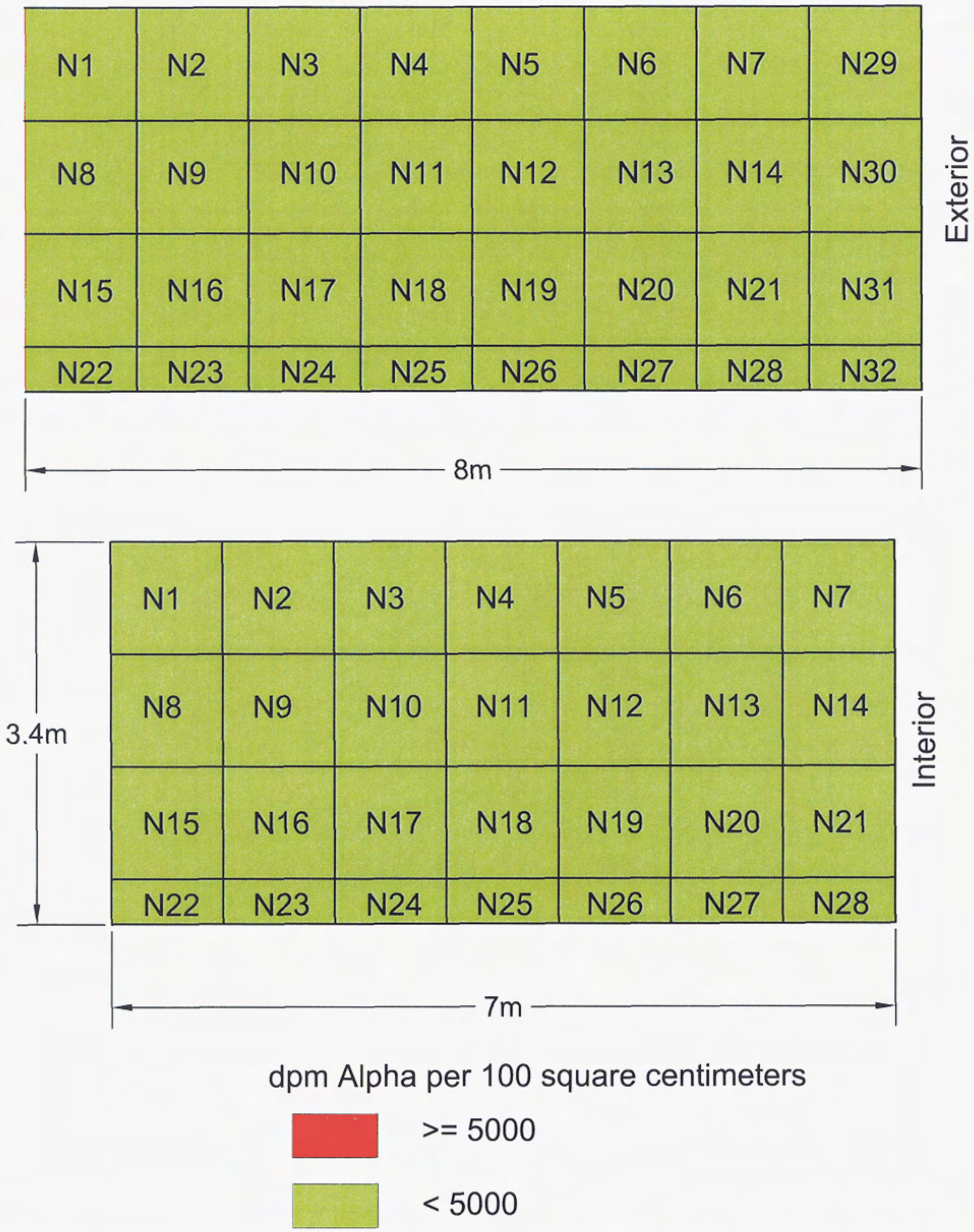
X-Ray 2, West Wall Survey
Unit and Scan Results

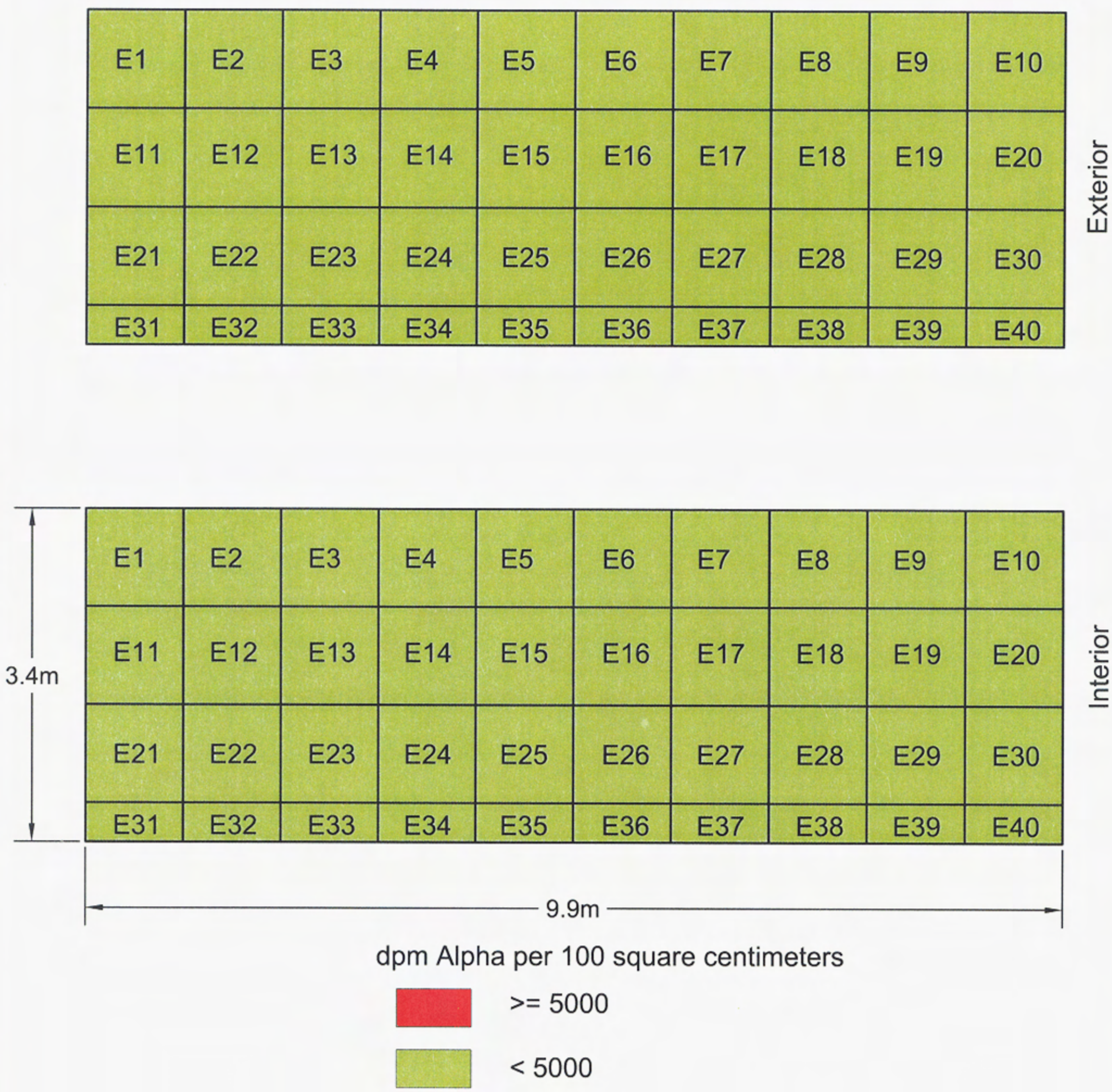
Transonic Final Status Survey
Report - Structures

Date: December 2004
Project #: 03-3004.00
File Name: X-Ray 2_WestWall
Prepared By: JTM

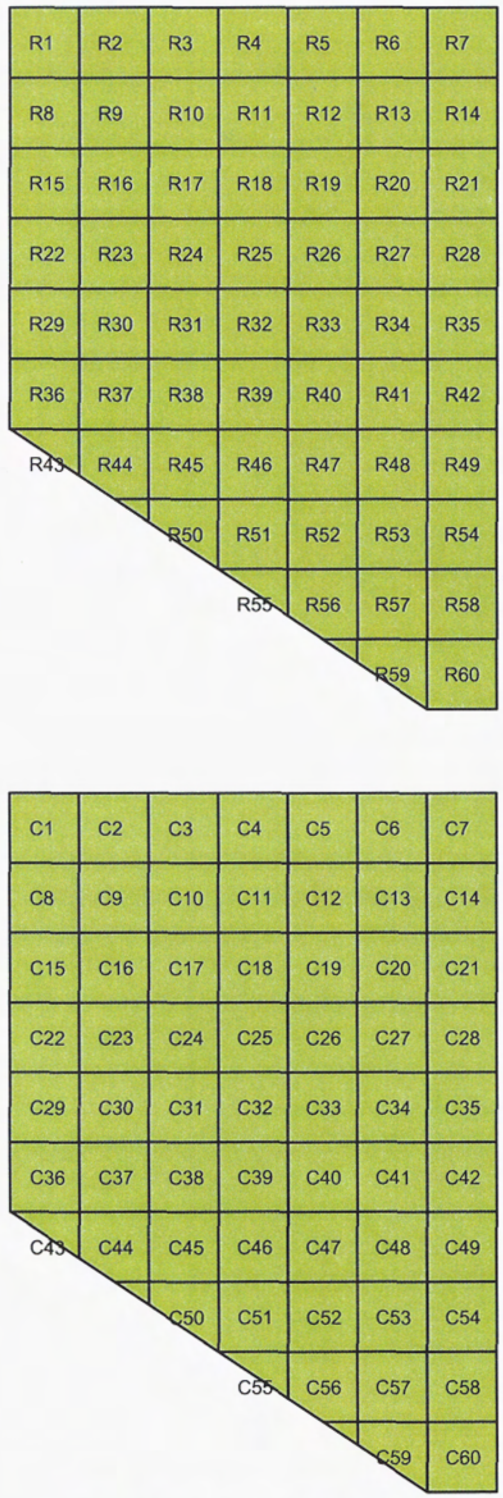
Figure:
7



CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	X-Ray 2 North Wall Survey Unit and Scan Results Transonic Final Status Survey Report - Structures	Date: December 2004 Project #: 03-3004.00 File Name: X-Ray 2_NorthWall Prepared By: JTM	Figure: 8



CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	X-Ray 2 East Wall Survey Unit and Scan Results Transonic Final Status Survey Report - Structures	Date: December 2004 Project #: 03-3004.00 File Name: X-Ray 2_EastWall Prepared By: JTM	Figure: 9



dpm Alpha per 100 square centimeters

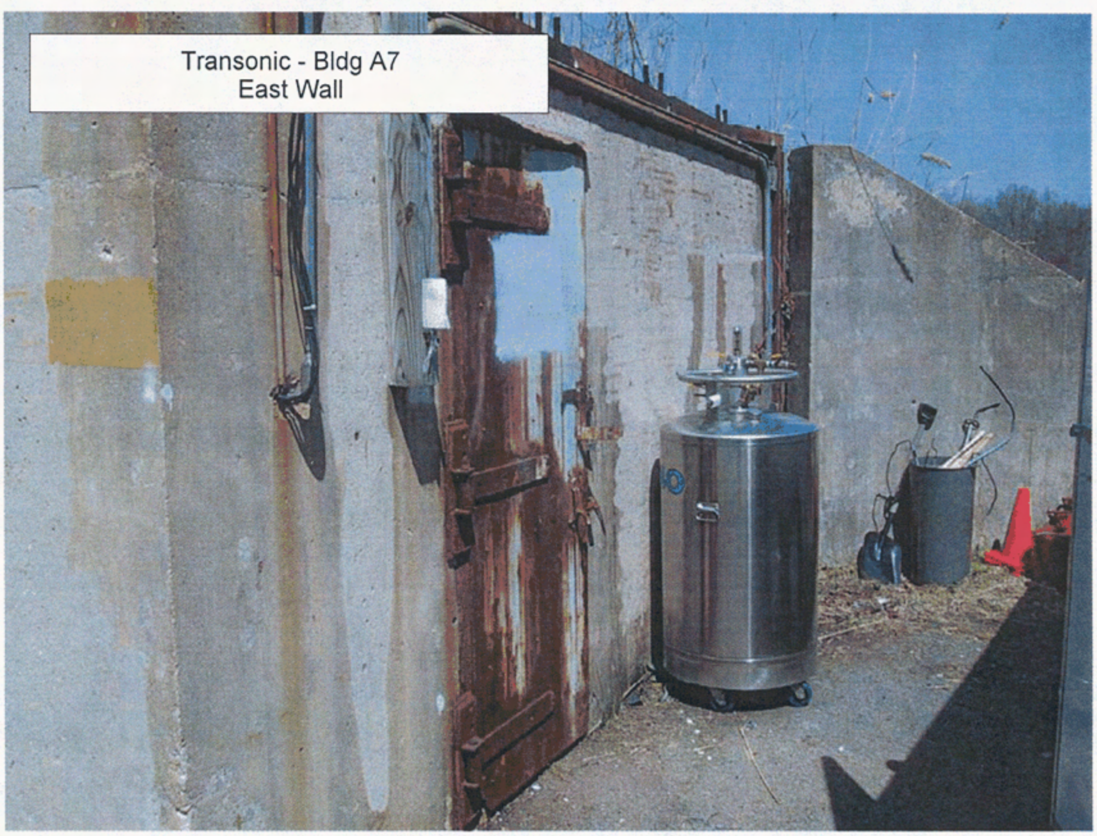
>= 5000

< 5000

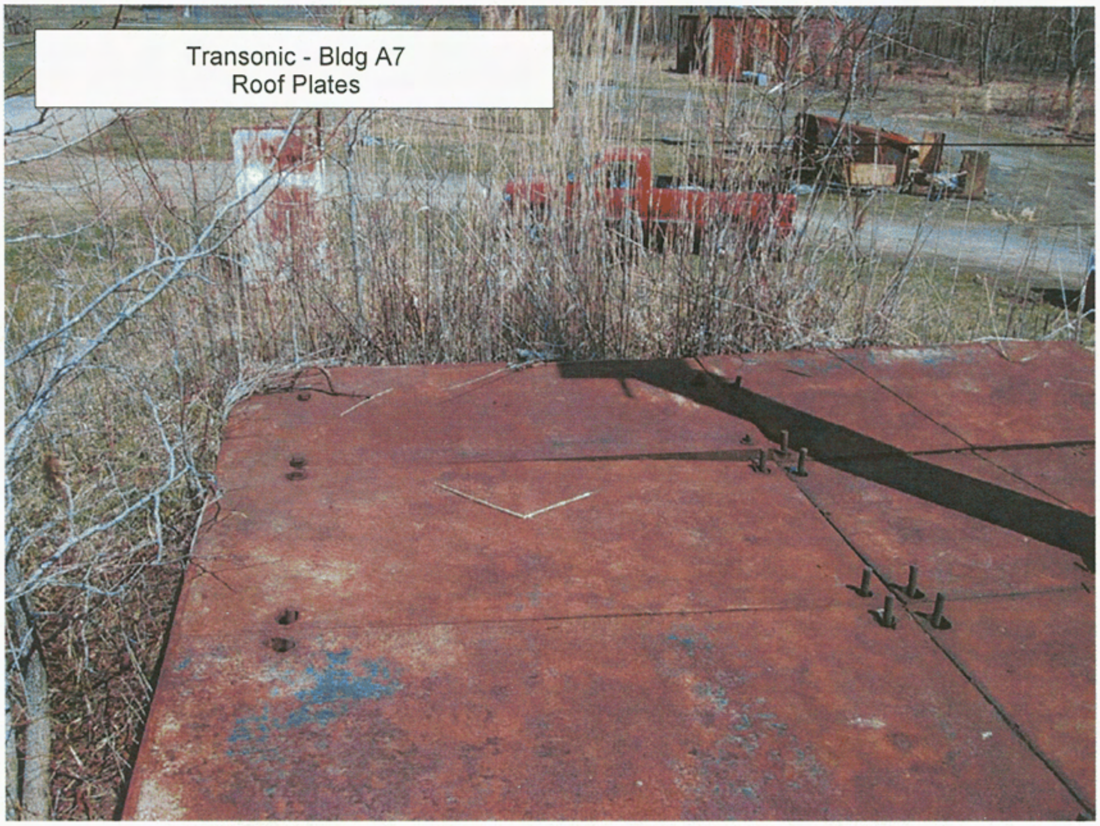
CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	X-Ray 2 Roof & Ceiling Survey Unit and Scan Results	Date: December 2004 Project #: 03-3004.00	Figure: 10
	Transonic Final Status Survey Report - Structures	File Name: X-Ray 2_RoofCeiling Prepared By: JTM	

Appendix A: Building Photographs


Transconic - Bldg A7
East Wall


Transonic - Bldg A7
East Wall

Transonic - Bldg A7
North Berm (excavated during investigation)



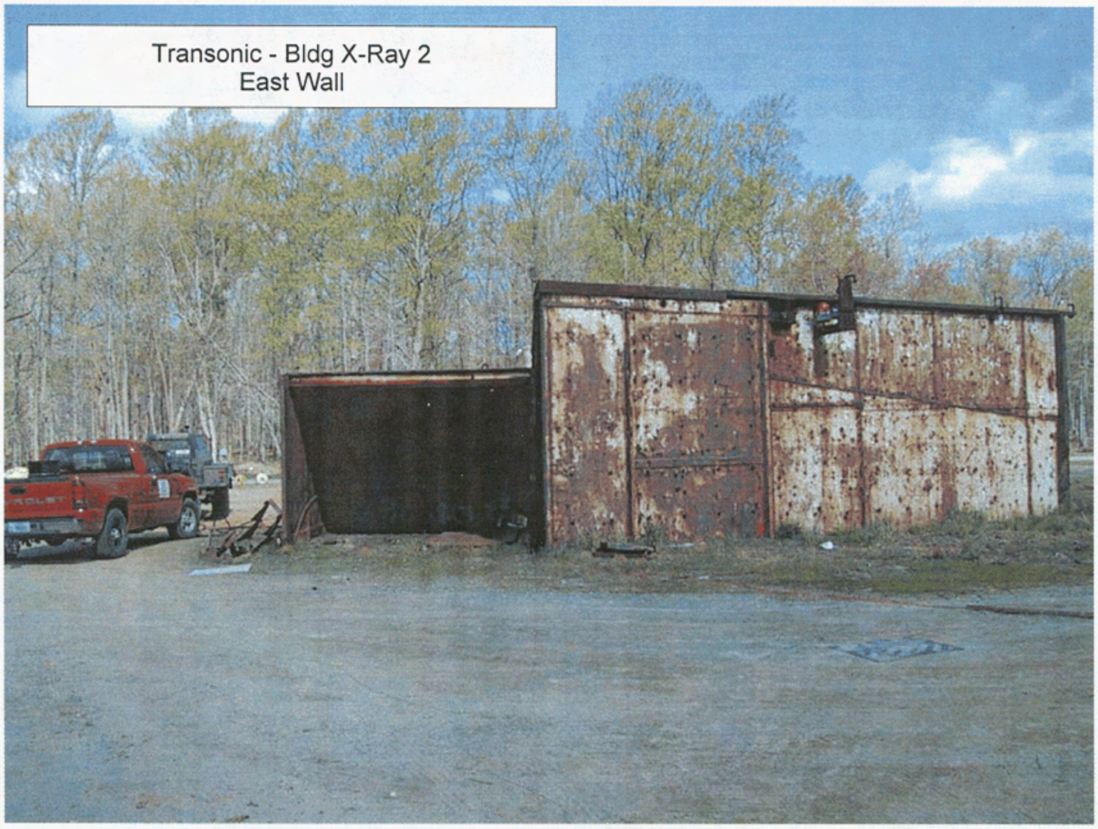
Transonic - Bldg A7
Roof Plates

Transonic - Bldg A7
South Wall

Transonic - Bldg A7
West Wall

Transonic - Bldg A7
West Wall (during excavation)

Transonic - Bldg X-Ray 2
East Wall



Transonic - Bldg X-Ray 2
Looking SW

Appendix B: ATG Decommissioning Plan

ABERDEEN PROVING GROUND

TRANSONIC RANGE
DEPLETED URANIUM STUDY AREA

DECOMMISSIONING PLAN

conducted under

Army Research Laboratory
NRC License No.:

SMB-141

Revision 1
March 1, 2000

Allied Technology Group, Inc.
669 Emory Valley Road
Oak Ridge, TN 37830

ABERDEEN PROVING GROUND

TRANSONIC RANGE
DEPLETED URANIUM STUDY AREA

DETAILED DECOMMISSIONING PLAN

Revision 1
March 24, 2000

Approval Page

Submitted by:	Lee Young, ATG Project Manager	Date
Concurrence:	Arthur J. Palmer, III, ATG QA/QC Manager	Date
Recommended for Approval:	Mike Styvaert, IOC Project Officer	Date
Approved:	Nuclear Regulatory Commission	Date

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1. BACKGROUND

Allied Technology Group, Inc. (ATG) has been contracted by the U.S. Army Industrial Operations Command (IOC) for the remediation and decommissioning of the Depleted Uranium Study Area (DUSA) of the Transonic Range located at Aberdeen Proving Grounds, MD. In addition, the contract requires ATG to provide a final release survey of the grounds and structures to show that they meet the release criterion and to provide for packaging, shipment, and disposal of the resulting waste. All decommissioning activities will be conducted under the requirements of Army Research Laboratory's NRC license (No. SMB-141). In addition, the ARL RSO will oversee all related activities and has the authority to suspend any operations deemed to be unsafe to workers and public or detrimental to the environment.

The release criterion can be found in the facility license provisions and "Radiological Criteria for License Termination", 10 CFR 20, Subpart E, (Reference 1). The corresponding release limit for the affected outdoor area, 230 pCi/gm, was derived by Argonne National Laboratory (ANL) using the unrestricted release criterion, for the resident-farmer scenario, of 25 mRem/yr. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", Argonne National Laboratory, 1999, (Reference 2) is the basis for the volumetric DCGLs of this Work Plan. The release limit for the structures are derived in accordance with the "Federal Register/Volume 62, Number 222/Wednesday, November 18, 1998", (Reference 3), and its associated Regulatory Guide, "Demonstrating Compliance with the Radiological Criteria for License Termination", Draft Regulatory Guide DG-4006, (Reference 4). This corresponds to Table 6.4 of "Army Regulation EM 385-1-80, Radiation Protection Manual" (Reference 5) for the material of interest, Depleted Uranium (DU).

1.1 REASON FOR REMEDIATION

DU penetrator ammunition rounds were tested at the DUSA between 1973 and 1979. In 1979 outdoor testing of the penetrators ceased, however the site continues to be listed as a radiation test facility in the U.S. Army Research Laboratory's (ARL) Nuclear Regulatory Commission (NRC) License. The determination was made in 1995 to cease licensed activities at the DUSA. To support this determination, IOC and ARL desire to terminate the license conditions and provisions associated with the DUSA. The need to perform remediation to support this termination is found in the NRC Branch Technical Position (BTP), "When to Remediate Inadvertent Contamination of the Terrestrial Environment", (Reference 6). According to the BTP, licensee sites which are no longer used to conduct licensed activities should be remediated to unrestricted use levels to preclude migration of the radioactivity.

1.2 MANAGEMENT APPROACH

The ATG approach to the Decontamination and Decommissioning of the DUSA is designed to provide the customer (IOC) with a top quality service at a reasonable price. We have provided environmental / radiological remediation and waste management services since ATG was founded in 1976, and have performed these services for the IOC since 1989. ATG will provide all aspects of on-site project management and work direction. To provide the best possible service to the IOC, we have teamed with Sanford Cohen & Associates, Inc. (SC&A) and MHF Logistical Services, Inc. (MHF-LS). SC&A will provide laboratory and data analysis services under the direction of the ATG Project Manager. MHF-LS will provide for transportation arrangements, also under the direction of the ATG Project Manager.

NOTE: The project organization chart and resumes of key personnel are included in the document "Specification for the Decommissioning Plan, Transonic Range - Aberdeen Proving Ground", Appendix 1 to this work plan.

The ATG Project Manager will oversee all on-site activities. The Project Manager is responsible for the safe progress of the job, oversight of the quality assurance aspects, field remediation activities, data/sample collection, and packaging/shipping of radioactive waste. The Project Manager will also be the on-site Radiation Safety Officer (RSO). The Project Manager will report directly to the IOC Point of Contact/Project Officer. All on-site activities will require working in conjunction with scheduled range activities as this facility is an active military testing facility. It is anticipated that this work will be performed on weekends and early morning hours when the range is inactive. Scheduling will be coordinated with the IOC Project Officer and the APG Point of Contact.

The work force for the setup, remediation activities, data/sample collection, on-site analysis, packaging and shipping of samples, and packaging, loading and shipping of radioactive waste will be under the direction of the ATG Project Supervisor. The Project Supervisor will also serve as the on-site health and safety officer and the health physics supervisor. The Project Supervisor will report to the ATG Project Manager.

The ATG QA/QC Manager will ensure that all work is performed in accordance with applicable Federal, State, and local regulations and requirements; the Decommissioning Work Plan; the provisions of the Project Quality Assurance (QA) Plan (Appendix 2); and the ATG Field Operating Procedures (Appendix 3). The QA/QC Manager will report to the ATG Project Manager, however, he will also report to the ATG Corporate QA/QA Manager who has a direct reporting chain to the IOC Project Officer.

The ATG Health, Safety, and Environmental Compliance Manager will ensure that all project personnel are trained and qualified in accordance with applicable Federal, State, and local regulations and requirements and that work is performed in compliance with the Project Health and Safety Plan (Appendix 4). The HS&E Manager will report to the ATG Project Manager.

The ATG UXO Supervisor will be ensure that the provisions of the Project UXO Avoidance Plan, (Appendix 5), are implemented in the field, as applicable. He will provide technical direction to the UXO specialist(s) assigned as part of the project workforce. The ATG UXO Supervisor will report to the ATG Project Manager.

Individuals assigned to this project will be trained and qualified in accordance with the provisions of 10 CFR 19.13 "Radiation Worker Training (Reference 7), 29 CFR 1910.120 "OSHA Construction Standards" (Reference 8), and applicable license provisions. Training records will be supplied and maintained as part of the project records in accordance with the Project QA Plan. Training specific to the project will be performed prior to the start of field work by or under the direction of the ATG HS&E Manager and APG personnel, as applicable. On-site training will be documented on ATG Form 027 (Training Record) in accordance with ATG Field Operating Procedures.

Daily briefing/training meetings will be conducted, prior to the start of field work, to discuss activities that will be performed that day. Radiological and Industrial safety concerns will be discussed , as well as proper Personnel Protective Equipment (PPE) and contamination controls. Compliance with state, local, and facility motor vehicle laws will also be covered in these briefings. These meetings will be conducted by the Project Manager and Project Supervisor and will be documented on ATG Form 027 (Training Record). These briefings will also be documented on the Pre-Job Briefing for Health Physics (ATG Form 026) and the Pre-Job Briefing for Industrial Hygiene/Safety (ATG Form 025), if applicable. Visitors who request access into the exclusion zone will be required to attend the daily briefing (or an equivalent briefing) and document attendance on the appropriate forms.

2. SITE DESCRIPTION

2.1 TYPE AND LOCATION OF FACILITY

Aberdeen Proving Ground (APG) located at Aberdeen, MD is an active U.S. Army testing and research facility. The APG lies along the western shore of the Chesapeake Bay in Harford and Baltimore Counties, MD, approximately 15 miles northeast of Baltimore, MD. The APG covers a total of 72,516 acres (land and water) and consists of two distinct areas: the northern portion of APG, referred to as the Aberdeen Area (AA); and the southern portion of APG, referred to as the Edgewood Area (EA). The AA became a formal military post, designated as APG, in 1917. The EA (formerly Edgewood Arsenal) was appropriated by Presidential Proclamation in 1918. The Depleted Uranium Study Area (DUSA) is located within the boundaries of the Transonic Range in the AA of APG.

2.2 OWNERSHIP

As an active military installation, APG is the property of the U.S. Government, Department of Defense. It is operated and maintained by the U.S. Army.

2.3 FACILITY DESCRIPTION

The DUSA comprises approximately 12 acres on the southeast end of the Transonic Range. The gun locations were located on the northern portion of the site and fired at targets to the south. The DUSA can be described as a cleared relatively flat tract, surrounded by woods to the east, south, and west. Swampy areas are found behind the Transonic Range catchbasin to the south, along the wooded areas to the west, and in the northeast section of the site.

The east side of the site was stabilized approximately ten years ago when a layer of landscaping plastic was laid north of building A-7 to the tree line to the east and west toward X-Ray 1. A 4 to 8 inch layer of gravel was laid over the plastic. At about the same time, the small swampy area to the north of the firing positions was covered with 2 to 4 feet of soil so that guns could be moved further away from the targets.

DU penetrator round testing was conducted on the site from 1973 to 1979. After outdoor testing ceased the Army Research Laboratory (ARL) health physicist conducted an initial site cleanup to reduce the radioactive waste inventory and to allow other non-radiological testing to be conducted on the site. ARL conducted soil sampling on the site as late as 1991 as a part of their environmental monitoring program. In 1995/96, the site was characterized by General Physics Corporation as a part of the preparations for decommissioning. The results of this characterization are found in "Transonic Range Depleted Uranium Study Area Radiological Characterization Study Report", General Physics Corporation, 1996 (Reference 9). These results are used as the radiological bases for this work plan.

2.4 STRUCTURES

The DUSA did contain five small industrial type structures. One building (X-Ray 1) has been removed since the characterization survey was conducted.

2.4.1 BUILDING A-7

Building A-7 is located on the southeast side of the DUSA and is constructed of concrete. The building covers approximately 20 m^2 and is approximately 3 meters high. The northern face of the building is covered by an earthen berm. There are no known drains from the building and no ventilation system. The interior does contain work tables and storage shelves. The installation used A-7 to store electronics equipment.

The west wall has an outer wall of three inch steel plate attached to the concrete and a single metal box penetrating the wall. The east wall contains a single metal door, the only access to the structure. The concrete roof is covered with three inch thick steel plates, approximately 6 ft. long and 41 in. wide, held in place by anchor bolts imbedded in the concrete.

Building A-7 meets the release guidelines with the exception of the joints between the steel plates on the roof and the east exterior wall. The area between the roof and the walls, the north exterior wall, and the west exterior wall could not be accessed for characterization and are therefore assumed to be contaminated.

2.4.2 X-RAY 2

X-Ray 2 is located on the southern portion of the DUSA and covers approximately 58 m^2 with a nominal wall height of approximately 3.5 meters. There are no known drains associated with X-Ray 2. The structure contains a US Army Field Electronics Trailer. The trailer is constructed of aluminum and rests on a raised platform above the ground.

The walls of X-Ray 2 consist of fitted 2.5 in. steel plate. The upper roof, over the trailer, is 1 in. thick steel. The lower roof, west side of the structure, is 2.5 in steel. The south wall contains the access door and the west wall has a slit cut into it for X-Ray passage.

Significant portions of X-Ray 2 were either inaccessible (therefore, considered contaminated) or showed fixed contamination above the guidelines. These areas include the west end of the south exterior wall, the west exterior wall, the lower roof, the upper roof, and the interior floor.

2.4.3 SECURITY BOXES

Security Box 1 covers approximately 50 m^2 and is located northwest of X-Ray 2 along the access road. Security Box 2 occupies approximately 26 m^2 and is located north of the affected area of the DUSA. Both are constructed of 1 in. steel, have 4 vents in the roof, and have a door and an equipment hatch in the south facing wall. There are no known drains from these structures.

The Security Boxes meet the release guidelines on the exterior portions of the structures. The interiors were inaccessible during the characterization and are therefore considered to be contaminated.

2.5 Grounds and Soils

The soil composition of the affected area of the DUSA is primarily a sandy loam with gravel added in certain areas.

ARL conducted soil sampling from 1973 to 1978, and again in 1991, as a part of their environmental monitoring program. Analytical results for soil samples collected from several areas around the radioactive waste storage area and behind the backstops showed levels in excess of the guideline values for unrestricted use. Most of the soil contamination was found in the radioactive waste storage area. Concentrations in this area ranged from 10 to 520 pCi/g.

During the characterization surveys of the DUSA (1995/96), numerous soil samples were taken and analyzed for radioactive and other hazardous components. The characterization report (Reference 9) concluded that all areas showed soil concentrations in excess of the guideline level of 35 pCi/g for depleted uranium developed for the characterization study (Reference 9). The highest average concentrations were reported in characterization grids C1, C2, B2, B3, A1, and A4. Small areas of elevated activity were reported in characterization grids A2, B4, C4, and Z2. The highest activity reported (4.23 E5 pCi/g) was found in characterization grid A2. It should be noted that this reported DU concentration will be evaluated to determine the source of the error, given that the specific activity of DU is less than 370,000 pCi/g. Much of the contamination is limited to the top three inches of soil. Also it appears that much of the contamination is localized to well defined areas.

The characterization data also indicates the potential for subsurface UXO, particularly in characterization grids A1, C1, and C2.

The characterization samples were also analyzed and compared to the disposal site criteria. This data indicated no hazardous material component in the soil that would cause the remediation waste to be classified as a mixed waste. These samples will be verified prior to packaging and shipment of waste generated in the remediation process.

3. OPERATING HISTORY

3.1 LICENSING STATUS

The Depleted Uranium Study Area (DUSA) is located within the boundaries of the Transonic Range in the AA of APG. The DUSA of the Transonic Range at Aberdeen Proving Ground (APG) is listed as a radiation test facility in the U.S. Army Research Laboratory's (ARL) Nuclear Regulatory Commission (NRC) license (No. SMB-141). The facility has been involved in testing of DU penetrator rounds from 1973 to 1979. Outdoor testing of the DU rounds ceased in 1979; however, the area continues to be listed as a radiation test facility. In 1995 a determination was made to cease all licensed activities at the DUSA and remove it from the list of radiation test facilities at APG.

After outdoor testing ceased in 1979, ARL conducted an initial site cleanup to reduce the radioactive waste inventory and allow other non-radiological testing to be conducted at the DUSA. This effort included removing shot target and other materials from the radioactive material storage area. This initial effort also included surveying and removing contaminated soil, sand, and other materials. Based on these "scoping" surveys and site history, it was estimated that approximately 12 acres should be considered suspect areas for DU contamination.

When the decision was made to cease licensed activities and remove the DUSA from the list of radiation test facilities, General Physics Corporation was contracted to perform a radiological "characterization" survey of the site. The report of this characterization, "Transonic Range Depleted Uranium Study Area Radiological Characterization Report", General Physics Corporation, 1996, (Reference 9) reached the following conclusions:

- Based on the radiation surveys no removable contamination was found on the structures surveyed at DUSA. However, fixed radiation levels in A-7, X-Ray 1 and 2 are in excess of the guideline values.

- Soil data does not show the presence of radionuclides other than isotopes of U-238 and U-235 above ambient levels. The approximate distribution of the uranium isotopes is that of depleted uranium.

- All areas showed soil concentrations in excess of guideline values for depleted uranium with the highest concentrations in grids C1, C2, B2, B3, A1, and A4. Much of the contamination is limited to the top three inches of soil. Also it appears that much of the contamination is localized to well defined areas. Any remedial actions will require careful planning and implementation as it is likely that subsurface UXO will be encountered. In particular, grids A1, C1, and C2 showed high concentrations of ferrous and non-ferrous metal from the magnetometry survey.

- The soil does not contain hazardous materials, pesticides, herbicides, or explosives above the regulatory limit.

NOTE: The guideline values referred to in the characterization report are not necessarily the guidelines used in this work plan. The guidelines used in this work plan were derived in accordance with the most current guidance, i.e., "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575 (Reference 10) for soil and "Demonstrating Compliance with the Radiological Criteria for License Termination", Draft Regulatory Guide DG-4006 (Reference 4) for structures.

Based on the scoping and characterization data IOC contracted Argonne National Laboratory (ANL) to provide the volumetric Derived Concentration Guideline Levels (DCGL) applicable to DUSA in accordance with the guidance contained in MARSSIM. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", Argonne National Laboratory, 1999, (Reference 2) is the basis for the volumetric DCGLs of this Work Plan.

The remediation and final survey documentation developed in the implementation of this work plan, along with the referenced reports, will form the bases for the NR Form 314 required as a part of the decommissioning and license termination of the DUSA.

3.2 PROCESSES

The DUSA is located on the southeast end of the Transonic Range and was used for DU testing from 1973 to 1979. Testing consisted of gun launching DU penetrator rounds from two locations on the northern portion of the site at targets mounted adjacent to the X-Ray units to the south. Stripper/deflector plates located in between the launch or shooting locations were designed to strip or deflect the sabot away from the penetrator while in flight to the target. Penetrators were either stopped in the target or penetrated the target and impacted into a backstop located a short distance behind the targets.

As a result of the testing, most of the DU melted into the target and backstops. However, some DU fell onto the soils around the targets or was scattered into the surrounding area. Test technicians wore protective clothing and dosimetry while in the test area and monitored activities for radioactive contamination. Shot targets and other designated materials were maintained on site in a radioactive materials storage area located to the east of the impact zone. While the shot target and other designated materials have been remediated, recycled, and/or disposed of as radioactive waste, the wooded storage site is still posted "Radioactive Materials Area".

3.3 WASTE DISPOSAL PRACTICES

During operation of the DUSA as a DU test range, radioactive wastes, except for shot targets and other designated materials, were handled through established radioactive waste disposal channels, i.e., packaged and shipped to a licensed disposal site. Shot targets and other designated materials were maintained on site in a radioactive waste storage area. After testing ceased, the ARL health physicist conducted an initial site cleanup to reduce the radioactive waste inventory and allow other non-radiological testing to be conducted at the DUSA. This effort included removing shot target and other materials from the radioactive material storage area. The shot target and other designated materials have been remediated, recycled, and/or disposed of as radioactive waste at a licensed disposal site.

4. REMEDIATION ACTIVITIES

4.1 OBJECTIVES

The objective of this project is the decontamination/remediation of the Depleted Uranium Study Area (DUSA) of the Transonic Range at Aberdeen Proving Grounds, including facilities and equipment, to acceptable ALARA (as low as is reasonably achievable) levels for unrestricted release. The criteria for this release shall be the Derived Concentration Guideline Levels (DCGLs) developed in compliance with the "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575, (Reference 10) for the soil and Army Regulation EM 385-1-80, "Radiation Protection Manual", Table 6-4 (Reference 5) for facilities and equipment. This objective will be accomplished by performing the following activities and tasks:

NOTE 1: It is estimated that the waste volume from this activity will be 2,500 ft^3.

NOTE 2: All work activities will be performed in accordance with this Decommissioning Work Plan, ATG Field Operating Procedures, and the requirements of the Site License.

4.1.1 Site Mobilization and Preparation
Mobilize personnel and equipment
Provide on-site training
Collect bioassay samples and issue dosimetry
Establish work schedule
Obtain necessary work permits
Establish UXO protocol for range activities
Establish Air Sampling protocol for range activities

4.1.2 Establish Characterization Grid Reference System
Preliminary UXO Sweep
Re-establish the grid boundaries used during the characterization
Verify the grid boundaries through radiation surveys
Post area boundaries (Radiological, HAZMAT, UXO)

4.1.3 Survey of Surfaces/Areas Inaccessible during Characterization
UXO Survey
Laydown area survey and establishment
Obstruction removal

4.1.4 Testing of Contaminated Structural Surfaces
Identification of Representative Contaminated Surfaces
Determination of Contamination Depth
Approximation of Background

4.1.5 REMEDIATION
UXO Support
Segregation/Excavation

4.1.6 EQUIPMENT AND DEMOBILIZATION
Surveys and Samples
Equipment Release
Demobilization

Note: The activities, including grid layout and surveys/samples, associated with the final release of the DUSA are discussed in Section 5 of this work plan.

4.2 RESULTS OF PREVIOUS SURVEYS

Environmental and work area surveys were conducted in the area of the Transonic Range during the full time operation of the range and during the interim period, i.e., prior to the decision to cease licensed activities. In late 1995 and early 1996 the site was characterized ("Transonic Range Depleted Uranium Study Area Radiological Characterization Study Report", General Physics, 1996, Reference 9) to determine the extent of radioactive contamination and other hazards. The results of this characterization is the basis for the remediation and decommissioning activities in this work plan. As part of the decommissioning activities these results will be verified and used to focus specific remediation tasks.

4.2.1 STRUCTURES
There are four structures remaining on the Transonic Range, Depleted Uranium Study Area (DUSA). None of the accessible areas of these structures showed loose surface contamination in excess of the guidelines contained in Army Regulation EM 385-1-80, "Radiation Protection Manual", Table 6-4. For purposes of planning the inaccessible areas are assumed to contain loose surface contamination above the guidelines. In addition fixed contamination above the guidelines was detected or assumed to be present as outlined below.

4.2.1.1 Building A-7
Building A-7 meets the release guidelines with the exception of the joints between the steel plates on the roof and the east exterior wall. The area between the roof and the walls, the north exterior wall, and the west exterior wall could not be accessed for characterization and are therefore assumed to be contaminated.

4.2.1.2 X-Ray 2
Significant portions of X-Ray 2 were either inaccessible (therefore, considered contaminated) or showed fixed contamination above the guidelines. These areas include the west end of the south exterior wall, the west exterior wall, the lower roof, the upper roof, and the interior floor.

4.2.1.3 Security Box 1

Security Box 1 meets the release guidelines on the exterior portions of the building. The interior was inaccessible during the characterization and is therefore considered to be contaminated.

4.2.1.4 Security Box 2

Security Box 2 meets the release guidelines on the exterior portions of the building. The interior was inaccessible during the characterization and is therefore considered to be contaminated.

4.2.2 Soil

The 1996 Characterization of the DUSA showed thirteen (13) soil areas with depleted uranium (DU) concentrations that exceed the ALARA target of 105 pCi/g (see Table 5.1 and Section 5.1 of this work plan). Twelve (12) of these locations are relatively small, with areas ranging from 4 to 10 m^2. The final location is a large area of elevated activity of about 250 m^2.

The grids of concern are A-1, A-2, A-4, B-2, B-3, B-4, C-1, C-2, C-4, and Z-2. The large area of elevated activity extends over the juncture of grids C-1/2, with small areas of elevated activity spotted over the remaining grids. The highest exposure rates and corresponding soil activity appear in grids A-2 and Z-2.

4.2.3 Unexploded Ordinance

As a preliminary phase of the characterization of the DUSA, the site was surveyed for and cleared of surface unexploded ordinance (UXO). Additional subsurface magnetometry scans were conducted during the characterization. The results of these sweeps and surveys indicate that encountering subsurface UXO is likely, particularly in grids A-2 and C1/2.

4.2.4 Other Hazards

In the characterization process the collected soils were analyzed for compatibility with disposal site criteria. This evaluation included analyses for the presence of materials regulated under 40 CFR 261, Reference 11 (Hazardous Materials) as well as an evaluation of physical properties. The characterization shows that the soil on the DUSA does not contain hazardous materials, pesticides, herbicides, or explosives above the regulatory limits. In those instances where hazardous materials were detected, only trace levels were found, which were well below the component limit. If additional information were to show that other hazardous materials (e.g., metals, semi-volatiles, and volatiles) were present, specific steps will be taken in conducting additional characterization for H&S purposes and waste disposal. The USA-IOC Project Officer and ARL RSO will be notified of such findings and any additional characterization efforts will be conducted only with IOC and ARL approval.

4.3 REMEDIATION PROCEDURES

4.3.1 Mobilization and Preparation

4.3.1.1 Mobilization

ATG will physically mobilize upon the receipt of the Notice to Proceed. Necessary equipment and material will be assembled and shipped/transported to APG. The necessary staff will mobilize and assemble at a pre-designated location in the area of APG to facilitate access.

Personnel: All personnel assigned to this project shall have completed the 40 hour Basic Hazardous Waste Training Program and, if needed, the 8 hour refresher Training in accordance with 29 CFR 1910.120, "OSHA Standards", Reference 8.

- Supervisors shall have completed the 8 hour Supervisors Training Program in accordance with 29 CFR 1910.120.
- All personnel will be required to provide evidence of training in accordance with 29 CFR 1910.120 e.6.
- All personnel will be required to provide evidence of Medical Certification in accordance with 29 CFR 1910.120 f.
- All respirator wearers will be trained and have documentation required for respirator use in accordance with 29 CFR 1910.134

Equipment: Tools and equipment necessary for the completion of this project shall be mobilized as needed. This is expected to include:

- Radiation Survey Instruments
- Radiation Counting Equipment
- Air Sampling Instruments
- Excavation Equipment, e.g., Backhoe, Front End Loader
- Sampling Equipment (including concrete boring tools)
- Hand Tools
- Cutting Torch
- Ventilation Equipment
- Scabbling Equipment
- Air Compressor
- Generator

Facilities: APG will provide office facilities and supplies, i.e., office space, restroom, telephone lines, fax equipment, and access to a copy machine. ATG will establish a field office in this location. Copies of all project records will be maintained at this location for field use, Base, IOC, and regulatory review.

4.3.1.2 Training

In addition to the training specified above all personnel shall receive the following training as a preliminary to field work. All on site training will be documented on a Training Record (ATG Form 027) and be kept as a part of the permanent project file.

Site Specific OSHA (29 CFR 1910.120) Training, including:

- Work Plan and Associated Documents
- Site Health and Safety Plan
- Site Specifics (APG)

Radiation Worker (10 CFR 19.13, Reference 7) Training, including:

- Radiation Worker Rights
- Sources of Radiation and Contamination
- Types of Radiation and Contamination
- Units of Radiation and Radioactivity
- Prenatal Exposure (Reg. Guide 8.13, "Prenatal Exposure", Reference 12)
- Biological Effects of Radiation
- Radioactive Contamination Control
- Use of Anti-C Clothing
- ALARA Concepts
- Emergency Procedures
- Use of Radiation and Contamination Detection Instruments

4.3.1.3 Monitoring

Performance of decommissioning activities on the Transonic Range is not expected to result in measurable dose equivalent to the workers. Personnel dosimetry (TLDs) and bioassay shall be used to verify that this condition is, in fact, true. TLDs will be issued and baseline bioassays will be collected during the mobilization phase.

Personnel monitoring methods will include:

- Dosimetry - Work crews will be required to wear TLDs during work activities at the site, visitors will be issued self-reading dosimetry (SRDs) during inspection or briefing tours.
- Bioassay - All workers will be required to provide a urine specimen for analysis prior to start of work (baseline) and at the completion of the project.

4.3.1.4 Scheduling

During mobilization, crew work schedules will be established based on the needs of the site. It is understood that the Transonic Range is an active firing range and that the mission of the base is paramount. Consequently, the schedule will have the necessary flexibility to maintain a minimum forty (40) hour work week during the hours the range is down.

Arrangements and schedules for surveys of the Security Box interiors will be established during the mobilization phase.

4.3.1.5 Site Permits

During the mobilization phase base required permits will be obtained (or arrangements made to expedite "as needed" receipt). Anticipated base permits are:

DARP - A Department of the Army Radiation Permit is required for the instrument check sources that will be needed for day-to-day activities.

Radiation Work Permit - A site issued Radiation Work Permit (RWP) is required for work on the Transonic Range. An ATG RWP (ATGF-002) will also be prepared and issued in accordance with ATG Field Operating Procedures, Appendix 3.

Safety Work Permit - A site issued Safety Work Permit (SWP) is required for work on the Transonic Range.

Cutting, Burning, Grinding Permit - Certain decontamination activities may require a "Hot" Work Permit, i.e., cutting, burning, and grinding. Base requirements will be ascertained during the mobilization phase.

Excavation Permit - Remediation activities may require the issuance of a base Excavation Permit. Base requirements will be ascertained during the mobilization phase.

Other - Other permits and authorizations may be required for certain remediation activities on the Transonic Range. Base requirements will be ascertained during the mobilization phase.

4.3.1.6 UXO Procedures

During the characterization of the DUSA, conducted in 1996, surface UXO was detected and properly disposed of. The characterization indicated that encountering sub-surface UXO is highly likely, particularly in grids A1 and C1/2. It is the policy of ATG and the Department of Defense (DoD) to provide the maximum possible protection to personnel and property from the damaging effects of potential accidents involving ammunition and explosives. Consequently, all activities conducted during the remediation of the Transonic Range will be preceded by the corresponding level of UXO Avoidance Activity (Project UXO Avoidance Plan, Appendix 5).

Work Site Establishment - UXO personnel shall assist in the establishment of the work site boundaries and control zones.

UXO Sweeps and Surveys - Prior to initial work area entry and any excavation activities UXO personnel shall perform the appropriate sweep or survey for the activity.

UXO Support - A UXO qualified individual shall be present during and monitor all excavation/soil disturbance activities.

UXO Qualifications - A UXO Technician is a graduate of the US Naval EOD School, Indian Head, MD, and has a minimum of 5 years of combined active duty EOD and commercial UXO experience.

4.3.1.7 Air Sampling Procedures

Sampling and analysis of the air in work areas containing radioactive contamination is required to ensure that workers and the general public do not receive an uptake of radioactive material or that any such uptake is accounted for and documented.

Air samples will be collected in the general area and breathing zone of workers during evolutions that have the potential for producing airborne radioactivity (e.g., soil or surface disturbing activities, container loading, etc.).

At a minimum two low volume (nominal flow rate 1 CFM) air samplers will be positioned down wind of the work area. One will be positioned as close to the work area as possible, while maintaining enough distance to prevent cross contamination from the work. The second will be placed at the closest downwind boundary of the work area.

A lapel sampler will be placed on at least one crew member to represent the breathing zone of the workers.

These air samples will be collected and analyzed in accordance with ATG Field Operations Procedure HP-OP-010, "Air Sampling and Analysis". Although no airborne radioactivity is anticipated from this remediation and decommissioning activity, these samples provide representative and reproducible data and will serve to quantify any release of radioactive materials or worker uptake of radioactive materials should airborne transport occur.

The general area air samples will be collected at 3 to 6 feet off the ground. The lapel samples will be collected as close to the individuals face as possible.

The health physics technician obtaining the samples will be responsible for ensuring that while the samples are being obtained they are maintained in a representative sample zone.

The *a priori* calculation with the below parameters shows that an air sample drawn for eight hours at a flow rate of 1 CFM will have a Lower Limit of Detection (LLD) of less than 2×10^{-12} uCi/ml or 0.1 Derived Air Concentration (DAC) for U-238 (or 2.0×10^{-11} uCi/ml, Class Y Compounds). The basis and calculation, using beta counting, assume:

LLD =

B_f = 1.89 ß/dis (DU)
C_e = beta counter efficiency, 12%
t_s = sample counting time, 5 min.
t_b = background counting time, 10 min.
R_b = background count-rate, 40 cpm
F_r = sample flow rate, 1 CFM or 28,317 mL/min.
S_t = sample duration, 8 hr
S_v = sample volume, 1.36×10^7 ml

2.22E+06 = Number of dpm per uCi

The LLD for a sample taken and evaluated under these conditions is about 2.0 x 10^{-12} uCi/ml, i.e., less than 10% of the DAC for U-238. The investigative limit for airborne activity will be 0.5 DAC for DU or 1 x 10^{-11} uCi/ml.

- If this limit is approached or exceeded the cause will be investigated and corrective actions identified.
- If this limit is exceeded work will be stopped until corrective actions have been taken.
- If 0.5 DAC is exceeded inhalation doses will be calculated and assigned to individuals as appropriate.
- If this limit is exceeded the base contact, the IOC Point of Contact/Project Manager, the ATG Project Manager/RSO, and the NRC will be notified as soon as possible of the occurrence.
- In the event of a second occurrence, work causing the elevated activity will be ceased, an investigation will be initiated to identify the cause of the elevated readings, institute the appropriate corrective actions, and determine if perimeter monitoring (Transonic Range Boundaries) need to be established. All resulting findings will be fully documented and notifications will be made to the ARL RSO.
- All events of elevated airborne activity will be thoroughly documented in the project logs and on the procedural forms.

Air samples will be collected every working shift (8 hours) and analyzed to ensure that elevated activity events are documented as soon as possible.

All personnel performing work in the area will submit a urine sample for analysis prior to the commencement of work (baseline) and upon completion of work, as a verification of the accuracy of the air sampling program.

Respiratory protection will be required in areas that exceed 0.5 DAC.

DAC-hour tracking will be required for all personnel wearing respiratory protection.

4.3.2 Establish Characterization Grid Reference System

Note 1: Prior to any range activities or change in range activities, e.g., change from surface work to excavation, the requirements of the ATG "UXO Avoidance Plan" will be implemented and met.

Note 2: All on site work will be done in accordance with the Project Health and Safety Plan, the Project Quality Assurance Plan, and the ATG Field Operating Procedures, which are an integral part of this plan, and are submitted as Appendix 4, Appendix 2, and Appendix 3. All stop work conditions, radiological and hazardous material, safety and industrial hygiene analysis are discussed in the Site Health and Safety Plan.

Note 3: All personnel with unescorted access to the work area will be required to wear TLDs during work activities at the site. Exposure Rate information from the characterization of the Transonic Range indicates that personnel exposure during remediation and decommissioning will be minimal. The highest indicated exposure rate is less than 0.1 mrem/ hr. A conservative estimate of individual exposure is: 12 hours per day for 20 days, yielding 12 * 20 * 0.1 or 24 mrem (TEDE).

Note 4: All material, tools, equipment, and personnel exiting the posted radiological work area must be surveyed to prevent the spread of contamination.

Note 5: Air samples will be collected in the general area and breathing zone of workers during evolutions that have the potential for producing airborne radioactivity (e.g., soil or surface disturbing activities, container loading, etc.). See Section 4.3.1.7 'Air Sampling Procedures" and Appendix 3 "ATG Field Operations Procedures".

Note 6: Protective clothing will be required, as per the RWP, in areas or during activities where the potential for personnel contamination exists (e.g., soil intrusion/excavation, decontamination).

Note 7: During excavation or other intrusive action of contaminated soils a source of water (e.g., spray tank) will be maintained in the area to minimize dusty conditions that could spread contamination.

The work area will be barriered and posted as "Radioactive Materials Area" and "Authorized Entry Only" based on visual assessment of identifiable landmarks. Access to these areas during work activities is as follows:

Table 4.1 Posting and Access Controls

POSTING	UNESCORTED ACCESS REQUIREMENTS
Radioactive Materials Area (10 CFR 20, Reference 13)	Rad Worker Training Dosimetry (TLD)Signed on RWP(s)
Authorized Entry Only (29 CFR 1910, Reference 8)	HAZMAT Training Project Document Training (Work Plan and Appendices)

Brush and other vegetation which would interfere with the identification of the original grids and/or surveys will be cleared with hand operated equipment (e.g., weed wackers, chain saws). The use of a bush hog or similar piece of equipment may be required depending on the thickness of the brush and vegetation. Removed materials will be surveyed, to ensure the radioactivity levels are below the guidelines, and removed from the immediate work area.

Establish a preliminary original grid pattern based on physical landmarks or other identifiable points of reference. One of the objectives when establishing this grid will be to correlate grid locations with the characterization grids. A GPS (Global Positioning Satellite) tracking system may be used during the gridding process to assist in identifying grid locations. Based on survey data and other available information re-establish, if necessary, the original characterization grids for reference.

Conduct a remedial action support and verification survey of the identified grids using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent). The objective of the remedial action support and verification survey will be to verify locations of areas requiring remediation identified in the 1996 characterization report (Reference 9) and ensure that these locations are remediated to levels below the site-specific ALARA level of 105 pCi/g. Table 4.2 lists areas at the site that may require remediation based on the results of the characterization survey. All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures. Mark (red surveyors flag or equivalent) any areas exceeding the site-specific ALARA level for further investigation or remediation.

Table 4.2 Areas of the DUSA Potentially Requiring Remediation

Characterization Grid	Description
C1 and C2	Large area of elevated activity near the dirt road
Z2	One debris pile
A2	One area southeast of the sandpile near a detonation crater
A4 and A5	Several small isolated areas with elevated beta readings
B3	Area between buildings X-Ray 1 and X-Ray 2
B3	Area surrounding dirt hill that covers the electronics building A-7
B4	Area in the vicinity of X=250', Y=575' (southeast corner of grid)

Developed using data from "Transonic Range Depleted Uranium Study Area" (Reference 9), Appendix A, pages 16 and 17.

Conduct a remedial action support and verification survey of the accessible areas of the range structures using a Ludlum Model 2221 with a Model 43-69 Gas Flow Proportional Detector (or equivalent). Particular attention should be paid to areas found to be above the site-specific DCGLs during the characterization surveys. All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures. Mark (red paint or equivalent) any areas exceeding the site-specific DCGL for further investigation or decontamination.

Based on survey data and other available information re-establish, if necessary, the work area boundaries (Radiological, HAZMAT, and Exclusion Areas).

4.3.3 Survey of Inaccessible Surfaces

Note 1: Prior to any range activities or change in range activities, e.g., change from surface work to excavation, the requirements of the ATG "UXO Avoidance Plan" will be implemented and met.

Note 2: All on site work will be done in accordance with the Site Health and Safety Plan, the Project Quality Assurance Plan, and the ATG Field Operating Procedures, which are an integral part of this plan. All stop work conditions, radiological and hazardous material, safety and industrial hygiene analysis are discussed in the Site Health and Safety Plan.

Note 3: All personnel with unescorted access to the work area will be required to wear TLDs during work activities at the site. Exposure Rate information from the characterization of the Transonic Range indicates that personnel exposure during remediation and decommissioning will be minimal. The highest indicated exposure rate is less than 0.1 mrem/ hr, as a conservative assumption. For scoping purposes, the dose to a hypothetical individual is estimated to be:

12 hrs/day x 20 days x 0.1 mrem/hr = 24 mrem (TEDE)

Once initial radiation survey evaluations are conducted in each area scheduled for remediation, the above estimate will be updated using actual measurement results.

Note 4: All material, tools, equipment, and personnel exiting the posted radiological work area must be surveyed to prevent the spread of contamination.

Note 5: Air samples will be collected in the general area and breathing zone of workers during evolutions that have the potential for producing airborne radioactivity (e.g., soil or surface disturbing activities, container loading, etc.).

Note 6: Protective clothing will be required, as per the RWP, in areas or during activities where the potential for personnel contamination exists (e.g., soil intrusion/excavation, decontamination).

Note 7: During excavation of contaminated soils a source of water (e.g., spray tank) will be maintained in the area to minimize dusty conditions that could spread contamination.

Based on survey data and other available information establish lay-down areas for clean, contaminated, and potentially contaminated materials in preparation for accessing unexposed or inaccessible areas of the range structures.

Using the least intrusive means available, remove any access interference to allow surveys of all portions of the range structures.

Areas known to have been inaccessible during characterization include:

Table 4.3 Areas Inaccessible During Characterization

STRUCTURE	LOCATION
Building A-7	eaves (i.e., area between the walls and roof)
Building A-7	roof under the steel plate
Building A-7	north exterior wall
Building A-7	west exterior wall
X-Ray 2	interior floor
Security Box 1	interior
Security Box 2	interior

Building materials removed to gain access will be surveyed to determine status. Materials above the DCGLs will be marked (e.g., red paint) held for decontamination or disposed of as Low Level Radioactive Waste (LLRW). All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures.

If the method used to gain access has the potential to cause airborne radioactivity (e.g., grinding or chipping on contaminated structures), a containment will be built around the structure or area prior to commencing the aggressive activity.

Soil removed to gain access to building exteriors will be surveyed using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent) to determine status. If the indicated activity is above the DCGL, move it away from the building and resurvey. All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures.

The newly exposed surfaces will be surveyed using a Ludlum Model 2221 with a Model 43-68 Gas Flow Proportional Detector (or equivalent) for fixed contamination and representative 100 cm^2 swipes for loose surface contamination. The swipes will be field counted using a Ludlum Model 2221 with a Model 44-9 GM Detector (or equivalent) and returned to the office area for laboratory counting with a Ludlum Model 2929 Scaler with a Model 43-10-1 ZnS(Ag)/plastic Scintillation Detector (or equivalent). All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures.

4.3.4 Structural Test Area(s)

Note 1: Prior to any range activities or change in range activities, e.g., change from surface work to excavation, the requirements of the ATG "UXO Avoidance Plan" will be implemented and met.

Note 2: All on site work will be done in accordance with the Site Health and Safety Plan, the Project Quality Assurance Plan, and the ATG Field Operating Procedures, which are an integral part of this plan. All stop work conditions, radiological and hazardous material, safety and industrial hygiene analysis are discussed in the Site Health and Safety Plan.

Note 3: All personnel with unescorted access to the work area will be required to wear TLDs during work activities at the site. Exposure Rate information from the characterization of the Transonic Range indicates that personnel exposure during remediation and decommissioning will be minimal. The highest indicated exposure rate is less than 0.1 mrem/ hr, as a conservative assumption. For scoping purposes, the dose to a hypothetical individual is estimated to be:

12 hrs/day x 20 days x 0.1 mrem/hr = 24 mrem (TEDE)

Once initial radiation survey evaluations are conducted in each area scheduled for remediation, the above estimate will be updated using actual measurement results.

Note 4: All material, tools, equipment, and personnel exiting the posted radiological work area must be surveyed to prevent the spread of contamination.

Note 5: Air samples will be collected in the general area and breathing zone of workers during evolutions that have the potential for producing airborne radioactivity (e.g., soil or surface disturbing activities, container loading, etc.).

Note 6: Protective clothing will be required, as per the RWP, in areas or during activities where the potential for personnel contamination exists (e.g., soil intrusion/excavation, decontamination).

Note 7: During excavation of contaminated soils a source of water (e.g., spray tank) will be maintained in the area to minimize dusty conditions that could spread contamination.

The depth of contamination on concrete and steel surfaces are of concern in identifying an appropriate background reference area for the structures. To address these concerns small test areas will be decontaminated to determine the depth of the contamination.

An area of about one meter by one meter will be selected on the interior of building A-7. This area should be representative of the levels of fixed contamination found on the interior.

This area will be enclosed to prevent excessive airborne contamination during the decontamination process.

The existing conditions will be documented with at least 5 direct measurements using a Ludlum Model 2221 with a Model 43-68 Gas Flow Proportional Detector (or equivalent). All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures.

A thin layer will be removed by scabbling (or other surface removal method) and the measurements will be repeated and documented.

This decontamination process will be repeated until all five measurements are less than 500 cpm (i.e., the estimated background plus 1.5 standard deviations).

If necessary to establish the contamination depth, core samples will be obtained of the concrete surfaces.

The process will be repeated for the exterior surface of building A-7.

At least 30 measurements will be obtained and documented in the decontaminated areas to provide an estimate of background for evaluating the remediation/decontamination data.

If the contamination depth appears to vary significantly (more than +50%) in X-Ray 2, then this process will be repeated in that structure.

4.3.5 REMEDIATION

Note 1: Prior to any range activities or change in range activities, e.g., change from surface work to excavation, the requirements of the ATG "UXO Avoidance Plan" will be implemented and met.

Note 2: All on site work will be done in accordance with the Site Health and Safety Plan, the Project Quality Assurance Plan, and the ATG Field Operating Procedures, which are an integral part of this plan. All stop work conditions, radiological and hazardous material, safety and industrial hygiene analysis are discussed in the Site Health and Safety Plan.

Note 3: All personnel with unescorted access to the work area will be required to wear TLDs during work activities at the site. Exposure Rate information from the characterization of the Transonic Range indicates that personnel exposure during remediation and decommissioning will be minimal. The highest indicated exposure rate is less than 0.1 mrem/ hr, as a conservative assumption. For scoping purposes, the dose to a hypothetical individual is estimated to be:

12 hrs/day x 20 days x 0.1 mrem/hr = 24 mrem (TEDE)

Once initial radiation survey evaluations are conducted in each area scheduled for remediation, the above estimate will be updated using actual measurement results.

Note 4: All material, tools, equipment, and personnel exiting the posted radiological work area must be surveyed to prevent the spread of contamination.

Note 5: Air samples will be collected in the general area and breathing zone of workers during evolutions that have the potential for producing airborne radioactivity (e.g., soil or surface disturbing activities, container loading, etc.).

Note 6: Protective clothing will be required, as per the RWP, in areas or during activities where the potential for personnel contamination exists (e.g., soil intrusion/excavation, decontamination).

Note 7: During excavation of contaminated soils a source of water (e.g., spray tank) will be maintained in the area to minimize dusty conditions that could spread contamination.

Based on verification survey data and anticipated area volumes, lay down area(s) will be established for the roll-off containers to be used for low level radioactive waste (LLRW).

Locate the appropriate number of hard cover roll-off containers, with 6 mil liners, in the lay down area(s).

4.3.5.1 Structures

The contaminated areas identified in the verification surveys of the DUSA structures will be decontaminated using the least intrusive means that is effective.

All contaminated materials removed and decontamination supplies will be contained for disposal as LLRW.
In-process surveys, using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent), of the area(s) being decontaminated will be taken to determine the end point of the decontamination effort.

If the method used for decontamination has the potential to cause airborne radioactivity (e.g., grinding or chipping on contaminated structures), a containment will be built around the structure or area prior to commencing the aggressive activity.

In cases where decontamination of small items and structural pieces is not cost effective, these items may be disposed of as LLRW.

Upon completion of decontamination, the last in-process survey will be documented. The documentation will be noted that the area is ready for final release survey.

4.3.5.2 Small Areas

The remediation method used in the small areas will depend on the extent of contamination found during the verification surveys.

For small, isolated spots, hand remediation using a shovel and pail or wheelbarrow is the preferred method. Hand remediation minimizes the chance of UXO encounters and minimizes LLRW.

For more extensive spots, heavy equipment (e.g., back-hoe, front-end loader), cutting approximately 1 foot of material per pass is more effective and expedient.

All removed material will be placed into the staged roll-off containers.

In-process surveys, using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent), of the area(s) being remediated will be taken to determine the end point of the remediation/decontamination effort.

Upon completion of remediation/decontamination, the last in-process survey will be documented. The documentation will be noted that the area is ready for final release survey.

4.3.5.3 Large Area

The large affected area will be bounded based on the verification surveys and other pertinent data.

A silt trench will be established around the area to prevent additional environmental contamination and/or cross contamination of additional areas.

Given appropriate UXO clearance to proceed, this area will be excavated, using heavy equipment (e.g., back-hoe, front-end loader) to a depth of approximately one foot.

The excavated material will be placed in the staged roll-off containers for disposal as LLRW.

During and upon completion of excavation an in-process survey, using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent), will be taken to determine the effectiveness of the remediation and the area status.

Any areas found to be above the site-specific ALARA level of 105 pCi/g will be flagged (red surveyors flag or equivalent) for additional remediation.

Depending on the extent of any remaining areas, hand or mechanical remediation will be continued until no additional areas exceeding the site-specific ALARA level are identified.

Upon completion of remediation/decontamination, the last in-process survey will be documented. The documentation will be noted that the area is ready for final release survey.

4.3.6 Equipment Release and Demobilization

Prior to release from the site, all tools and equipment shall be surveyed for loose and fixed radioactive material.

All data will be documented on ATGF-001, "Radiological Survey Report" in accordance with ATG Field Operations Procedures.

Release of material from the site will be noted in the project logs with reference to the survey number for tracking purposes.

4.4 REMEDIATION WASTE

4.4.1 Radioactive Waste Volume Estimates and Handling

Contaminated soils will be excavated using a backhoe and front end loader, while for some areas, waste removals will be done manually depending UXO clearance requirements. Contaminated structures (i.e., Building A-7, X-Ray 2, and both Security Boxes) will be decontaminated using scabblers, cut using oxyacetylene torches, or otherwise dismantled.

The waste generated from these activities will be packaged in hard covered roll-off intermodal transport containers (ITC) using a 6-mil thick insert liner. ITC containers meet the DOT definition of a strong tight container. Each container will be inspected for damages before use, including overall integrity, cracks, damaged gasket seals, and fitness of top cover. Once loaded, the top cover will be put in place and bolted down to ensure a tight-gasketed seal. The containers will be staged in the loading area on transport trucks or on cleared ground. All partially full containers will be covered at the end of the work day, or if work is suspended for more than 2 hours. The exact staging locations will be determined jointly with the Range Control Officer and ARL RSO. During on-site storage and until shipment, the storage area will be posted as a "Radioactive Materials Storage Area" and "Authorized Entry Only". An emergency call list will be developed to identify organizations and individuals to contact in the event of emergencies or unusual conditions. The call list will be coordinated with the Firing Range Officer and ARL RSO.

All exterior surfaces of the containers and transport vehicles will be verified to be free of loose surface contamination prior to shipment from the DUSA. All containers will be surveyed prior to shipment in accordance with ATG Field Operating Procedures and in compliance with 49 CFR Part 171-179. Maximum external dose rates containers are expected to be less than 1,000 uR/hr. The general area (30 cm) dose rate is anticipated to be between 20 and 100 uR/hr, depending on the distribution of DU in the containers and packages. Radiation levels from contaminated items and PPEs discarded as radioactive waste are expected to be non-distinguishable from ambient background radiation exposure rates.

The highest waste activity levels are expected to be less than the specific activity of DU, about 3.7 E+5 pCi/g. While lower DU concentrations are expected to range from non-detectable levels to about 520 pCi/g. The amounts of waste with higher DU concentrations are expected to be a fraction of the total volume of waste. It is expected that all shipments will be less than 0.05% by weight of source material. Waste will be sampled and analyzed onsite using an MCA as it is being generated. A composite sample will be prepared from each of the nine ITC containers and analyzed by an offsite laboratory for isotopic U by alpha spectroscopy and for U and Th decay products by gamma spectroscopy. The analysis will be used to confirm that only DU is present and that U and Th decay product concentrations are associated with naturally occurring radioactivity, including K-40. The same samples will be used for TCLP analysis. In both cases, the analyses will be conducted by laboratories certified by disposal sites or listed by USA-IOC.

Approximately 2,500 ft^3 of solid radioactive waste will be generated during remediation activities. The total amount shipped for disposal is estimated to be higher, about 3,125 ft^3 assuming growth factor of about 1.25, applied to the base estimate of 2,500 ft^3. Waste will be packaged in nine ITC containers. Expected waste forms are expected to include soils, concrete, wood, steel, and miscellaneous waste and debris. Contaminated soils are expected to make up most of the waste volume. Any natural moisture contained in soils generated during remediation activities will be absorbed with an approved desiccant prior to shipment for disposal. If excessive amounts of liquids are found in the waste, sampling and analysis will be performed in accordance with the ATG Field Operating Procedures. Arrangements for the processing and disposal of liquids wastes will be coordinated with the USA-IOC Project Officer and ARL RSO.

Based on prior characterization data, no other types of hazardous materials are expected that would result in the waste being classified as a mixed waste. However, should the presence of other types of hazardous materials be found (e.g., lead), ATG will immediately inform the USA-IOC Project Officer and ARL RSO. Any subsequent characterization efforts will be conducted under USA-IOC and ARL RSO approved methods. In addition, specific arrangements will be made for the disposal of such wastes, as needed.

All data generated in support of waste characterization and packaging will be recorded to later prepare the required shipping manifests (NRC Form 541 - Uniform Low-Level Radioactive Waste Manifest) and demonstrate compliance with the waste acceptance criteria of the disposal facilities (Envirocare and/or WCS). The data recorded will include external surface radiation exposure rates, container surface contamination levels, type, weight and volume of container, DU concentration, total DU inventory, RQ, waste class, physical and chemical form, type of absorbents if used, transport index, and shipment methods.

The full containers will be transported from APG to a local rail spur for trans-shipment (or directly on the transport truck) to Envirocare or WCS of Texas. MHF-Logical Solutions, Inc. (or an equally qualified company) will provide transportation services to the disposal sites. All shipments will meet the DOT requirements and comply with the IOC Standard Operating Procedures - "Shipping Procedures for Unwanted Radioactive Material". In addition, all activities associated with packaging, loading, survey, and shipment will be conducted in accordance with the ATG Field Operating Procedures. The drivers will be qualified and trained in accordance with DOT regulations under 49 CFR Part 172.700.

The broker used for the waste shipments will be USA-IOC certified in accordance with the IOC Standard Operating Procedure - "Shipping Procedures for Unwanted Radioactive Material". It is anticipated that waste generated during remediation activities will be shipped on a continual basis, thereby, leaving only small amounts of waste to be shipped at the end of the project.

4.4.2 Miscellaneous and Investigation-Derived Wastes

All equipment, supplies, and materials leaving site will be surveyed in accordance with protocol established for the project (see Table 5.1). Release limits will be those established in DG-4006, Demonstrating Compliance With the Radiological Criteria for License Termination and with Army Regulation EM 385-1-80. Equipment, tools, and materials not meeting the free release criteria will be decontaminated or disposed of as radioactive waste. Used PPE and other related wastes will be managed and disposed of with contaminated soils.

Liquid wastes are not expected during the conduct of remediation activities, nor are any liquid effluents. Any natural moisture contained in soils generated during remediation activities will be absorbed with desiccant prior to shipment for disposal. If liquids are found, sampling and analysis will be performed in accordance with the ATG Field Operating Procedures, which are based on the requirements of 10 CFR Part 20, Table 2, Col. 2. Compliance with these requirements will be documented.

Similarly, airborne effluents are not expected as a result of project activities. An air sampling program will be established in accordance with Section 4.3 of the Decommissioning Plan following the requirements of 10 CFR Part 20, Table 2, Col.1. Compliance with these requirements will be documented.

5. FINAL SURVEY PROCEDURES

5.1 MARSSIM ASSUMPTIONS AND PARAMETERS

The surveys and samples collected to demonstrate compliance with the release criterion have been designed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual", MARSSIM, NUREG-1575, (Reference 10) for the soil, Army Regulation EM 385-1-80, "Radiation Protection Manual", (Reference 5) for facilities and equipment, and "Demonstrating Compliance with the Radiological Criteria for License Termination" Draft Regulatory Guide DG-4006, (Reference 4). The release criterion for this site is found in "Radiological Criteria for License Termination", 10 CFR 20, Subpart E, (Reference 1).

Derived Concentration Guideline Limits (DCGLs) are radionuclide and site specific activity concentrations within a survey unit that correspond to the release criterion. DCGLs are required for volumetric (i.e., soil) contamination and structural surface contamination as an average activity level ($DCGL_w$) and for small areas of elevated activity ($DCGL_{EMC}$). The volumetric DCGLs for the Depleted Uranium Study Area (DUSA) of the Aberdeen Proving Ground (APG) Transonic Range were derived by Argonne National Laboratory (ANL) using the unrestricted release criterion, for the resident-farmer scenario, of 25 mRem/yr. The DCGLs are summarized here in Table 5.1. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", (Reference 2) is the basis for the volumetric DCGLs of this Work Plan. The ALARA target in Table 5.1 was selected based on the characterization results (Reference 9).[1] The Non-Detectable target is taken from Table 6 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions" (Reference 17). Army Regulation EM 385-1-80 provides the basis for the surface DCGLs - see Table 5.2. Depending on NRC requirements, site-specific surface contamination limits may be developed using other tools, such as RESBUILD and DandD.

Table 5.1 DUSA Volumetric $DGCL_W$

CONDITION	$DCGL_W$ pCi/g
ANL (Ref. X) U-238 DCGL	230
ANL (Ref. X) U-238 DCGL (adjusted for DU and daughters)	190

[1] The results of the characterization study provide drawings identifying areas of the DUSA that exceed 35 pCi/g, 70 pCi/g, and 105 pCi/g. 35 pCi/g is below the detection limit for the field measurements, and 70 pCi/g is essentially equal to the detection limit. 105 pCi/g was selected as the ALARA limit and remediation goal because areas exceeding this concentrations are identified by the characterization survey results, can be detected using field measurement techniques, and this concentration is approximately half of the $DCGL_W$.

ALARA Target	105
Non-Detectable Target	60

Table 5.2 DUSA Structural DCGLs

CONDITION	LIMIT	
Loose Surface Contamination	< 1,000 dpm/100 cm^2 (a, ß)	$DCGL_L$
Fixed Contamination, Average	< 5,000 dpm/100 cm^2 (a, ß)	$DCGL_W$
Fixed Contamination, Maximum	< 15,000 dpm/100 cm^2 (a, ß)	$DCGL_{EMC}$

The $DCGL_{EMC}$ is not a single value, but a family of values developed for the site using the same modeling assumptions and parameter values but reducing the size of the area containing the activity. MARSSIM defines the ratio of the $DCGL_{EMC}$ to the $DCGL_W$ as the area factor. Since the scan MDC is less than the $DCGL_W$, the area factors do not affect the development and design of the release survey. In the event that small areas of elevated contamination are evident after remediation of the DUSA, conservative $DCGL_{EMC}$s will be developed based on the relative size of the areas and the guidance provided in "Manual for Conducting Radiological Surveys in Support of License Termination", NUREG-5849 (Reference 14) to determine the need for additional remediation.

The DUSA occupies approximately 50,000 m^2. Areas with DU activity greater than 105 pCi/gm, as identified in the characterization report and redefined in the confirmation surveys will be remediated (See Section 6, Remediation Activities). MARSSIM recommends that remediated areas receive a survey unit designation of Class 1. Areas of the DUSA that are remediated will be designated as Class 1 areas. Areas of the DUSA that do not require remediation will be designated as Class 2 areas. The results of the characterization survey indicate that the majority of the DUSA has the potential to contain concentrations of DU greater than 35 pCi/gm, therefore, no areas were designated as Class 3 or non-impacted areas.

Survey units are areas of specified size and shape for which a separate decision will be made whether the unit attains the site-specific $DCGL_W$. Survey units are formed by grouping contiguous site areas with a similar use history and the same classification. It is expected, based on the characterization results, that most of the DUSA will be classified as Class 2.

The sample variability in the DUSA was estimated to be approximately 26 pCi/g using the expected range of the data following remediation (0 pCi/g to 105 pCi/g) divided by four. The standard deviation for the characterization data less than 105 pCi/g for the five rows on the characterization grid ranged from 11 pCi/g for row 5 (grids A5, B5, and C5) to 30 pCi/g for row 2 (grids Z2, A2, B2, and C2). The estimated variability of 26 pCi/g is consistent with these values. MARSSIM defines the lower bound of the gray region (LBGR) as the activity where the user would like to know the probability of failing to release a "clean" survey unit For the DUSA the LBGR was selected to be 105 pCi/gm because this was the cut off for identifying areas that require remediation, so the probability of failing to release a site with activity below this level should be low. The relative shift is defined as the $DCGL_W$ minus the LBGR, divided by the variability. This results in a relative shift of 3.2 ([190-105]/26). MARSSIM recommends rounding down to 3.0 when the relative shift exceeds 3. Therefore, 3.0 was used to determine the number of measurements per survey unit. The acceptable Type I and Type II decision error rates were selected as 0.05. This means there is a 5% chance that a survey unit with an actual concentration of 190 pCi/g of DU would be determined to have a concentration less than 190 pCi/g. It also means that there is a 5% chance that a survey unit with an actual concentration of 105 pCi/g would be determined to have a concentration greater than 190 pCi/g. MARSSIM, Table 5.5, lists 14 measurements for a relative shift of 3.0 and decision error rates of 0.05. This means that 14 samples will be collected in each Class 1 survey unit greater than 140 m^2 and in each Class 2 survey unit.

5.1.1 Delineation and Layout of Class 1/Class 2 Survey and Sample Areas

5.1.1.1 Soil Survey Units

The DUSA is too large to be considered a single Class 2 survey unit. MARSSIM recommends that the survey unit size match the modeling assumptions used to develop the DCGLs. Since the ANL report does not list the area of exposure used, the RESRAD default value of 10,000 m^2 was used to divide the site into 5 Class 2 survey units of approximately 60 x 180 meters. This value (10,000 m^2) is consistent with the guidance found in MARSSIM. These survey units will roughly correspond to the rows (i.e., 1 through 5) of the characterization maps, adjusted to keep the areas approximately equal in size. The survey units will be designated and marked for identification (e.g., color coded metal stakes) in the north-west corner. (The DUSA does not lay perfectly aligned north and south. The perpendicular from the east-west axis will be designated as "Survey North".) Each survey unit will be subdivided and marked (e.g., color coded wood steaks) at ten meter intervals for reference and establishment of sampling and measurement locations. Two 400 m^2 areas will be identified and marked, in each Class 2 survey unit, as verification areas. These areas will be randomly selected, but skewed to not coincide with Class 1 survey units (including the "buffer") or structures. A GPS (Global Positioning Satellite) tracking system may be used during the gridding process to assist in identifying grid locations. Example sample locations have been determined and placed on the figures using a random-start triangular grid system. Sample locations that fall within structures or within Class 1 survey units (including the "buffer") will be eliminated and replaced, if necessary, with additional randomly selected locations to maintain the correct number of measurements.

Figure 5.1 shows the expected boundaries of the five Class 2 survey units. Figure 5.2 depicts the expected locations of the Verification Areas within the Class 2 survey units. Figures 5.3 through 5.7 show examples of sample locations on a random-start triangular grid in Class 2 survey units 1 through 5, respectively. The actual survey unit boundaries, areas, and sample locations cannot be finalized until after the remedial action support survey when the area classifications are finalized.

For remediation purposes, there were thirteen areas of concern (Class 1 areas), i.e., one large area and twelve small areas. Due to proximity and orientation, for final survey planning purposes these areas correspond to three Class 1 survey units of greater than $100m^2$. The exact dimensions of the units will be determined by field surveys (remedial action support surveys). For work planning purposes the large area is expected to be approximately 250 m^2 with two smaller areas of approximately 120 m^2 each. If, based on field conditions, isolated small areas exist outside the bounds of these three areas, they will be marked and bounded as described below. While the Class 1 survey unit boundaries cross over individual Class 2 survey unit boundaries, all of the Class 1 survey units are fully contained within Class 2 survey units. The area surrounding each Class 1 survey unit, in Class 2 survey units, will receive 100% scan coverage. The width of this "buffer" will be dependent upon the relative size of the Class 1 survey unit. At a minimum, the width of this area will be 10 % of the maximum dimension of the remediated area. The perimeter and interior of the Class 1 survey units (including the "buffer") will be delineated and marked, as they fall within the Class 2 survey units, using the same system as the Class 2 survey units. The Class 1 survey units and the associated "buffer" will be differentiated from the Class 2 survey units using different color boundary indicators (e.g., green stakes - Class 2, yellow stakes - buffer, red stakes - Class 1). The sample locations will be field determined and placed using a random-start triangular grid system. It is likely that some small areas of elevated activity will be identified and remediated during the remedial action support and verification survey with areas less than 140 m^2. MARSSIM guidance states that special considerations may be necessary for land areas less than approximately 100 m^2. Remediated areas smaller than 140 m^2 and larger than 1 m^2 will have one sample collected for every 10 m^2. The number of samples will not be sufficient to support the assumptions of the statistical tests so these results will be compared directly to the $DCGL_W$. Areas less than 1 m^2 will not have any samples collected, but will receive a 1-minute direct count with the NaI(Tl) detector. All Class 1 survey units will receive 100% scan coverage. The 1 m^2 area is selected to correspond with the area of elevated activity used to develop the scanning sensitivity. A scan speed of 0.5 m/sec is expected to be able to identify a 1 m^2 area with a concentration of 60 pCi/g 95% of the time.

Figure 5.8 depicts the expected Class 1 survey units and their relationship to the Class 2 survey units.

5.1.1.2 Structural Survey Units

There are ten structural survey units based on the characterization survey data. (Two additional survey units may be necessary based on the results of the inaccessible area surveys of the security box interiors.) Survey units that exceeded the characterization criteria are identified as Class 1 survey units, the remaining surfaces are identified as Class 2 survey units.

Building A-7 will be divided into two survey units. The entire interior of the structure will be considered as one Class 2 survey unit. The entire exterior of the building and those areas considered inaccessible during the characterization survey will be designated as one Class 1 survey unit. Figures 5.9 and 5.10 depict the survey units for building A-7.

Building X-Ray 2 will be divided into six survey units. The interior and exterior of the north wall will be designated as one Class 2 survey unit, as will the interior and exterior of the east wall. The interior and exterior of the south wall will be designated as one Class 1 survey unit, as will the interior and exterior of the west wall. The ceiling and roof will be designated as a Class 1 survey unit. The final survey unit (Class 1) will be comprised of the floor and the ground immediately (approximately 1 meter or the width of the excavation necessary to expose inaccessible surfaces) outside of the walls. Figures 5.11 through 5.16 depict the survey units for building X-Ray 2. Figure 5.17 shows the Class 1, floor and ground, survey unit with the sample locations marked.

The exterior (and interior) surfaces of each Security Box will be designated as a Class 2 survey unit. If contamination is detected during the survey of inaccessible areas, the interiors will be designated as Class 1 survey units. Figures 5.18 and 5.19 depict the survey units for the Security Boxes.

The structural surfaces will be gridded at 1 meter intervals for survey purposes. The grid lines will be marked using a readily identifiable and repeatable system (e.g., paint or chalk lines). The floor and exterior ground of X-Ray 2 will be gridded using 1 meter grid intervals, but treated for sampling location purposes as a Class 1 soil survey unit, i.e., 14 locations placed using a random-start triangular grid system.

Table 5.3 Structural Survey Units

BUILDING	SURVEY UNIT	SURVEY CLASS
A-7	All interior surfaces	2
A-7	All exterior and inaccessible surfaces	1
X-Ray 2	South wall - interior and exterior	1
X-Ray 2	West wall - interior and exterior	1
X-Ray 2	North wall - interior and exterior	2
X-Ray 2	East wall - interior and exterior	2
X-Ray 2	Ceiling and roof	1
X-Ray 2	Floor (soil) and ground outside the walls	1
Security Box 1	Exterior	2
Security Box 1	Interior	*
Security Box 2	Exterior	2
Security Box 2	Interior	*

* The classification of the interior surfaces of the Security Boxes will be determined during the verification surveys taken during the Remediation Phase. If no contamination is detected during the verification, they will be combined with the exterior surfaces as a Class 2 survey unit. If contamination is detected, they will be considered as individual Class 1 survey units.

5.1.2 Surveys/Scans of Class 1 Areas

5.1.2.1 Soil Survey Units

The scan coverage for each Class 1 survey unit will be 100%. This will be documented based on the sub-grids established in the field layouts. This scan will be conducted using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent) with a scan speed of less than 0.5 m/sec.

Direct measurements using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent) will be taken at each sample location prior to collecting the surface soil sample. These direct measurements will be integrated one minute counts.

Dose rates will be obtained at each sample location using a Ludlum Model 19 μR meter (or equivalent). Dose rates will be obtained at contact with the surface prior to collecting the soil sample and at waist level (1 meter).

If, based on field conditions, isolated small areas exist outside the bounds of the three anticipated Class 1 survey units of greater than 100 m^2, one direct measurement and dose rate point will be marked for each 10 m^2 of surface area. These direct measurement results will be compared directly to the $DCGL_W$ and will not use the statistical tests to demonstrate compliance and eligibility for release. A minimum of three measurements and dose rates will be obtained in each limited area identified.

5.1.2.2 Structural Survey Units

The scan coverage for each Class 1 survey unit will be 100% using a Ludlum Model 2221 with a Model 43-69 Gas Flow Proportional Detector (or equivalent). This scan will be conducted at a scan speed not to exceed ½ probe width per second (approximately 2" per second).

A direct measurement will be obtained from each 1 meter square grid, at the point of the highest scan count rate, using a Ludlum Model 2221 with a Model 43-69 Gas Flow Proportional Detector (or equivalent). These direct measurements will be integrated one minute counts.

5.1.3 Samples from Class 1 Areas

5.1.3.1 Soil Survey Units

Surface soil samples will be collected from each of the 14 locations in each Class 1 survey units greater than 100 m^2.

These samples will be approximately 1 kg (2.2 lb) from the top six inches of soil at the sampling location.

The sampling tool (e.g., garden trowel) will be cleaned between samples to prevent cross contamination of samples.

Chain-of-Custody (COC) will be established and maintained in accordance with ATG Field Operating Procedures (Appendix 3).

Samples analysis will include gamma spectroscopy on all samples (42) and alpha spectroscopy on 15% of the samples (7).

5.1.3.2 Structural Survey Units

A 100 cm^2 smear (swipe) sample will be obtained from each square meter grid for structural Class 1 survey units.

Smear samples will be field counted using a Ludlum Model 2221 with a Model 44-9 GM Detector (or equivalent) and returned to the office area for analysis with a Ludlum Model 2929 Scaler with a Model 43-10-1 ZnS(Ag)/plastic Scintillation Detector (or equivalent).

Media samples will be obtained from each Class 1 survey unit including: core bore samples and/or chips from the concrete surfaces, pieces of steel (approximately 100 cm^2 samples), and soil from the soil surfaces of X-Ray 2. Anticipated distribution of samples is: soil 14, concrete 4, and steel 2).

The floor and exterior grounds of X-Ray 2 will be gridded using 1 meter grids and sampled using the protocol established for the Class 1 soil survey units, i.e., 14 soil samples from locations field determined and placed using a random-start triangular grid system.

Chain-of-Custody (COC) will be established and maintained for media samples in accordance with ATG Field Operating Procedures.

Samples analysis will include alpha and gamma spectroscopy on all samples (20).

The release limits identified in Table 5.2 will be used for the purpose of disposing of materials cleared by the above noted survey methods. Depending on NRC requirements, site-specific surface contamination limits may be developed using other tools, such as RESBUILD and DandD.

5.1.4 Surveys/Scans of Class 2 Areas

5.1.4.1 Soil Survey Units

The scan coverage of each Class 2 survey unit (exclusive of: area taken up by structures, Class 1 survey units, and verification areas), will be a minimum of 10%. The minimum scan coverage of 10% is expected to be adequate for the Class 2 areas because a scan survey with 100% coverage was performed as part of the characterization. The 10% scan coverage in the Class 2 survey units and the 100% scan coverage in the verification areas will be performed to verify the results of the characterization survey and provide an additional level of confidence that all areas of concern have been identified and addressed. This will be documented based on the sub-grids established in the field layouts. This scan will be conducted using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent) with a scan speed of less than 0.5 m/sec.

The scan coverage for each verification area (2 ea. 400 m^2 areas per Class 2 survey unit) will be 100%. This will be documented based on the sub-grids established in the field layouts. This scan will be conducted using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent) with a scan speed of less than 0.5 m/sec. Suspect areas, i.e., readings greater than the field action level, will be flagged for further investigation.

Direct measurements using a Ludlum Model 2221 with a Model 44-10 2 x 2 NaI(Tl) Detector (or equivalent) will be taken at each sample location prior to collecting the surface soil sample. These direct measurements will be integrated one minute counts.

Dose rates will be obtained at each sample location (including suspect spots identified in the verification areas) using a Ludlum Model 19 μR meter (or equivalent). Dose rates will be obtained at contact with the surface prior to collecting the soil sample and at waist level (1 meter).

5.1.4.2 Structural Survey Units

The scan coverage for each Class 2 survey unit will be 100% using a Ludlum Model 2221 with a Model 43-69 Gas Flow Proportional Detector (or equivalent). This scan will be conducted at a scan speed not to exceed ½ probe width per second (approximately 2" per second).

NOTE: The scan coverage for unrestricted release, in accordance with References 4 and 5, is intended to encompass 100% of the surface. If the documentation of the verification of characterization and remedial action support surveys encompasses 100% of the surface, a 10% scan and reference to those surveys will be considered to meet the intent of the regulations.

A direct measurement will be obtained from each 1 meter square grid, at the point of the highest scan count rate, using a Ludlum Model 2221 with a Model 43-69 Gas Flow Proportional Detector (or equivalent). These direct measurements will be integrated one minute counts.

5.1.5 SAMPLES FROM CLASS 2 AREAS

5.1.5.1 Soil Survey Units

Surface soil samples will be collected from each of the 14 locations in each of the 5 Class 2 survey units.
Surface soil samples will also be collected, for investigative purposes, from any suspect spots identified in the verification areas.

These samples will be approximately 1 kg (2.2 lb) from the top six inches of soil at the sampling location.

The sampling tool (e.g., garden trowel) will be cleaned between samples to prevent cross contamination of samples.

Chain-of-Custody (COC) will be established and maintained in accordance with ATG Field Operating Procedures.

Samples analysis will include gamma spectroscopy on all samples (70) and alpha spectroscopy on 15% of the samples (11). The total number of samples submitted for alpha spectroscopy may be revised if it can be shown that a lesser number of samples will not impact the quality of the data and interpretation of the results in confirming that D&D objectives have been met.

Samples analysis will include gamma spectroscopy on all samples and alpha spectroscopy on 15% of the samples collected for investigative purposes.

5.1.5.2 Structural Survey Units

A 100 cm^2 smear (swipe) sample will be obtained from each square meter grid for structural Class 2 survey units.

Smear samples will be field counted using a Ludlum Model 2221 with a Model 44-9 GM Detector (or equivalent) and returned to the office area for analysis with a Ludlum Model 2929 Scaler with a Model 43-10-1 ZnS(Ag)/plastic Scintillation Detector (or equivalent).

5.2 BACKGROUND AND QUALITY ASSURANCE SURVEYS

In order to ensure quality, measures will be instituted to evaluate all field measurements and corresponding analyses for samples sent out to an off site laboratory. In addition, instrument responses will be bench-marked during mobilization to determine background counting rates, and to develop instrument specific relationships, e.g., cpm vs. pCi/g, uR/hr vs. pCi/gm. These relationships will be used to develop and establish "field action levels" to guide the D&D and the final status surveys.

These instrument relationships will be developed relating the response (cpm or uR/hr) to known soil contamination levels (pCi/g). A series of regression analyses will be developed to express the response to specific measurement geometry, soil matrix, and surface condition. Instrument response may be expressed as a power function in the form:

C_{DU} = a (cpm or uR/hr)^b, where:

C_{DU} = Lab derived DU soil concentration, pCi/g, cpm, uR/hr = Instrument response, net cpm or uR/hr, corresponding to sampling location,

a, b = Regression coefficients, qualified with coefficients of determination, r^2.

These relationships will take into account that the associated uncertainty between field and laboratory analyses will increase as radioactivity levels decrease. A total of 25 samples will be collected for this purpose and sent out for gamma and alpha spectroscopy analysis. In addressing this aspect, the method will identify ways to compensate for these uncertainties, e.g., increasing counting times for fixed integrated measurements or decreasing scan rate. These relationships between soil activity levels and instrument response will be full documented to withstand technical and regulatory scrutiny.

The performance of the scanning and direct measurement instruments will be monitored in the field using daily performance checks and background plotted on control charts. The performance of the measurement system will be evaluated by replicating 5% of the direct measurements and scans.

The depth of contamination on concrete and steel surfaces and identifying an appropriate background under field conditions will be addressed as a part of the D&D/ER process. Small test areas (i.e., 1 m^2) will be identified on the interior and exterior of Building A-7. The existing conditions will be documented with 5 direct readings from the surface(s). A thin layer will be removed by scabbling (or other surface removal technique) and the measurements will be repeated. This process will be repeated until all 5 readings are less than 500 cpm (i.e., the estimated background plus 1.5 standard deviations). Once the depth of contamination has been determined for each area, these areas will provide a background reference area. At least 30 direct measurements will be performed in the reference areas to estimate the background for reference and data evaluation.

The analytical laboratory will provide information on the historical performance of the alpha and gamma spectroscopy procedures and demonstrate that the measuring systems were operating within these historical parameters during the analysis of surface soil samples. In addition, 25 collocated surface soil samples will be collected and sent to the laboratory for analysis. These samples locations will be randomly selected from the Class 1 and Class 2 final status survey locations. (Analysis will replicate the analysis of the original sample.) These collocated samples will be used to provide an estimate of the overall precision associated with the survey design for the exterior survey units. The results of these analyses will be used to evaluate the overall uncertainty associated with the decisions made based on the survey results.

5.3 SAMPLE ANALYSIS

Table 5.4 provides a recap of the analysis required on the soil samples taken to demonstrate compliance with the DCGLs. These samples include final status survey samples, investigative samples, survey design precision estimation, and instrument relationships.

Table 5.4 DUSA Sample and Analysis Recap

SAMPLE TYPE/LOCATION	APPROXIMATE NUMBER *	ANALYSIS REQUIRED
Class 1 Survey Units	42	Gamma Spec - 100% (42) Alpha Spec - 15% (7)
Class 2 Survey Units	70	Gamma Spec - 100% (70) Alpha Spec - 15% (11)
QA Collocated	25	Gamma Spec - 100% (25) Alpha Spec - 15% (4)
QA Relationship	25	Gamma Spec - 100% (25) Alpha Spec - 100% (25)
Investigative	50	Gamma Spec - 100% (50) Alpha Spec - 15% (8)
Structural (Includes Soil)	20	Gamma Spec - 100% (20) Alpha Spec - 100% (20)

NOTE: In some cases one sample may serve 2 functions, i.e., a collocated sample may also serve as a relationship sample or a survey unit sample may also serve as relationship sample.

5.4 IDENTIFICATION OF MAJOR CONTAMINANT

Based upon available information and historic assessment of site operations and on the results of the 1996 characterization surveys and sampling the significant radiological contaminate in the Transonic Range Depleted Uranium Study Area (DUSA) has been determined to be Depleted Uranium (DU). The isotopic distributions of U-234, U-235, and U-238 appear to be those described for DU since the U-238 activity is greater than 80% with U-234 at less than 20%. If the activity were natural uranium the U-238 and U-234 activities would be equal, since the daughter, U-234, would be in natural equilibrium with the parent, U-238.

For this effort, the radionuclides of concern from the DU are U-238, U-234, Th-234, Pr-234, and Pr-234m. The Thorium and Protactinium isotopes are short lived daughter products from the decay of U-238.

Characterization samples were also analyzed for gamma emitting radionuclides and Technecium 99 (Tc-99). No other significant gamma emitting radionuclides were detected. Tc-99 was not detected in the sample.

On the basis of the combination of contaminates, the DCGLs for building, equipment, and material surfaces are considered to be equivalent to the acceptable surface contamination levels for Uranium listed in Table 6-4 of Reference 5. These levels are recapped in Table 5.5.

Table 5.5 DUSA Surface DCGLs

CONDITION	LIMIT	
Loose Surface Contamination	< 1,000 dpm/100cm² (a, ß)	$DCGL_L$
Fixed Contamination, Average	< 5,000 dpm/100cm² (a, ß)	$DCGL_W$
Fixed Contamination, Maximum	< 15,000 dpm/100cm² (a, ß)	$DCGL_{EMC}$

6.0 RADIOACTIVE WASTE MANAGEMENT

All equipment, supplies, and materials leaving the site will be surveyed in accordance with the protocol established in ATG Field Operating Procedures (Appendix 3). Release limits will be those established in DG 4006, Demonstrating Compliance with the Radiological Criteria for License Termination (Reference 4) and Army Regulation EM 385-1-80. Equipment, supplies, and materials not meeting the free release criteria will be decontaminated or disposed or as radioactive waste.

No liquid wastes are expected to be generated as a result of this project, nor are any liquid effluents expected to be recovered or sampled during this project. Any moisture derived from the soil remediation will be absorbed with desicant prior to shipment of the remediated material for disposal. If liquid samples are required, they will be performed in accordance with ATG field Operating Procedures which are based on the regulations and limitations of 10 CFR 20 (Reference 13).

No airborne effluents are expected to be generated as a result of this project. However, an Air Sampling Program will be established in accordance with Section 4 of this Work Plan and Appendix 3. The results of the samples will be used to document compliance with 10 CFR 20.

Approximately 2,500 ft3 of solid radioactive waste (soil and debris) is anticipated to be generated as a result of this project. Based on the characterization data, there are no other hazardous components that would result in the waste being classified as a mixed waste. This data will be verified prior to packaging and disposal of the waste generated in the remediation process. This waste will be handled, packaged, stored, and disposed of as follows.

The highest sample activity, recorded in the characterization data, was 4.23 E5 pCi.g. While the anticipated average concentration is much lower, this activity will be used for planning purposes.

The waste generated from this project will be packaged in hard covered roll-off containers with a 6 mil liner. These containers will be staged in the loading area on transport trucks or on cleared ground. Staging will be based on field conditions.

Containers will be covered and sealed upon completion of loading. All partially full containers will be covered at the end of the work day, or if work is suspended for more than 2 hours.

All exterior surfaces of the containers, and the transport vehicles, will be verified to be free of loose surface contamination prior to removal from the DUSA.

If on-site storage is necessary prior to shipment, the storage area will be barriered and posted "Radioactive Materials Storage Area" and Authorized Entry Only".

All containers will be surveyed prior to shipment in accordance with ATG Field Operating Procedures and in compliance with 49 CFR 171 – 179 (Reference 15). Maximum expected dose rates on the exterior of the containers is 1,000 uR/hr. The general area (30 cm) dose rate is anticipated to be between 20 and 100 uR/hr, depending on the distribution of DU inside the container.

- The full containers will be transported from APG to a rail spur for trans-shipment (or directly on the transport truck) to WCS of Texas or other licensed and approved disposal site. The final mode of transportation will be field determined.

- All shipments will meet the DOT requirements of Reference 15 and comply with the IOC Standard Operating Procedure – Shipping Procedure for Unwanted Radioactive Material, (Reference 16). In addition, all activities associated with packaging, loading, survey, and shipment will be conducted in accordance with the ATG Field Operating Procedures.

- The broker for this waste will be IOC approved in accordance with Reference 16.

- It is anticipated that all waste generated during this project will be shipped before the end of the project.

7.0 SELECTED PROCEDURES AND EQUIPMENT

7.1 INSTRUMENTATION

7.1.1 CALIBRATION

Electronic and source calibrations of field instruments used for decommissioning and unrestricted release of facilities and sites will be performed by the manufacturer or by another approved vendor laboratory.

Third party analytical laboratories will provide information on the calibration and historical performance of analytical equipment and demonstrate that the measurement system was operating within these parameters during the analysis of project samples.

Copies of the calibration data will be maintained in the field office as a part of the field instrument control data file.

7.1.2 CORRELATION

Instrument responses will be benchmarked, on a project specific basis during mobilization and setup, to determine background rates and establish instrument specific relationships (e.g., cpm vs. pCi/gm and/or uR/hr vs. pCi/gm) used to establish field action levels and end points.

These responses will be documented as a part of the field instrument control data file.

7.1.3 DAILY RESPONSE

All field instruments will be response checked on a daily basis. The minimum checks will include: a visual survey for physical damage, a verification that the calibration and performance check stickers are intact, verification that the instrument is in calibration, i.e., the calibration due date has not passed, a battery check, and response check to a known source.

The response check data will be recorded in accordance with ATG Field Operating Procedures, Appendix 3, on ATGF-003.

The background and source check data for field and laboratory instruments will be plotted on control charts as a measure of performance reliability.

As an additional measure of reliability, a minimum of 5 percent of the direct measurements and scans will be replicated. The locations of replicate measurements will be determined on a biased random basis.

7.1.4 Operation

Field instruments will be operated in accordance with the ATG Field Operating Procedures.

Instruments obtained for use on a specific project, (e.g., leased, borrowed) that are not a part of the ATG inventory, will be operated in accordance with the operating procedure provided by the vendor/owner.

7.2 INSTRUMENT SELECTION

To ensure quality of measurements and that the measurements meet the intent of the applicable guidelines and regulations (i.e., can detect the levels of radioactivity required for release), instruments for the DUSA project have been selected using the relevant guidelines of "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575, (Reference 10) and "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions", NUREG-1507, (Reference 17).

Table 6.1 lists the instruments to be used for the DUSA survey activities along with typical operating parameters. While specific Types/Models of instruments and detectors are listed, this does not preclude the use of equivalent meters or detectors. Substitution may be made for a variety of reasons including equipment availability and operational considerations.

Table 6.1 Instrument Selection

Indicated Use	Meter	Detector	Detector Type	Efficiency	Minimum Detectable Concentration
Alpha Survey	Ludlum Model 3	Ludlum 43-65	Scintillator ZnS(Ag)	15 %	90 dpm/100 cm^2
Alpha Survey	Ludlum Model 2221	Ludlum 43-68	Gas Flow Proportional	15 %	50 dpm/100 cm^2
Beta Survey	Ludlum Model 3	Ludlum 44-9	G-M	20 %	1080 dpm/100 cm^2
Beta Survey	Ludlum Model 2221	Ludlum 43-68	Gas Flow Proportional	20 %	420 dpm/100 cm^2
Alpha Surface Activity	Ludlum Model 2929	Ludlum 43-10-1	Scintillator ZnS(Ag)/Plast.	35 %	150 dpm/100 cm^2
Beta Surface Activity	Ludlum Model 2929	Ludlum 43-10-1	Scintillator ZnS(Ag)/Plast.	30 %	727 dpm/100 cm^2
Gamma Scan	Ludlum Model 2221	Ludlum 44-10	Scintillator 2 x 2 NaI(Tl)	N/A	56 pCi/gm
Gamma Dose Rate	Ludlum Model 19	Integral	Scintillator 1 x 1 NaI(Tl)	N/A	1 uR/hr

8.0 REFERENCES

1 Radiological Criteria for License Termination, 10 CFR 20, Subpart E, USNRC

2 Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD, ANL, 1999

3 Federal Register/Volume 62, Number 222/Wednesday, November 18, 1998

4 Demonstrating Compliance with the Radiological Criteria for License Termination, Draft Regulatory Guide DG-4006, USNRC, 1998

5 Army Regulation EM 385-1-80, Radiation Protection Manual

6 When to Remediate Inadvertent Contamination of the Terrestrial Environment, USNRC, Branch Technical Position, 1995

7 Radiation Worker Training, 10 CFR 19.13, USNRC

8 OSHA Construction Standards, 29 CFR 1910.120, USDOL

9 Transonic Range Depleted Uranium Study Area Radiological Characterization Study Report, General Physics Corporation, 1996

10 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575

11 Hazardous Materials, 40 CFR 261

12 Prenatal Exposure, Reg. Guide 8.13, USNRC

13 Standards for Protection Against Radiation, 10 CFR 20, USNRC

14 Manual for Conducting Radiological Surveys in Support of License Termination, NUREG-5849

15 49 CFR 171 - 179, DOT

16 IOC, AMSIO-DMW. Standard Operating Procedure - Shipping Procedure for Unwanted Radioactive Material, 1999

17 Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions, NUREG-1507

9.0 APPENDICES

NO	TITLE
1	Specification for the Decommissioning Plan Transonic Range - Aberdeen Proving Ground
2	Project Quality Assurance Plan
3	ATG Field Operating Procedures
4	Project Health and Safety Plan
5	Project UXO Avoidance Plan

Figure 5.1 DUSA Class 2 Survey Units

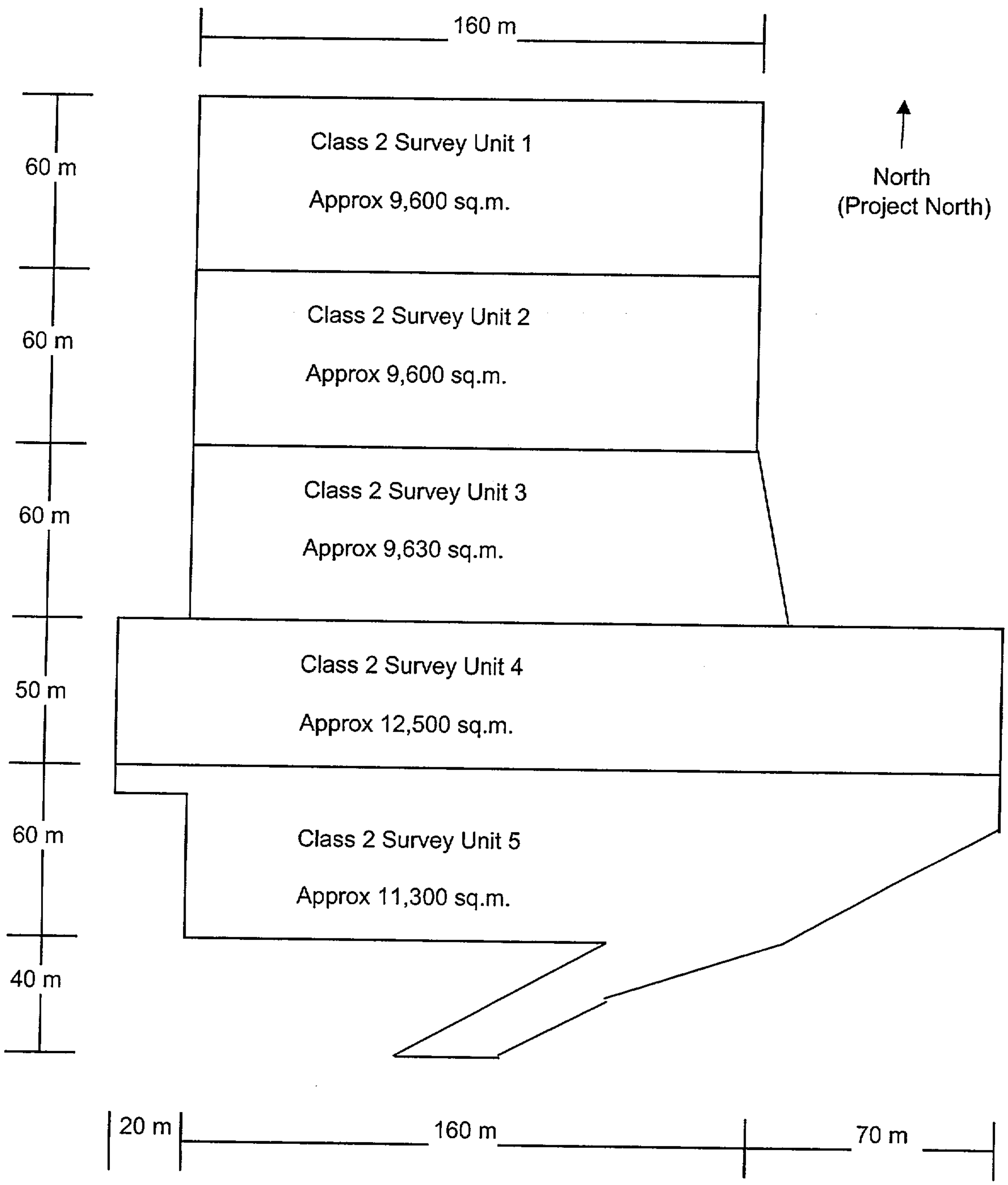


Figure 5.2 DUSA Class 2 Survey Units Verification Areas

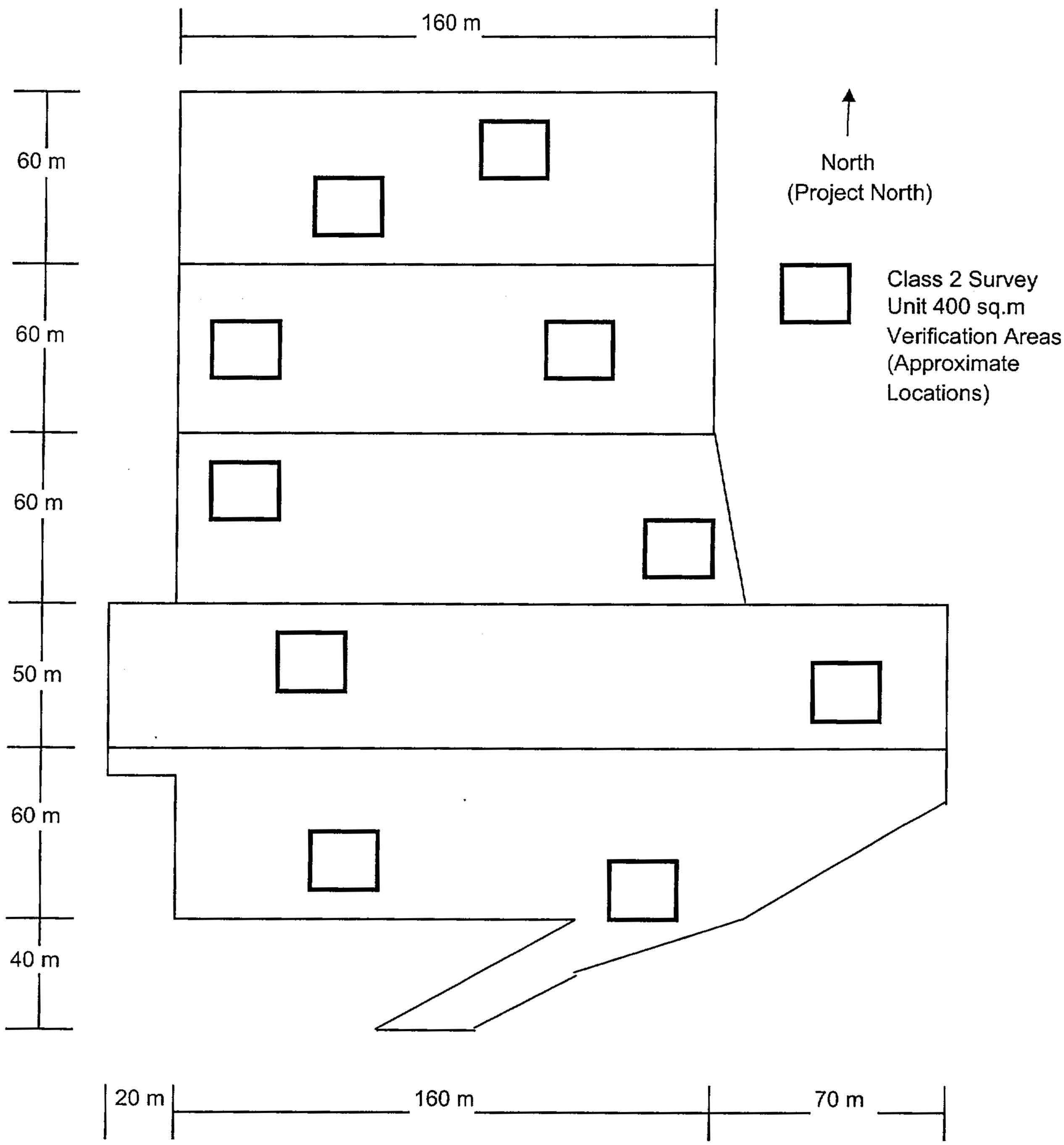
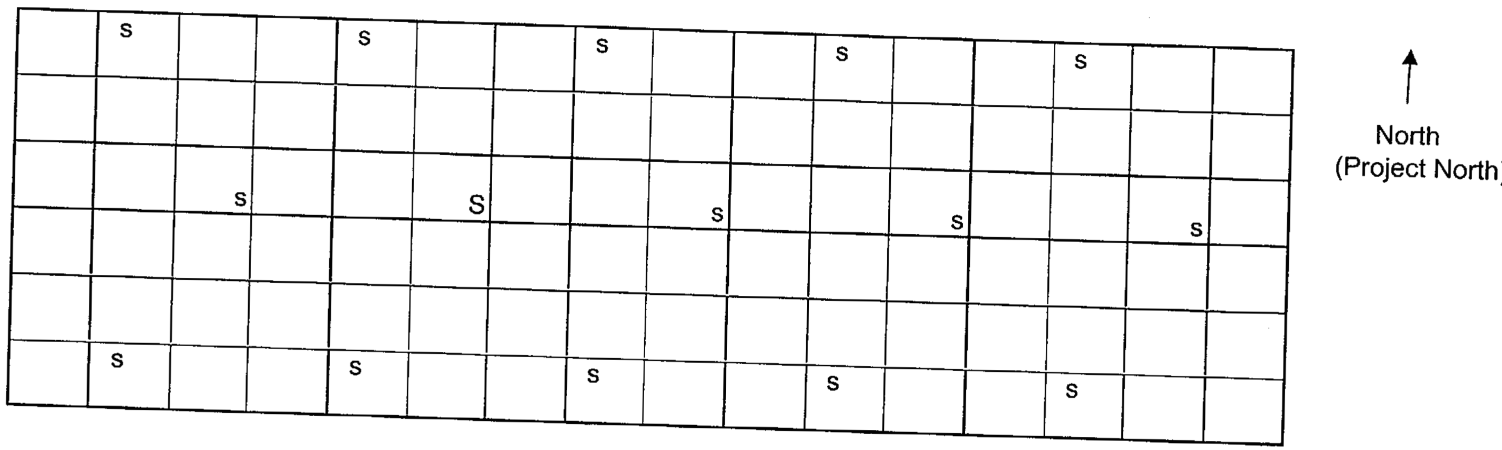


Figure 5.3 Class 2 Survey Unit 1 Sample Locations



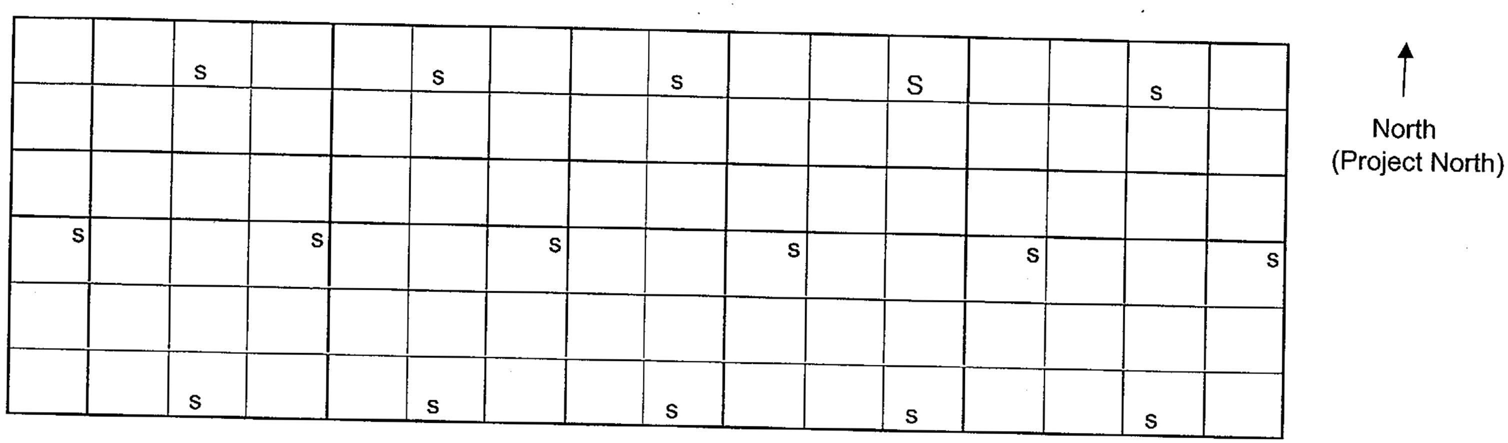
S Randomly selected starting point

s Sample points layed out from S using Triangular Grid Measurement Pattern

Points will be added or dropped in the field to maintain 14 statistical points

___ 10 meter grid lines

Figure 5.4 Class 2 Survey Unit 2 Sample Locations



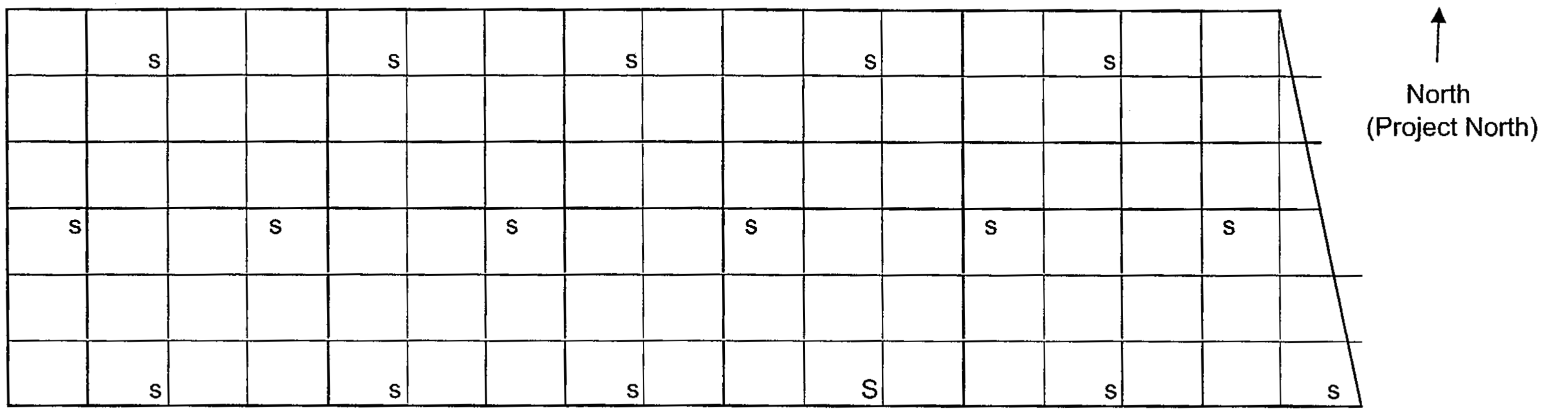
S Randomly selected starting point

s Sample points layed out from S using Triangular Grid Measurement Pattern

Points will be added or dropped in the field to maintain 14 statistical points

___ 10 meter grid lines

Figure 5.5 Class 2 Survey Unit 3 Sample Locations



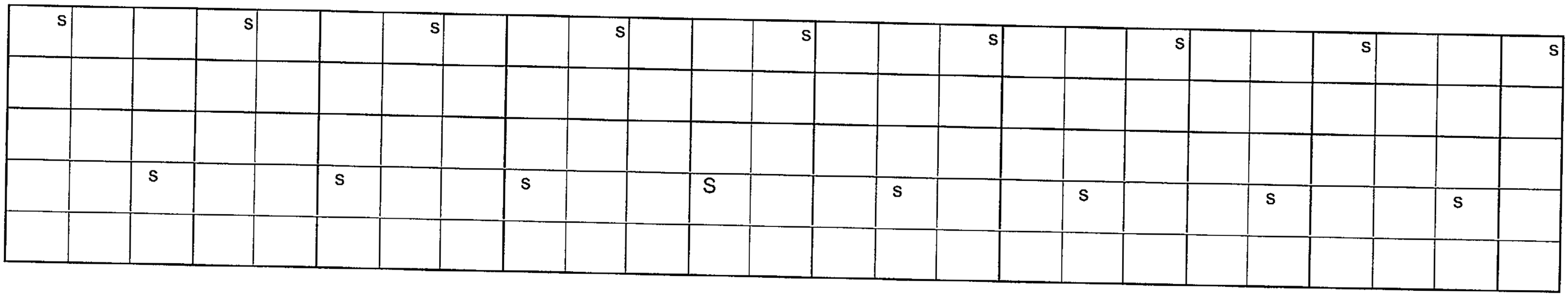
S Randomly selected starting point

s Sample points layed out from S using Triangular Grid Measurement Pattern

Points will be added or dropped in the field to maintain 14 statistical points

___ 10 meter grid lines

Figure 5.6 Class 2 Survey Unit 4 Sample Locations



S Randomly selected starting point

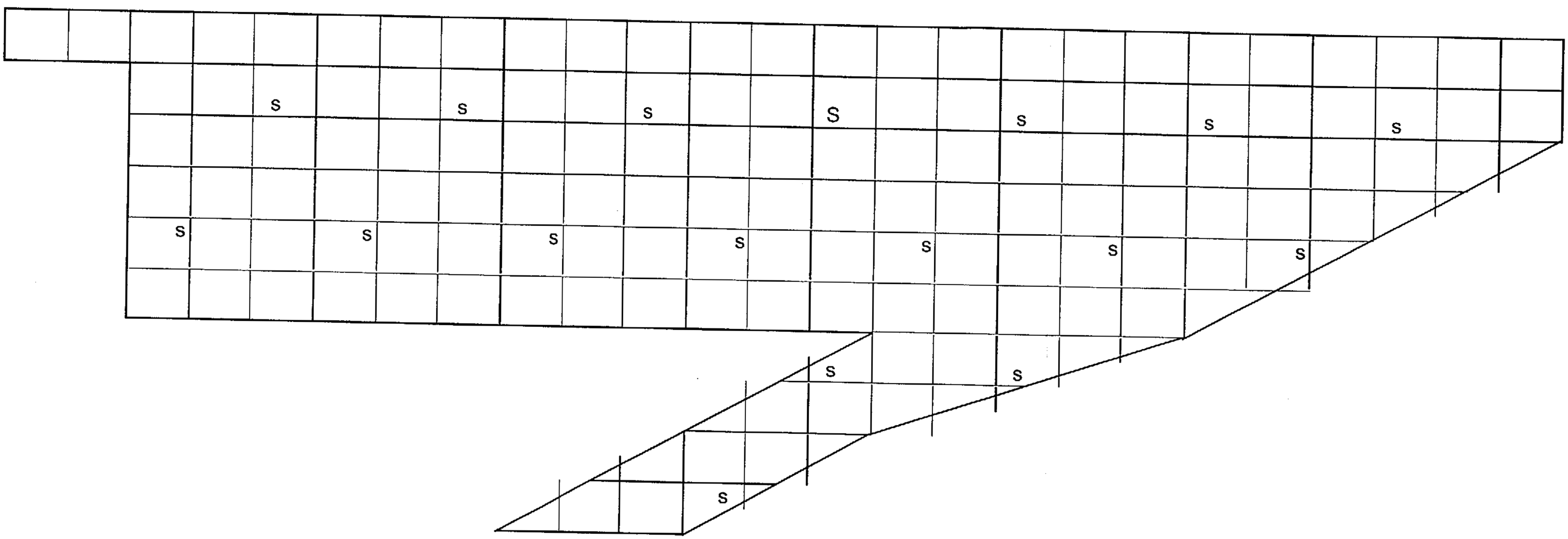
s Sample points layed out from S using Triangular Grid Measurement Pattern

Points will be added or dropped in the field to maintain 14 statistical points

___ 10 meter grid lines

North
(Project North)

Figure 5.7 Class 2 Survey Unit 5 Sample Locations



S Randomly selected starting point

s Sample points layed out from S using Triangular Grid Measurement Pattern

Points will be added or dropped in the field to maintain 14 statistical points

___ 10 meter grid lines

North
(Project North)

Figure 5.8 DUSA Class 1 Survey Units

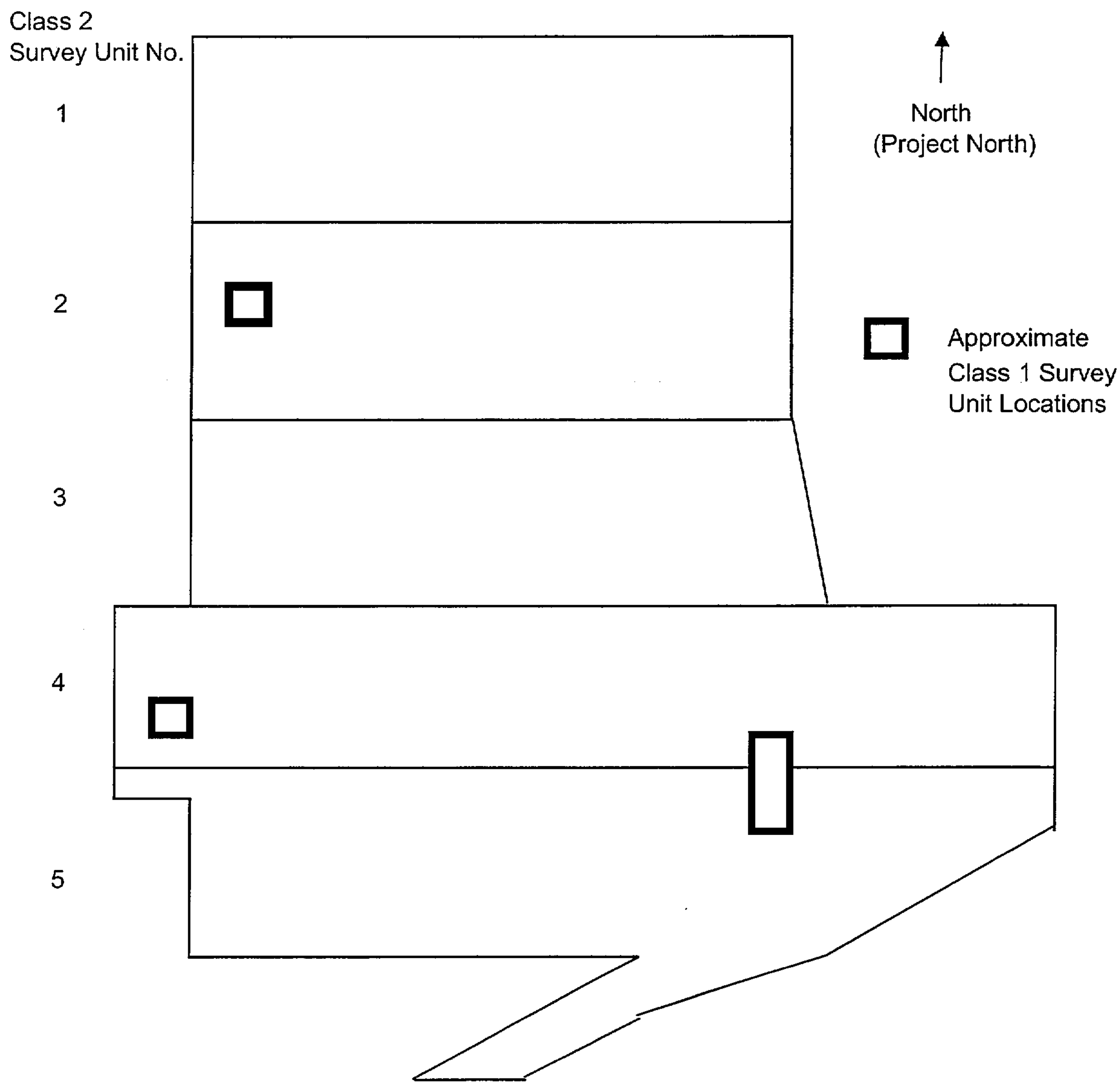


Figure 5.9 Building A-7, Class 2 Survey Unit - Interior

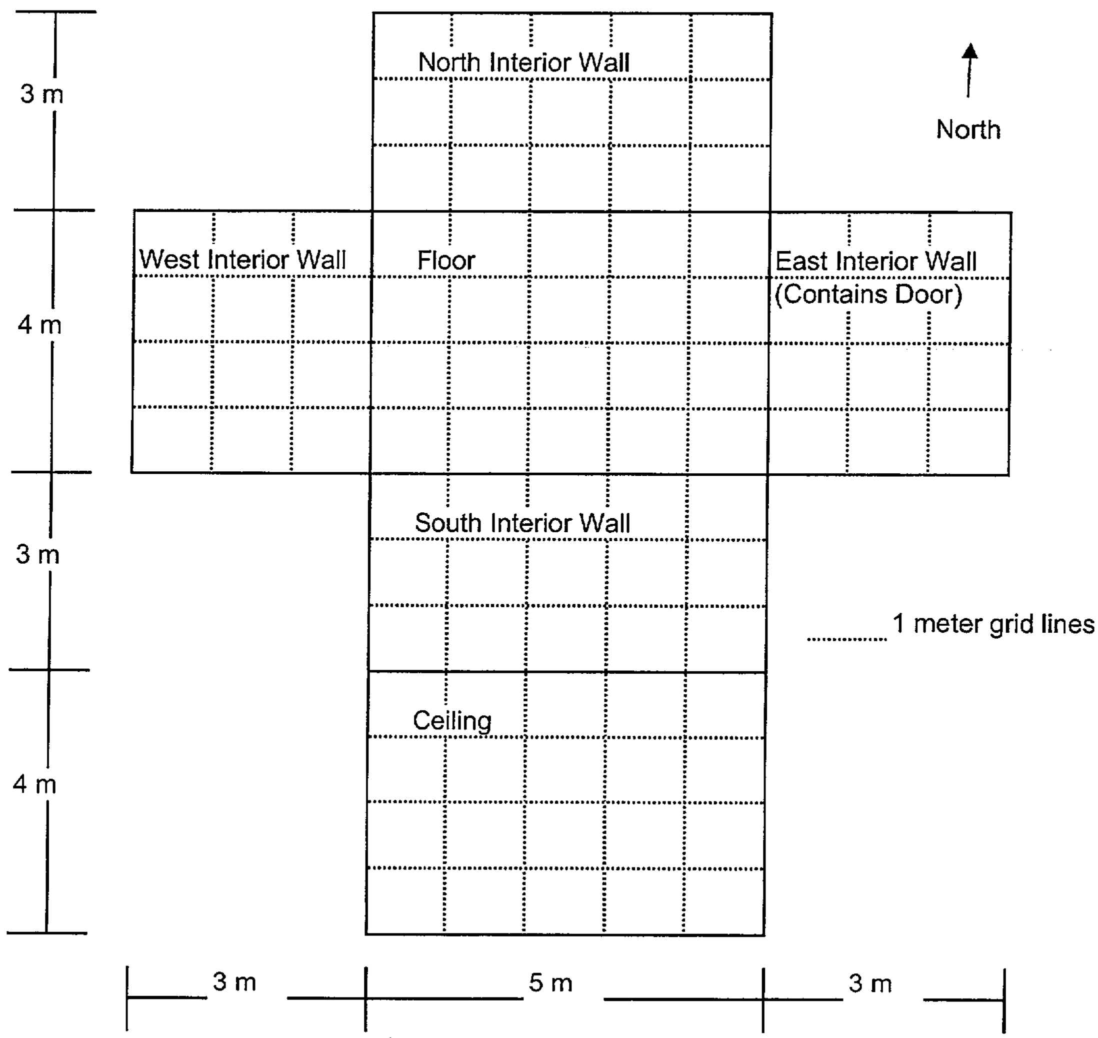


Figure 5.10 Building A-7, Class 2 Survey Unit - Exterior

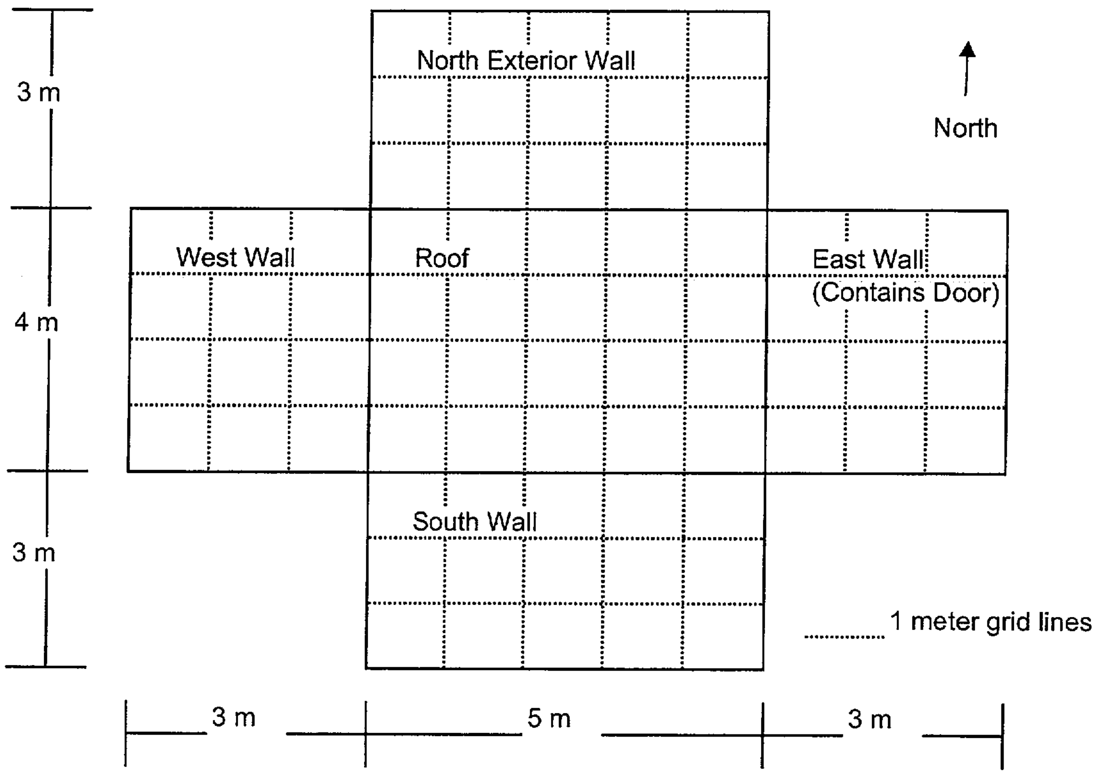
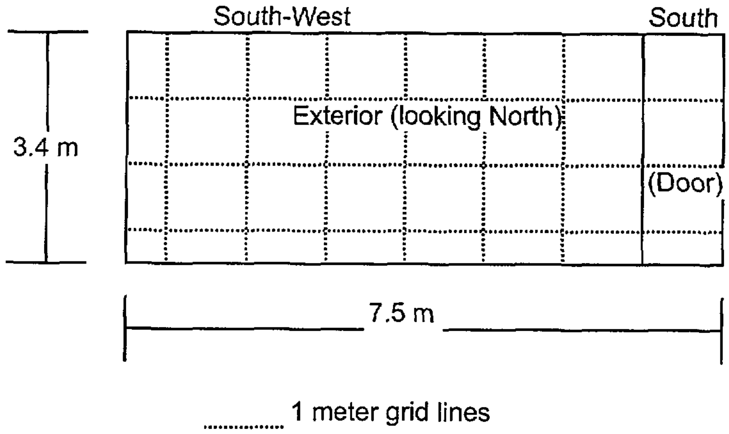


Figure 5.11 X-Ray 2, Class 1 Survey Unit, South Wall



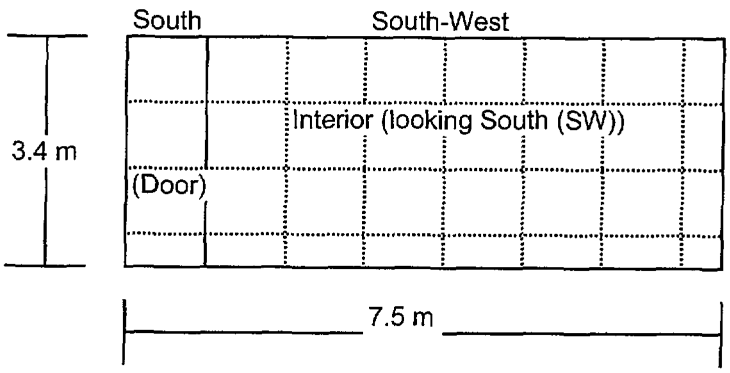


Figure 5.12 X-Ray 2, Class 1 Survey Unit, West Wall

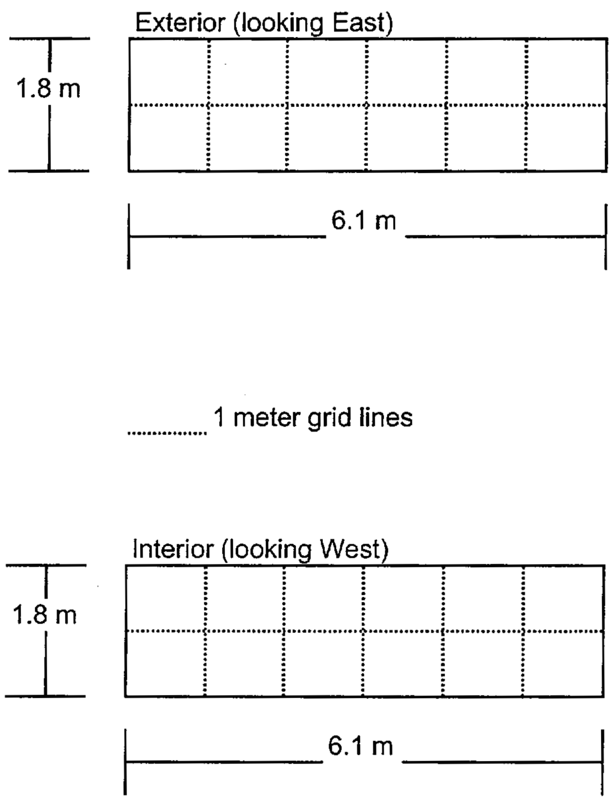


Figure 5.13 X-Ray 2, Class 2 Survey Unit, North Wall

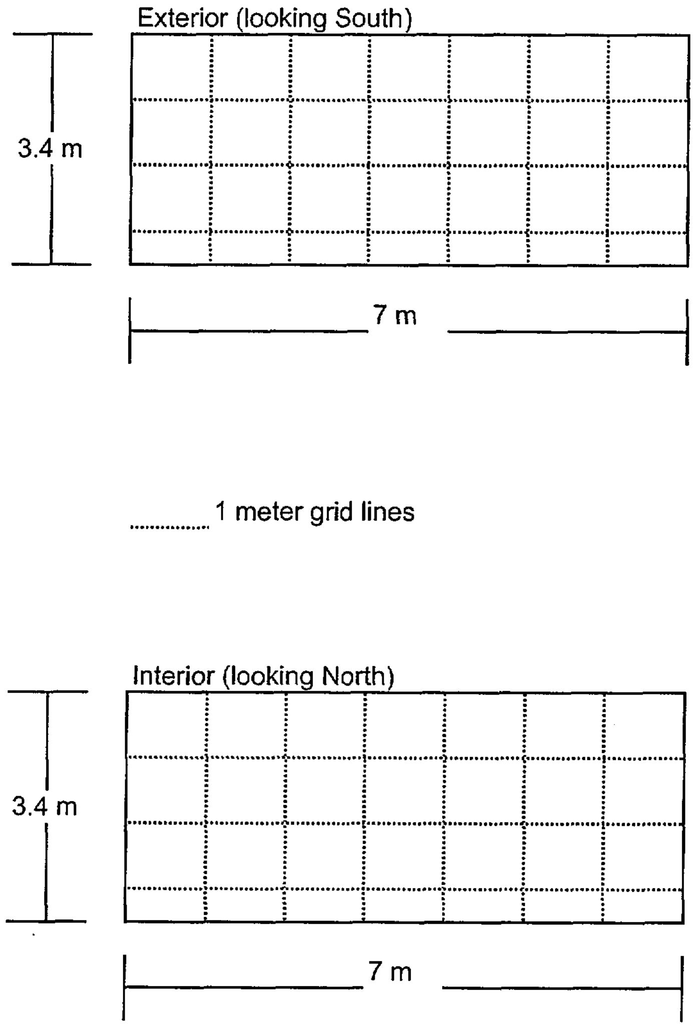
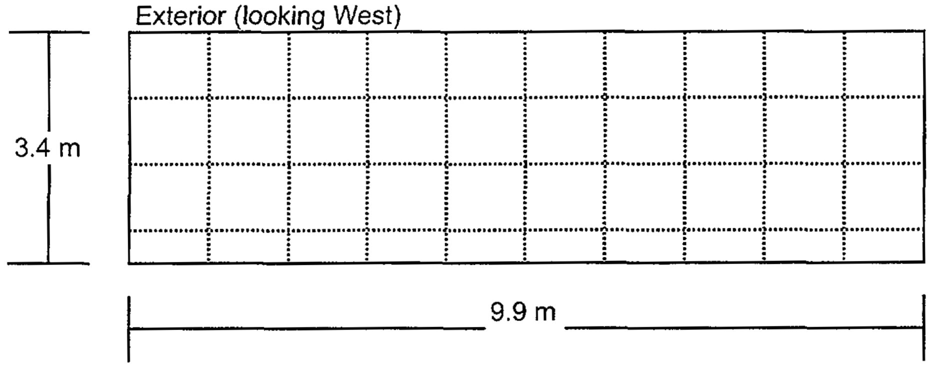


Figure 5.14 X-Ray 2, Class 2 Survey Unit, East Wall



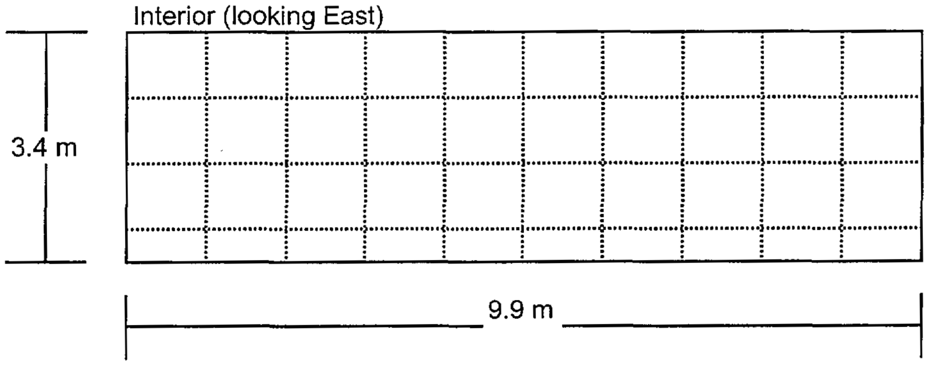


Figure 5.15 X-Ray 2, Class 1 Survey Unit, Roof and Ceiling

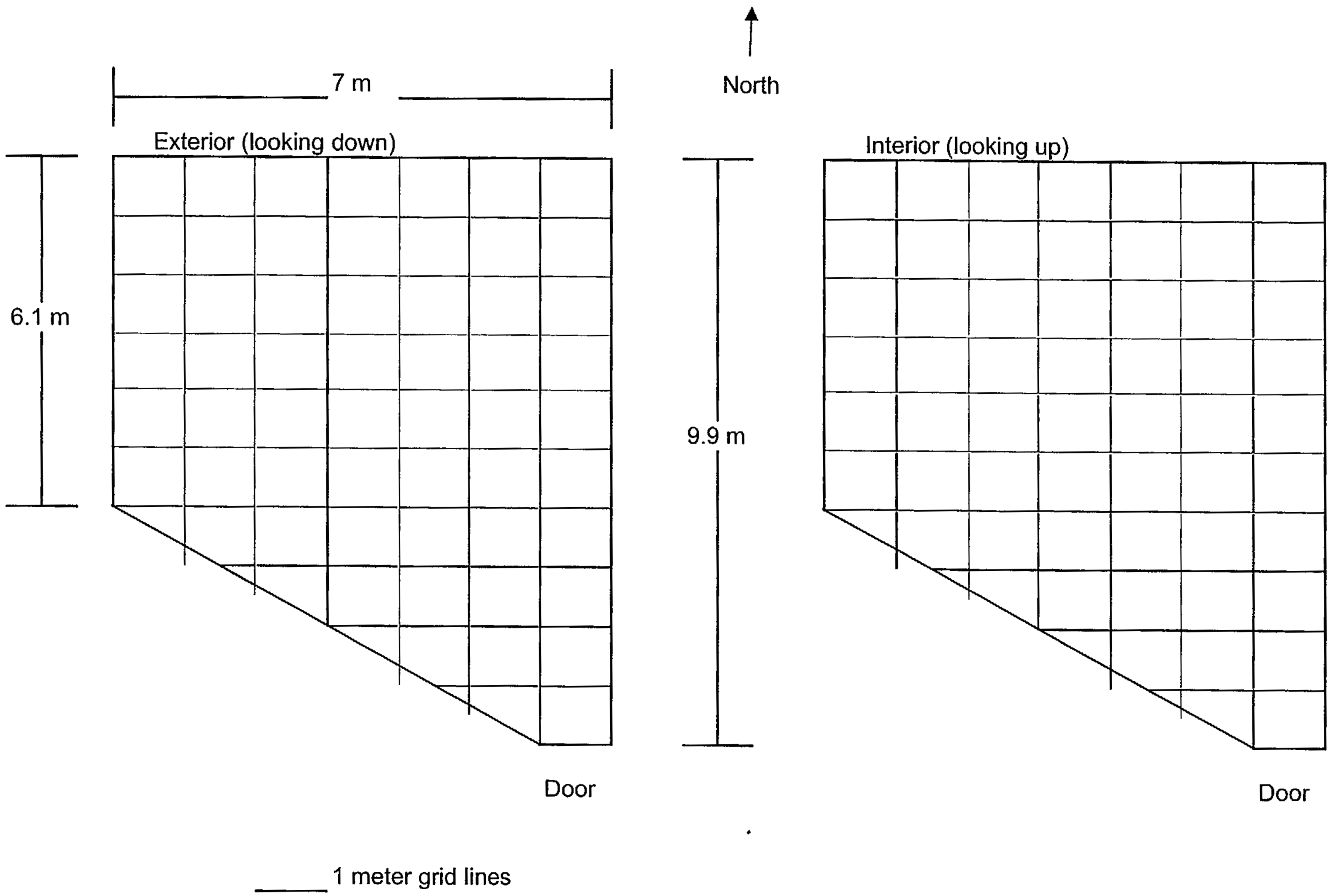


Figure 5.16 X-Ray 2, Class 1 Survey Unit, Floor and Grounds

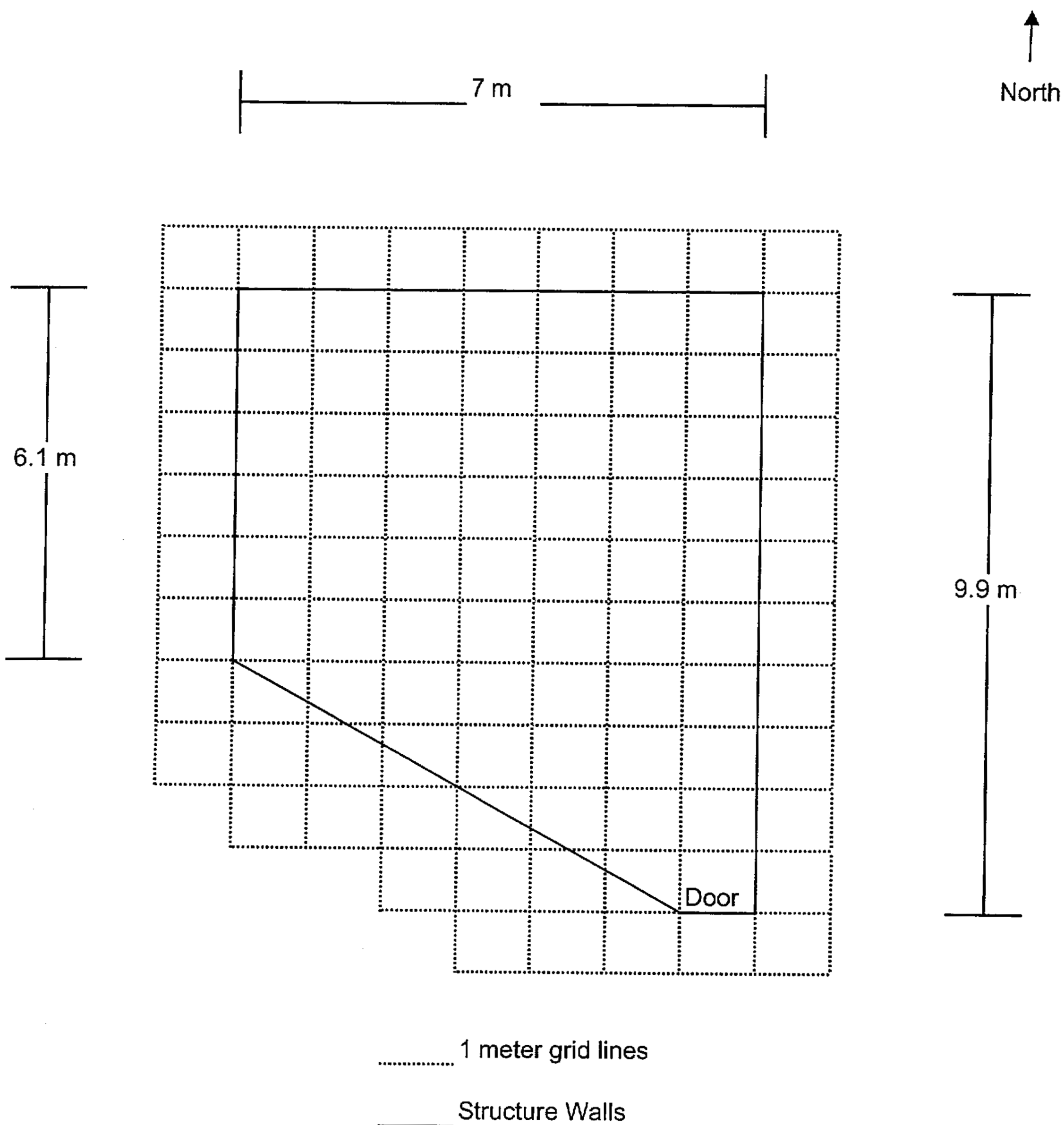
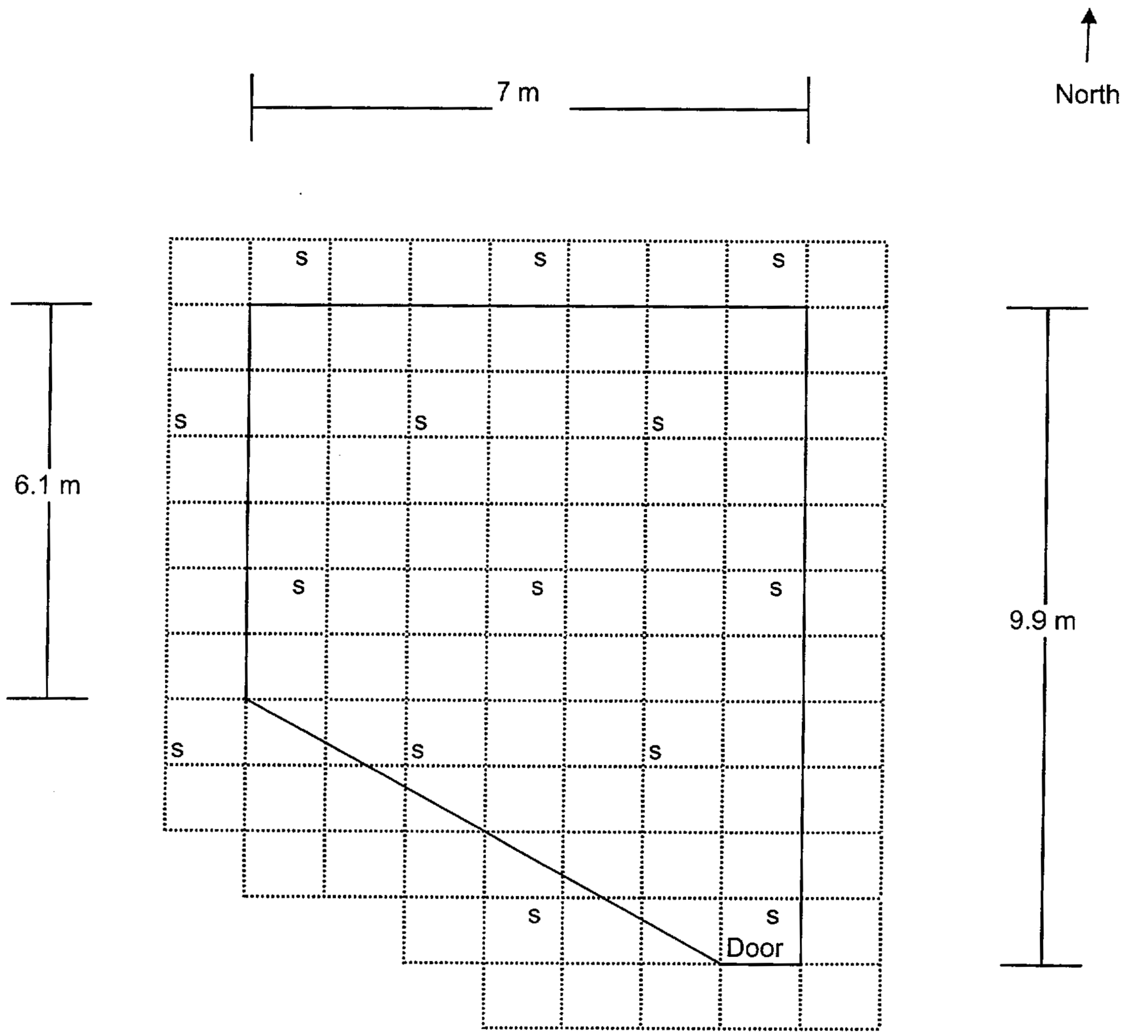


Figure 5.17 X-Ray 2, Class 1 Survey Unit, Floor and Grounds Sample Points



1 meter grid lines

Structure Walls

s Sample Locations (Random Start Triangular Grid)

Figure 5.18 Seurity Box 1 Survey Unit(s)

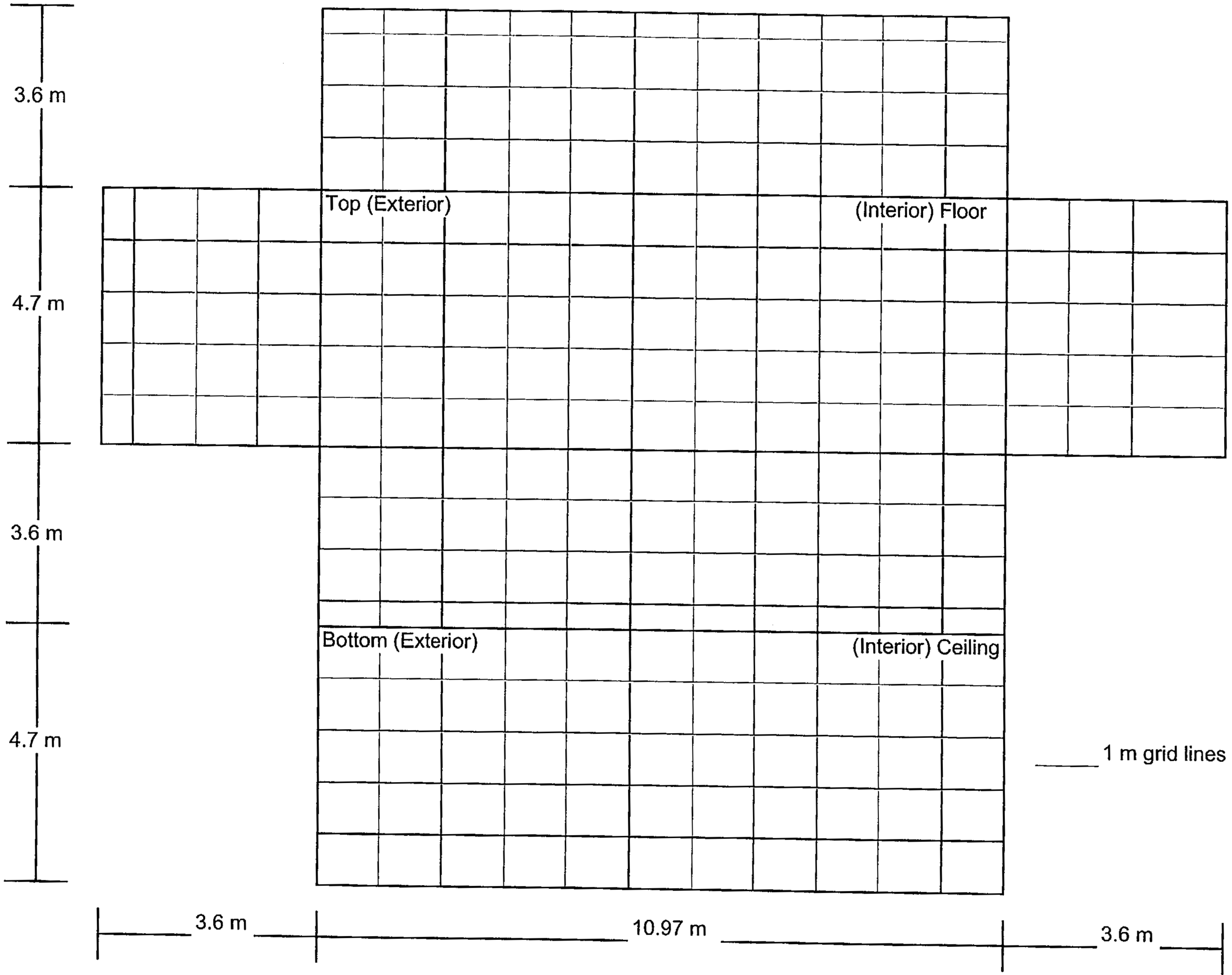
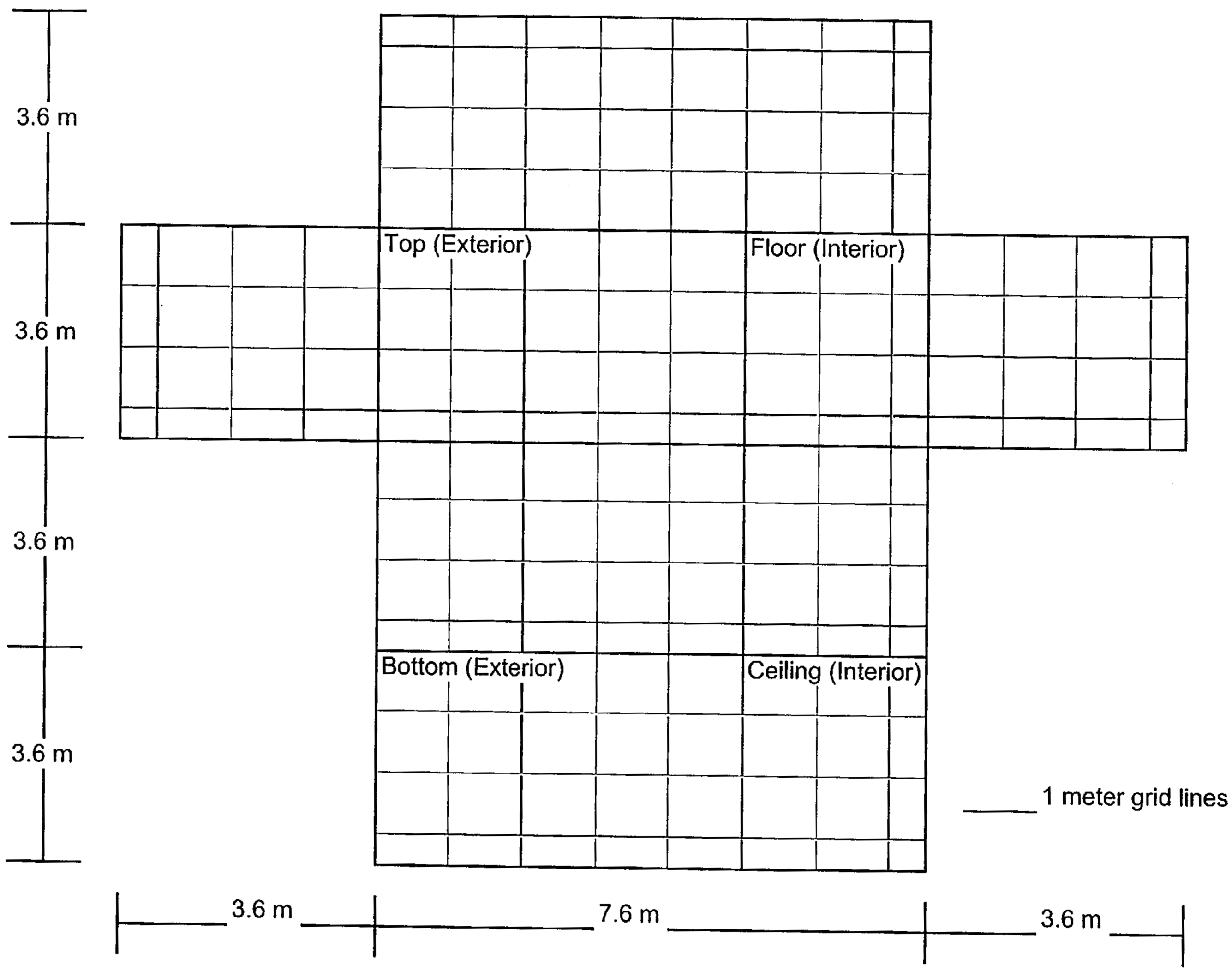


Figure 5.19 Seurity Box 2 Survey Unit(s)



SPECIFICATIONS FOR DECOMMISSIONING PLAN

1.0 GENERAL INFORMATION

The purpose of this Decommissioning Plan will be to provide guidance for the remediation and decommissioning of the area of the Transonic Range at Aberdeen Proving Ground, specifically to the 12 acres of the Transonic Range referred to in the General Physics Corporation's 'Radiological Characterization Report' as the Depleted Uranium Study Area (DUSA). This Decommissioning Plan for the DUSA of the Transonic Range and the associated structures associated with this area will provide guidance for the remediation and surveys and samples required to ensure that the established release criterion is in compliance with the guidance provided in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM, NUREG-1575) , the Radiological Criteria for License Termination (Draft Regulatory Guide DG-4006), and the release criterion for the site as defined in Subpart E, "Radiological Criterion for License Termination" of 10 CFR Part 20. Site Specific Derived Concentration Guideline Levels ($DCGL_w$) Averages are developed in this Decommissioning Plan. Additional guidance will be provided by the methodology prescribed in the Federal Register/Volume 63, Number 222/Wednesday, November 18, 1998 pages 64132 to 64134. Building and material surfaces will have DCGLs which reflect the acceptable surface contamination levels for uranium in Table 6-4 of Army Regulation EM 385-1-80.

The following is an excerpt form the General Physics Corporation's 'Radiological Characterization Report for the Transonic Range, Depleted Uranium Study Area'. The history of the range was obtained from archival data and from interviews with current and former employees at the site and from environmental monitoring reports from the site.

The Transonic Range, Depleted Uranium Site Area (DUSA), is located at a site within the boundaries of the Transonic Range. This area is in the Aberdeen Area of the Aberdeen Proving Ground (APG). The Aberdeen Proving Ground lies along the western shore of the Chesapeake Bay in Harford and Baltimore Counties of the state of Maryland, approximately 15 miles northeast of Baltimore. APG covers a total of 72,516 acres of land and water and consists of two distinct areas: the northern portion of APG, referred to as the Aberdeen Area (AA) and the southern portion of APG, referred to the Edgewood Area (EA).

The Aberdeen Area became a formal military post, designated as Aberdeen Proving Ground, in 1917. The Edgewood Arsenal was appropriated by Presidential

Proclamation in 1918.

The Depleted Uranium Study Area (DUSA) is located on the southeast end of the Transonic Range and was used for Depleted Uranium (DU) testing from 1973 through 1979. Testing consisted of gun launching DU penetrators from two locations located on the northern portion of the site at targets mounted adjacent to the X-ray units to the south. Stripper/deflector plates located in between the launch or shooting locations were designed to strip or deflect the sabot away from the penetrators while the shell was in flight to the target. Penetrators were either stopped in the target or penetrated the target and impacted into a backstop located a short distance behind the target. The majority of the DU melted into the targets or backstops. Some of the DU fell onto the soils around the targets or was scattered into the surrounding areas. All DU ammunition was treated as radioactive material.

Except for shot targets and other designated contaminated materials, most radioactive materials were maintained onsite in a radioactive material storage area located to the east of the impact zone. These shot targets and other designated materials have been remediated, recycled and/or disposed of at an approved radioactive material waste disposal site.

After testing with DU materials ceased, the Army Research Laboratory (ARL) Health Physicist conducted an initial site cleanup to reduce the radioactive waste inventory and to allow for the testing of other ammunition which did not contain radioactive material such as DU. This effort included removing shot targets and other materials from the radioactive storage area. This initial effort also included surveying and removing contaminated soil, sand, and other contaminated material. The result of this initial characterization and remediation was to bound and define the remaining potentially radioactive contamination into an approximately 12 acre site, the Depleted Uranium Study Area (DUSA).

From December of 1995 through May of 1996 a study of the DUSA was conducted by the General Physics Corporation to determine the extent of the contamination at the site. The site continues to be listed as a radiation test facility in the U.S. Army Research Laboratory's Nuclear Regulatory Commission License even though no testing with DU materials has been conducted in this area since 1979. A determination was made by the U.S. Army in 1995 to cease licensed activities at the DU Study Area (DUSA). This characterization was performed by the requirements of the NRC's Branch Technical Position, 'When to Remediate Inadvertent Contamination of the Terrestrial Environment'.

The report of this characterization, "Transonic Range Depleted Uranium Study Area

Radiological Characterization Report", General Physics Corporation, 1996 reached the following conclusions:

- Based on the radiation surveys no removable contamination was found on the structures surveyed at DUSA. Fixed radiation contamination levels in structures A-7, X-Ray 1 (removed since the characterization), X-Ray 2 are in excess of the guideline values.

- Soil data does not show the presence of any radio nuclides other than isotopes of U-238 and U-235 above ambient levels. The approximate distribution of the uranium isotopes is that of depleted uranium.

- All areas showed soil concentrations in excess of the guideline values for depleted uranium with the highest concentrations in grids C1, C2, B2, B3, A1 and A4. Much of the contamination is limited to the top three inches of the soil. Also it appears that much of the contamination is localized to well defined areas. Any remedial actions will require careful planning and implementation as it is likely that subsurface UXO will be encountered. In particular, grids A1, C1, and C2 showed high concentrations of ferrous and non-ferrous metal from the magnetometry surveys.

- The soil does not contain any other hazardous materials, pesticides, herbicides, or explosives above the regulatory limit.

NOTE: The guideline values referred to in the characterization report are not necessarily the guidelines used in the work plan. The guideline used in this work plan were derived in accordance with the most current guidance, i.e., "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575 for soil and "Demonstrating Compliance with the Radiological Criteria for License Termination", Draft Regulatory Guide DG-4006 for structures.

Based on the scoping and characterization data, the Industrial Operations Command contracted Argonne National Laboratory (ANL) to provide the volumetric Derived Concentration Guideline Levels (DCGL) applicable to the DUSA in accordance with the values contained in MARSSIM. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", Argonne National Laboratory, 1999 is the basis for the volumetric DCGLs of this Decommissioning Work Plan.

1.1 License and Required Permits

The license for this decommissioning activity is the US Army Garrison, Aberdeen Proving Ground, Directorate of Safety, Health and Environment, Aberdeen Proving Ground Health Physics Office's Broadscope License. This broadscope Nuclear Regulatory Commission (NRC) License provided for possession and testing of Depleted Uranium (DU) ammunition. The license number is SMB-1141

The license will not be terminated by this decommissioning activity. All remediation and decommissioning activities for the Transonic Range will be conducted under the guidance of this license and the approved NRC Decommissioning Work Plan.

A Department of the Army Radiation Permit (DARP) will be obtained by ATG from APG Radiation Protection Management. This permit will identify any radioactive material, specifically check sources, which will be brought on the site as part of the remediation activities for more than 15 days.

Before any excavation is conducted at the site, an Excavation Permit will be obtained from responsible base personnel. This permit will ensure that the required excavation areas have been evaluated as much as possible for potential underground hazards including electrical and water lines.

A Burn Permit will be issued by ATG Management Personnel in accordance with the attached Health and Safety Plan prior to the use of any heat sources for welding, burning, or grinding. This permit will detail the requirements to be followed for this evolution including fire watches, fire extinguishers, separation of flammable material, and the like.

1.2 Affected Grounds and Structures

The Depleted Uranium Study Area comprises approximately 12 acres of property on the southeast end of the Transonic Range at Aberdeen Proving Grounds. The gun locations were located on the northern portion of the site and fired at targets to the south. The DUSA can be described as a cleared relatively flat tract, surrounded by woods to the east, south, and west. Swampy areas are found behind the Transonic range catch basin to the south, along the wooded areas to the west, and in the northeast section of the site.

The east side of the site was stabilized approximately 10 years (late 1980s) when a layer of landscaping plastic was laid north of building A-7 to the tree line to the east and west toward X-Ray 1. A four to eight inch layer of gravel was laid over the plastic. At about the same time, the small swampy area to the north of the firing positions was covered with 2 to 4 feet of soil so that the guns could be moved further away from the targets.

The DUSA originally contained five small industrial type associated structures. Since the characterization one structure, X-Ray 1, has been removed. The remaining structures are:

- Building A-7: This structure is located on the southeast side of the DUSA and is constructed of concrete. The building covers approximately 20 m^2 and is approximately 3 meters high. The northern face of the building is covered by an earthen berm. No known drains or ventilation systems are associated with this building. The interior does contain work tables and storage shelves. The installation used A-7 to store electronics equipment.

  Building A-7 meets the release guidelines with the exception of the joints between the steel plates on the roof and east exterior wall. The area between the roof and the walls, the north exterior wall, and the west exterior wall could not be accessed for characterization and are therefore assumed to be contaminated.

- X-Ray 2: X-Ray 2 is located on the southern portion of the DUSA and covers approximately 58 m^2 with a nominal wall height of approximately 3.5 meters. There are no known drains associated with X-Ray 2. The structure contains a U.S. Army Field Electronics Trailer. The trailer is constructed of aluminum and rests on a raised platform above the ground.

  Significant portions of X-Ray 2 were either inaccessible (therefore, considered contaminated) or showed fixed contamination above the guidelines. These areas include the west end of the south exterior wall, the west exterior wall, the lower roof, the upper roof, and the interior floor.

- Security Boxes: Security Box 1 covers approximately 50 m^2 and is located northwest of X-Ray 2 along the access road. Security Box 2 occupies approximately 26 m^2 and is located north of the affected area of the DUSA. Both are constructed of 1 inch steel, have 4 vents in the roof, and have a door and an equipment hatch in the south facing wall. There are no known drains in these structures.

  The Security Boxes meet the release guidelines on the exterior portions of the structures. The interiors were inaccessible during the characterization and are therefore considered to be contaminated.

Grounds and Soils:

The soil composition of the affected areas of the DUSA is primarily a sandy loam with gravel added in certain areas.

ARL conducted soil sampling from 1973 to 1978, and again in 1991, as part of their environmental monitoring program. Analytical results for soil samples collected from several areas around the radioactive waste storage area and behind the backstops showed levels in excess of the guideline values for unrestricted use. Most of the soil contamination was found in the radioactive waste storage area. Concentrations in this area ranged from background to 520 pCi/gm.

During the characterization surveys of the DUSA in the 1995 and 1996 timeframe, numerous soil samples were taken and analyzed for radioactive and other hazerdous components. The characterization report issued by General Physics concluded that all areas showed soil concentrations in excess of the guideline values fo depleted uranium with the highest concentrations residing in characterization grids C1, C2, B2, B3, A1, and A4. Much of the contamination is limited to the top three inches of the soil. It also appears from the characterization data that much of the contamination is localized to well defined areas. The highest activity reported in the characterization report was found in characterization grid A2 and was 4.23 E5 pCi/gm (See Attachment 1 "DU Study Area Survey Locations" for a graphic representation of the site radiological contamination).

The characterization data also indicates the potential for subsurface unexploded ordnance (UXO), which was predominate in characterizationgrids A1, C1, and C2.

The characterization samples were also analyzed and compared to the disposal site criteria. This data indicated no hazardous material component in the soil that would cause the remediated waste to be classified as a mixed waste. These sample results will be verified prior to packaging and shipment of remediated waste generated during this evolution.

1.3 Procedure for Updating or Revising Pages

In accordance with guidance provided in Regulatory Guide 3.65, Page 3, Section 3.3, data and text in the Decommissioning Plan should be updated or revised by replacing pages. For any major changes to the Decommissioning Plan which will involve a major change to the intent of these procedure this requirement will be followed. This will involve a review by appropriate management members of ATG, IOC, and the NRC.

For minor changes to the procedures which do not involve an intent change changes can be made on procedure change request forms and submitted by the ATG Project Manager to the IOC, Health Physicist, for approval.

2.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

This section provides a description of the planned decommissioning activities and tasks. In accordance with Regulatory Guide 3.65, "Standard Format and Content of Decommissiong Plan for Licensees Under 10 CFR 30, 40, and 70", an activity is an orgnaized uniot of work for performing a function and may consist of several tasks. A task is a specified work assignment or job.

2.1 Decommissioning Objectives, Procedures, Activities, and Schedules

2.1.1 Decommissioning Objective

The objective of this project is the decontamination/remediation of the Depleted Uranium Study Area (DUSA) of the Transonic Range at the Aberdeen Proving Grounds, including facilities and equipmenet, to acceptable ALARA (As Low As is Reasonable Achievable) levels for unrestricted release. The criteria for this release shall be the Derived Concentration Guideline Levels (DCGLs) developed in compliance with the "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575 for the soil and Army Regulation EM-385-1-80, "Radiation Protection Manual", Table 6-4 for facilities and equipment.
Derived Concentration Guideline Limits (DCGLs) are radionuclide and site specific activity concentrations within a survey unit that correspond to the release criterion. DCGLs are required for volumetric (i.e., soil) contamination and structural surface contamination as an average activity level ($DCGL_W$) and for small areas of elevated activity ($DCGL_{EMC}$). The volumetric DCGLs for the Depleted Uranium Study Area (DUSA) of the Aberdeen Proving Ground (APG) Transonic Range were derived by Argonne National Laboratory (ANL) using the unrestricted release criterion, for the resident-farmer scenario, of 25 mRem/yr. The DCGLs are summarized here in Table 5.1. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", (Reference 2) is the basis for the volumetric DCGLs of this Work Plan. The ALARA target in Table 5.1 was selected based on the characterization results (Reference 9).[1] The Non-

[1] The results of the characterization study provide drawings identifying areas of the DUSA that exceed 35 pCi/g, 70 pCi/g, and 105 pCi/g. 35 pCi/g is below the detection limit for the field measurements, and 70 pCi/g is

Detectable target is taken from Table 6 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions" (Reference 17). Army Regulation EM 385-1-80 provides the basis for the surface DCGLs - see Table 5.2. Depending on NRC requirements, site-specific surface contamination limits may be developed using other tools, such as RESBUILD and DandD.

DUSA Volumetric $DGCL_W$ TABLE

CONDITION	$DGCL_W$ pCi/gm
ANL (Ref. 2) U-238 DCGL	230
ANL (Ref. 2) U-238 DCGL (adjusted for DU and daughters	190
ALARA Target	105
Non-Detectable Target	60

essentially equal to the detection limit. 105 pCi/g was selected as the ALARA limit and remediation goal because areas exceeding this concentrations are identified by the characterization survey results, can be detected using field measurement techniques, and this concentration is approximately half of the $DCGL_W$.

DUSA STRUCTURAL DCGLs TABLE

CONDITION	LIMIT	
Loose Surface Contamination	< 1,000 dpm/100cm^2 (α, β)	**$DGCL_L$**
Fixed Contamination, Average	< 5,000 dpm/100cm^2 (α, β)	**$DGCL_W$**
Fixed Contamination, Maximum	< 15,000 dpm/100cm^2 (α, β)	**$DGCL_{EMC}$**

The $DCGL_{EMC}$ is not a single value, but a family of values developed for the site using the same modeling assumptions and parameter values but reducing the size of the area containing the activity. MARSSIM defines the ratio of the $DCGL_{EMC}$ to the $DCGL_w$ as the area factor. Since the scan MDC is less than the $DCGL_w$, the area factors do not affect the development and design of the release survey. In the event that small areas of elevated contamination are evident after remediation of the DUSA, conservative $DCGL_{EMC}$s will be developed based on the relative size of the areas and the guidance provided in the "Manual for Conducting Radiological Surveys in Support of License Termination", NUREG-5549 to determine the need for additional remediation.

The DUSA occupies approximately 50,000 m^2. Areas with DU activity greater than 105 pCi/gm, as identified in the characterization report and redefined in the confirmation surveys will be remediated (See Section 6, Remediation Activities). MARSSIM recommends that remediated areas receive a survey unit designation of Class 1. Areas of the DUSA that are remediated will be designated as Class 1 areas. Areas of the DUSA that do not require remediation will be designated as Class 2 areas. The results of the characterization survey indicate that the majority of the DUSA has the potential to contain concentrations of DU greater than 35 pCi/gm, therefore, no areas were designated as Class 3 or non-impacted areas.

Survey units are areas of specified size and shape for whixh a separate decision will be made whether the unit attains the site-specific $DCGL_W$. Survey units are formed by grouping contiguous site areas with a similar use history and the same classification. It is expected, based on the characterization results, that most of the DUSA will be classified as Class 2.

The sample variability in the DUSA was estimated to be approximately 26 pCi/g using the expected range of the data following remediation (0 pCi/g to 105 pCi/g) divided by four. The standard deviation for the characterization data less than 105 pCi/g for the five rows on the characterization grid ranged from 11 pCi/g for row 5 (grids A5, B5, and C5) to 30 pCi/g for row 2 (grids Z2, A2, B2, and C2). The estimated variability of 26 pCi/g is consistent with these values. MARSSIM defines the lower bound of the gray region (LBGR) as the activity where the user would like to know the probability of failing to release a "clean" survey unit For the DUSA the LBGR was selected to be 105 pCi/gm because this was the cut off for identifying areas that require remediation, so the probability of failing to release a site with activity below this level should be low. The relative shift is defined as the $DCGL_W$ minus the LBGR, divided by thevariability. This results in a relative shift of 3.2 ([190-105]/26). MARSSIM recommends rounding down to 3.0 when the relative shift exceeds 3. Therefore, 3.0 was used to determine the number of measurements per survey unit. The acceptable Type I and Type II decision error rates were selected as 0.05. This means there is a 5% chance that a survey unit with an actual concentration of 190 pCi/g of DU would be determined to have a concentration less than 190 pCi/g. It also means that there is a 5% chance that a survey unit with an actual concentration of 105 pCi/g would be determined to have a concentration greater than 190 pCi/g. MARSSIM, Table 5.5, lists 14 measurements for a relative shift of 3.0 and decision error rates of 0.05. This means that 14 samples will be collected in each Class 1 survey unit greater than 140 m^2 and in each Class 2 survey unit.

The work will utilize several methods of decontamination, including, excavation for soil areas, and wiping , removal, and abrasive decontamination as necessary for structures. All remediated soils and materials will be packaged and shipped in accordance with the Industrial Operations Command (IOC) procedure, "Shipping Procedures for Unwanted Radioactive Materials" using an approved IOC broker as designated by this procedure. Following the successful remediation of the Transonic Range and associated structures, a request will be submitted to the NRC for the release of this area from APG's license SMB 1141.

2.1.2 Activities and Tasks

An in-depth radiological characterization of the Transonic Range and associated structures was completed and issued by General Physic's Corporation. An evaluation of the site radiological activity was performed by Argonne National Laboratories (ANL) and remediation Derived Concentration Levels were proposed. The conclusions from the General Physics Corporation's characterizaton, "Transonic Range Depleted Uranium Study Area Radiological Characterization Report", 1996 are as follow:

- Based on the radiation surveys no removable contamination was found on the structures surveyed at the DUSA. However, fixed radiation levels in A-7, X-Ray 1 and X-Ray 2 are in excess of the guideline values.

- Soil data does not show the presence of radionuclides other than isotopes of U-238 and U-235 above the ambient levels. The approximate distribution of uranium isotopes is that of depleted uranium.

- All areas showed soil concentrations in excess of the guideline values for depleted uranium with the highest concentrations in grids C1, C2, B2, B3, A1, and A4. Much of the contamination is limited to the tope three inches of soil. Also it appears that much of the contamination is localized to well defined areas. Any remedial action will require careful planningand implemnetation as it is likely that subsurface UXO will be encountered. In particular, grids A1, C1, and C2 showed high concentrations of ferrous and non-ferrous metals from the magnetrometry surveys.

- The soil does not contain hazardous materials, pesticides, herbicides, or explosives above the regulatory limit.

  Note: The guideline values referred to in the characterization report are not necessarily the guideline values used in the Decommissioning Work Plan. The guidelines used in the Decommissioning Work Plan were derived in accordance with the most current guidance, i.e., "Multi-Agency Radiation Survey and Site Investigation Manual" (MARRSIM), NUREG-1575 for soil and "Demonstrating complance with the Radiological Criteria for License Termination", Draft Regulatory Guide DG-4006 for structures.

The activities planned for accomplishing the remediation of the Transonic Range and its associated structures are described in this NRC Decommissioning Work Plan which consists of the Detailed Work Plan, the Health and Safety Plan, the Quality Assurance Plan and this document the Decommissioning Plan. Each document serves as a part of the instruction that provides the consistency of operation required to successfully complete the decommissioning.

A final report will be prepared upon completion of the remediation effort. This final report, when complete, together with the approved Decommissioning Plan, will contain the required documentation supporting free release of the Transonic Range and associated structures. When complete. This report would constitute a revision to the decommissioning plan and would be added to that document. The remainder of this section provides a brief summary of the contents of each document in the work package.

Detailed Work Plan

The Work Plan is the action document of the Work Package. It provides the step-by-stepl work process for the performance of the remediation, waste management, and final survey and sample as well as other specific task. The Work Plan also include the basic background of the area, a description of the transonic range and associated structure, the operating history, previous characterization survey information, related map and profiles of the transonic range and related structures, remediation activities and objectives, final survey requirements, radioactive waste management, and instruments and procedures.

The Work Plan for this project provides a summary discussion of the background of the Transonic Range and associated structures including a description of the site and associated structures. The Work Plan summarizes radiological data from the Transonic Range, Depleted Uranium Study Area, Radiological Characterization Report prepared by General Physics. The instruments to be used, their detection capabilities, and the required calibration data and documentation are included in this document.

The Remediation Procedure includes guidance for the preparation and mobilization effort, establishing the characterization grid reference system, surveys of structural areas including inaccessible areas, remediation, equipment release and demobilization. The Final Survey Procedures describe the final release survey which shall be accomplished within the guidance of NUREG-1575, MARSSIM. This section includes a discussion of MARSSIM assumptions and parameters, the delineation and layout of Class 1 and Class 2 Survey and Sample Areas, Surveys and Samples from these areas, Background and Quality Assurance Surveys, Sample Analysis, and Identification of Major Contaminants.

The section on Radioactive Waste Management describes the staging of radioactive waste generated from the remediation of soil and structural material generated during the remediation effort. The packaging of this material into strong type containers and the shipment and involved paperwork and required labeling and placarding of the waste are also discussed in this section.

All efforts conducted in the Work Plan will be performed in a manners that will provide for the most efficient remediation and contamination removal techniques available with the least amount of human exposure in accorance with the As Low As is Reasonable Achievable (ALARA) principles. Albiet remediation methods are discussed in the Work Plan, it does not negate the potential for the use of different procedures should this be required and dictated by ALARA and efficiency. The goal will to always utilize the most efficient and dose effective methods available.

Project UXO Avoidance Plan

The Project UXO Avoidance Plan is found in Appendix 5 of the Work Plan. This document provides definitions relevant to unexploded ornance detection and avoidance, procedures to be followed for establishment of work areas, sweeps and surveys to be performed for the determination of UXO material and procedures to be followed after the UXO material has been identified. Qualifications of UXO personnel are identified in this document. This UXO Avodance Plan is to be used during the implementation of on-site activities under the Site Work Plan specifically remediation, survey and sampling activities.

Project Health and Safety Plan

The Health and Safety Plan (HASP) is found in Appendix 4 of the Work Plan. The Health and Safety Plan defines the applicability and responsiblity with respect to compliance with Federal and State Regulations and contractor safety procedures. The HASP defines the scope of work as applicable to safety. An assessment of the hazards that may be encountered at the site is made and this may include unexploded ordnance, radiological hazards, industrial hazards, enviromental hazards, bloodborne pathogens, lead, and unknown hazards. Measures to be taken for Worker Protection are described including personnel protection, procedures, personnel monitorining, industrial hygiene monitoring, training, decontamination, bioassays, radiological surveys, and ALARA principles. General Safety Rules are described as well as specific safety rules and disciplinary actions to be followed for intentionally not adhering to these rules. The applicability of Stop Work Conditions for weather or any unsafe condition is outlined. Accident reporting if required are discussed. The Hazerdous Communication Program which includes label and markings to identify hazerdous material as well as Material Safey Data Sheets (MSDS) is covered. Project roles and responsibilities as related to Health and Safety are described here. The Emergency Plan is covered including evacuations, medical emergencies, radiological incidents, responsibilities, safety signals, emergency information, key ATG personnel, key APG Site personnel, and other key personnel (IOC) are given in this section. Finally a Spill Prevention Control section is covered along with actions and responses to be taken for the spill response to mitigate the consequences of a spill of hazerdous material.

The Quality Assurance Plan

The Quality Assurance (QA) Plan is found in Appendix 2 of the Work Plan. The QA Plan describes the background for the project and the project scope and objectives. The QA Assurance Program is described including the QA Assurance :Plan, the QA training, and Technical Training and Personnel Qualifications. The project organization as related tothe implementation of the QA Program is described. Procurement Document Control is discussed. The QA applicability to the Decommissioning Work Plan is covered. Document Control and Inspections are outlined and described. The Control of Measuring and Test Equipment (M&TE) is covered. Handling, Storage and Shipping of radioactive material is covered. Control of Non-Conformance Items including identification and reporting of non-conformances, evaluation of non-conformance reports, and tracking of non-conformance reports are all covered. Corrective actions including recommendations of corrective actions and corrective action implementation and verification are covered. The handling of Quality Assurance Records and the requirements of QA Records is specified. The requirements for QA Audits is given in this document.

2.1.3 Procedures

In order to ensure compliance to federal, state, local and responsible government agency requirements the following documents and procedures will be followed. Decommissioning activities and tasks will be covered in accordance with the guidance given in the US Army procedures, AR 385-11. The license for this decommissioning activity is the US Army Garrison, Aberdeen Proving Ground, Directorate of Safety, Health and Environment, Aberdeen Proving Ground Health Physics Office's Broadscope License. This broadscope Nuclear Regulatory Commission (NRC) License provided for possession and testing of Depleted Uranium (DU) ammunition. The license number is SMB-1141. The provisions of this license will be followed in the implementation of the Decommissioning Work Plan. The ATG procedures as implemented by the Decommissiong Work Plan in the Work Plan as Appendix 3, Field Operating Procedures will be adhered to. In all aspects related to the Shipping and Handling of Radioactive Material the IOC procedure, IOC, AMSIO-DMW, Standard Operating Procedure, "Shipping Procedures for Unwanted Radioactive Materials will be followed.

2.1.4 Schedule

Figure 1 shows a timeline based on a projected start date and corresponding task durations. This schedule is only an example of the potential work schedule for the remediation of the Transonic Range and associated structures. Only the major activities are shown in this attached schedule. The schedule is a Gant Chart derived from Microsoft Project and actual durations and timeframes will be input into the chart and submitted into the final report.

Figure 5, SCHEDULE FOR THE TRANSONIC RANGE REMEDIATION

Figure 1, Schedule for the Transonic Range (Page 2)

2.2 Decommissioning Organization and Responsibilities

The Decommissioning Organization is shown in Figure 2, Aberdeen Proving Ground Organization Chart. The project organization will report to the Industrial Operations Command, Health Physicist, Mike Styvaert who is responsible for managing this project for the IOC. On-Site the project organization will report to Matt Wilherle, the US Army Point-of-Contact (POC) and to Richard Markland, APG Health Physicist who are responsible for the management of this project for APG.

Allied Technology Group, ATG, personnel consist of the ATG Project Manager, Frank Whitaker, who is responsible for the overall management of this project for contractor related activities. The Project Manager reports to the IOC, Health Physicist, and the APG POC and APG Health Physicist. The ATG Site Supervisor, Terry Keane, is responsible for on-site remediation activities and reports to the ATG Project Manager (See Attachment 2 "Personnel Resumes"). All senior and junior health physics technicians, equipment operators and the UXO specialist reports to the ATG Site Supervisor. The ATG Health & Safety and Environmental Compliance Supervisor, Stanley Leffew, is responsible for all Health and Safety issues on the site and ensuring that all site activities comply with environmental compliance requirements. The ATG Health & Safety Supervisor reports to the ATG Project Manager. The UXO Specialist, Bob Hickman, is responsible for the implementation of the UXO Avoidance Plan and reports to the ATG Project Manager and Site Supervisor. The ATG Broker, Steve Singledecker, is responsible for the packaging, transportation, and disposal of remediated waste in accordance with federal, state, and site regulations and reports to the ATG Project Manager. The ATG QA Manager, Joel Cehn, is responsible for ensuring the performance of all ATG activities are in compliance with federal, state, and site regulations and are in compliance with requirements of the APG Decommissioning Work Plan and ATG Field Procedures. The ATG QA Manager reports to the Project Manager on-site. The ATG QA Manager also reports to the ATG QA Director, Fred Feizollahi, who is responsible for overall compliance of the remediation activities for ATG. In this capacity the ATG QA Director reports to the IOC, Health Physicist, as a direct report to avoid any conflict of interest.

Stan Cohen & Associates, subcontractors to ATG for the development and implementation of MARSSIM for all on-site activities, have two positions. The first position is the Manager Technical Project Support, Jean-Claude Dehmel, is responsible for the correct development and implementation of MARSSIM in the Decommissioning Work Plan and for all site activities. The SC&A Manager Technical Project Support, reports to the ATG Project Manager. An SC&A Engineer, is responsible for the coordination of MARSSIM activities on-site and reports to the SC&A Manager of Technical Project Support.

FIGURE 2, ABERDEEN PROVING GROUND ORGANIZATION CHART

2.3 Training

The Army defines the level of training for its RPOs, ARPOs, and other radiation safety specialists in Army Regulations (AR) 385-11. The training standard for radiation safety is a three (3) week course taught at the Army Chemical Command in Fort Leonard Wood, MO. The Army Regulation makes allowance for other types of traditional and/or specialized training that is not taught by the Army.

The Army's radiation worker's necessary level of required skill and training varies with the radioisotopes being used. This variation in training makes an acceptable standard difficult to define.

All of the IOC, APG, ATG, and SC&A principals involved in this project are qualified by education, experience, and in accordance with AR 385-11, as demonstrated in their resumes.

All ATG personnel are qualified for radiation workers in accordance with the ATG Radiation Protection Training Program and the requirements of 10 CFR 19.13. All ATG personnel will receive on-site training to the APG Decommissioning Work Plan which will be documented. Training will include:

- Radiation Worker Rights
- Source of Radiation and Contamination
- Types of Radiation and Contamination
- Units of Radiation and Radioactivity
- Prenatal Exposure (Regulatory Guide 8.13)
- Biological Effects of Radiation
- Radioactive Contamination Control
- Use of Anti-C Clothing
- ALARA Concepts
- Emergency Procedures
- Use of Radiation and Contamination Detection Instruments

All personnel performing remediation activities on site will be qualified for hazardous waste remediation in accordance with OSHA (29 CFR 1910.120). This will be implemented on site with the Decommissioning Work Plan and APG Site Specifics. Personnel requirements for compliance with OSHA (29 CFR 1910.120) are as follows:

- Supervisors shall have completed the 8 hour Supervisor Training Program in accordance with 29 CFR 1910.120.

- All personnel will be required to provide evidence of training in accordance with 29 CFR 1910.120 e.6.
- All personnel will be required to provide evidence of Medical Certification in accordance with 29 CFR 1910.120f.
- All respirator wearers will be trained and have documentation required for respirator use in accordance with 29 CFR 1910.134.

2.4 Contractor Assistance

APG has chosen the option of a contractor-assisted remediation for the Transonic Range and associated structures. The remediation project will be conducted by ATG trained personnel. ATG's Remediation and Waste Management Services are approved on the IOC's Qualified Bidders' List (QBL) for work on IOC remediation, brokerage, and radioactive materials contract.

ATG will use three subcontractors for the performance of work activities at the APG Transonic Range. The first subcontractor will be Stan Cohen & Associates. SC&A will supplement ATG for the development and implementation of NUREG-1575, MARSSIM, for the remediation, layout of areas, survey and samples for the Final Release Surveys. SC&A will provide review and input into the development of the Decommissioning Work Plan. SC&A will also provide on-site support to ensure that the layout of area, and surveys and samples for the Final Release Surveys are performed in accordance with MARSSIM procedures. SC&A will provide laboratory support for the analysis of final release soil samples.

Paragon Analytical Laboratories will provide laboratory analysis of waste characterization samples of remediated waste for disposal of the waste at either Envirocare Inc. of Utah or Waste Management Corporation of Texas. Paragon Analytical Laboratories is a Utah approved laboratory as required by Envirocare Inc. for characterization of their waste stream for disposal.

MHF, Logistics Inc of Pittsburgh, PA, will provide the packages, intermodals, and coordinate the transpiration of these packages to the appropriate waste disposal site.

3.0 DESCRIPTION OF METHODS USED FOR THE PROTECTION OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY.

3.1 Facility Radiological History Information

The Transonic Range, Depleted Uranium Site Area (DUSA), is located at a site within the boundaries of the Transonic Range. This area is in the Aberdeen Area of the Aberdeen Proving Ground (APG). The Aberdeen Proving Ground lies along the western shore of the Chesapeake Bay in Harford and Baltimore Counties of the state of Maryland, approximately 15 miles northeast of Baltimore. APG covers a total of 72,516 acres of land and water and consists of two distinct areas: the northern portion of APG, referred to as the Aberdeen Area (AA) and the southern portion of APG, referred to the Edgewood Area (EA). The Aberdeen Area became a formal military post, designated as Aberdeen Proving Ground, in 1917. The Edgewood Arsenal was appropriated by Presidential Proclamation in 1918.

The Depleted Uranium Study Area (DUSA) is located on the southeast end of the Transonic Range and was used for Depleted Uranium (DU) testing from 1973 through 1979. Testing consisted of gun launching DU penetrators from two locations located on the northern portion of the site at targets mounted adjacent to the X-ray units to the south. Stripper/deflector plates located in between the launch or shooting locations were designed to strip or deflect the sabot away from the penetrator while the shell was in flight to the target. Penetrators were either stopped in the target or penetrated the target and impacted into a backstop located a short distance behind the target. The majority of the DU melted into the targets or backstops. Some of the DU fell onto the soils around the targets or was scattered into the surrounding areas. All DU ammunition was treated as radioactive material. Except for shot targets and other designated contaminated materials, most radioactive materials were maintained onsite in a radioactive material storage area located to the east of the impact zone. These shot targets and other designated materials have been remediated, recycled and/or disposed of at an approved radioactive material waste disposal site.

After testing with DU materials ceased, the Army Research Laboratory (ARL) Health Physicist conducted an initial site cleanup to reduce the radioactive waste inventory and to allow for the testing of other ammunition which did not contain radioactive material such as DU. This effort included removing shot targets and other materials from the radioactive storage area. This initial effort also included surveying and removing contaminated soil, sand, and other contaminated material. The result of this initial characterization and remediation was to bound and define the remaining potentially radioactive contamination into an approximately 12 acre site, the Depleted Uranium Study Area (DUSA).

From December of 1995 through May of 1996 a study of the DUSA was conducted by the General Physics Corporation to determine the extent of the contamination at the site. The site continues to be listed as a radiation test facility in the U.S. Army Research Laboratory's Nuclear Regulatory Commission License even though no testing with DU materials has been conducted in this area since 1979. A determination was made by the U.S. Army in 1995 to cease licensed activities at the DU Study Area (DUSA). This characterization was performed by the requirements of the NRC's Branch Technical Position, 'When to Remediate Inadvertent Contamination of the Terrestrial Environment'.

The report of this characterization, "Transonic Range Depleted Uranium Study Area Radiological Characterization Report", General Physics Corporation, 1996 reached the following conclusions:

- Based on the radiation surveys no removable contamination was found on the structures surveyed at DUSA. Fixed radiation contamination levels in structures A-7, X-Ray 1 (removed since the characterization), X-Ray 2 are in excess of the guideline values.

- Soil data does not show the presence of any radionuclides other than isotopes of U-238 and U-235 above ambient levels. The approximate distribution of the uranium isotopes is that of depleted uranium.

- All areas showed soil concentrations in excess of the guideline values for depleted uranium with the highest concentrations in grids C1, C2, B2, B3, A1 and A4. Much of the contamination is limited to the top three inches of the soil. Also it appears that much of the contamination is localized to well defined areas. Any remedial actions will require careful planning and implementation as it is likely that subsurface UXO will be encountered. In particular, grids A1, C1, and C2 showed high concentrations of ferrous and non-ferrous metal from the magnetometry surveys.

- The soil does not contain any other hazardous materials, pesticides, herbicides, or explosives above the regulatory limit.

NOTE: The guideline values referred to in the characterization report are not necessarily the guidelines used in the work plan. The guideline used in this work plan were derived in accordance with the most current guidance, i.e., "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM), NUREG-1575 for soil and "Demonstrating Compliance with the Radiological Criteria for License Termination", Draft Regulatory Guide DG-4006 for structures.

Based on the scoping and characterization data, the Industrial Operations Command contracted Argonne National Laboratory (ANL) to provide the volumetric Derived Concentration Guideline Levels (DCGL) applicable to the DUSA in accordance with the values contained in MARSSIM. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", Argonne National Laboratory, 1999 is the basis for the volumetric DCGLs of this Decommissioning Work Plan.

3.2 Ensuring that Occupational Radiation Exposures are As Low As Reasonably Achievable (ALARA)

The implementation of the ATG ALARA Program will be established through the performance of the Decommissioning Work Plan and by conducting all activities in accordance with ATG Field Procedures. The ALARA Program will also be implemented through the observation of all pertinent federal, state, and site regulations. The site's license requirements will also be adhered to in pursuit of ALARA objectives. IOC procedures and requirements will also be an implementing mechanism to achieve ALARA principals. ATG has a documented formal ALARA Procedural Program.

The major radiological isotope of concern from the depleted uranium associated with the site is Uranium (U-238). The only gamma radiation associated with the U-238 decay to its daughter products, and the energies for these emissions are in the 50 KeV to 1 MeV range, on average. Dose rates in the general areas of the Transonic Range and its associated structures are less than 1 mrem/hr. The primary detection for DU in the soil will be the gamma emission of the decaying U-238. The primary detection capability for the contamination on the surfaces is due to the daughter product (β^-) emissions in the 0.1 to 2.3 MeV range, on average.

The DU in the soil is in discreet particles and is unlikely to become airborne during remediation. The contamination in the structures is adhered to the surfaces, requiring some pressure to create smearable conditions. Thus it is highly unlikely that this radioactive material will become airborne. In those remediation situations where contamination will be made airborne, HEPA ventilation containments and respiratory protection will be used to prevent personnel and/or environmental contamination if required.

The control of handling and storage of radioactive wastes will be controlled by the APG NRC License, the APG Decommissioning Work Plan, and ATG Field Procedures.

Remediation activities will be conducted to a target DCGL values of 105 pCi/gm for ALARA purposes versus the required DCGL (for U-238) of 230 pCi/gm.

3.3 Health Physics Program

The Industrial Operations Command and the licensee (APG Health Physics) will provide oversight of the remediation project. The Decommissioning Work Plan and the ATG Field Procedures will normally provide the day-to-day implementing mechanism for the Health Physic's Program. The Decommissioning Work Plan and the ATG Field Procedures are in compliance with 10 CFR 19 and 20.

Specific aspects of Radioactive Waste Management will be conducted in accordance with the Work Plan, Section 6, 'Radioactive Waste Management'.

Selected health physics instrumentation, their respective calibrations, relevant correlations, daily responses, operation and minimum detectable sensitivities are described in the Work Plan Section 7, 'Selected Procedures and Equipment'.

3.4 Contractor Personnel

Aspects of the ATG Decommissioning Team and its subcontractors including programs, organization and interactions are described in this document and the Decommissioning Work Plan. This area is expanded in the Work Plan.

3.5 Radioactive Waste Management

All equipment, supplies, and materials leaving site will be surveyed in accordance with protocol established in ATG Field Operating Procedures. Release limits will be those established in DG-4006, 'Demonstrating Compliance With the Radiological Criteria for License Termination' and with Army Regulation EM 385-1-80. Equipment, supplies, and materials not meeting the free release criteria will be decontaminated or disposed of as radioactive waste.

No liquid wastes are expected to be generated as a result of this project, nor are any liquid effluents expected to be recovered or sampled during this project. Any moisture derived from the soil remediation will be absorbed with desiccant prior to shipment of the remediated material for disposal. If liquid samples are required, they will be performed in accordance with the ATG Field Operating Procedures which are based on maintaining compliance with regulations and limitations of 10 CFR 20.

No airborne effluents are expected to be generated as a result of this project. An Air Sampling Program will be established in accordance with Section 4 of the Work Plan. The results of these samples will be used to document compliance with 10 CFR 20.

Approximately 2,500 ft^3 of solid radioactive waste (soil and debris) is anticipated to be generated as a result of this project. Based on the characterization data, there are no other hazardous components that would result in the waste being classified as a mixed waste. This data will be verified prior to packaging and disposal of the waste generated in the remediation process. This waste will be handled, packaged, stored, and disposed of as follows:

- The highest sample activity, recorded in the characterization data, was 4.23 E5 pCi/gm. While the anticipated average concentration is much lower, this activity will be used for planning purposes.

- The waste generated from this project will be packaged in hard covered roll-off containers with a 6 mil inserted liner. These containers will be staged in the loading area on transport trucks or on cleared ground. Staging will be based on field conditions.

- Containers will be covered and sealed upon completion of loading. All partially full containers will be covered at the end of the work day, or if work is suspended for more than 2 hours.

- All exterior surfaces of containers and transport vehicles will be verified to be free of loose surface contamination prior to removal from the DUSA.

- If on-site storage is necessary prior to shipment, the storage area will be barriered and posted as a "Radioactive Materials Storage Area" and "Authorized Entry Only".

- All containers will be surveyed prior to shipment in accordance with ATG Field Operating Procedures and in compliance with 49 CFR 171-179. Maximum expected dose rates on the exterior of the containers is expected to be less than 1000 μR/hr. The general area (30 cm) dose rate is anticipated to be between 20 and 100 μR/hr, depending on the distribution of the DU in the containers or packages.

- The full containers will be transported from APG to a rail spur for trans-shipment (or directly on the transport truck) to WCS of Texas or other licensed and approved disposal site. The final mode of transportation will be field documented.

- All shipments will meet the DOT requirements and comply with the IOC Standard Operating Procedures - "Shipping Procedures for Unwanted Radioactive Material". In addition, all activities associated with packaging, loading, survey, and shipment will be conducted in accordance with the ATG Field Operating Procedures.

- The broker for this waste will be IOC certified in accordance with the IOC Standard Operating Procedure - "Shipping Procedures for Unwanted Radioactive Material".

- It is anticipated that all waste generated during this project will be shipped before the end of the project.

4.0 PLANNED FINAL RADIATION SURVEY

The final radiation survey is described in Section 5, "Final Survey Procedures", of the Work Plan. The surveys and samples used to demonstrate compliance with the release criteria have been designed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual", MARSSIM, NUREG-1575 for soil release, Army Regulation EM 385-1-80, "Radiation Protection Manual for facilities and equipment, and "Demonstrating Compliance with Radiological Criteria for License Termination", Draft Regulatory Guide DG-4006.
Remediation excavation and deconning will continue until release Derived Concentration Guideline Limits (DCGLs) are reached. A DCGL is a radionuclicde and site specific activity for volumetric contamination and structural surface contamination as an average activity level ($DCGL_w$) and for small areas of elevated activity ($DCGL_{EMC}$). The volumetric DCGL for the Depleted Uranium Study Area (DUSA) of the Aberdeen Proving Ground (APG) was derived by Argonne National Laboratory (ANL) using the unrestricted release criteria, for the resident farmer, of 25 mRem/yr. The report, "Derived Uranium Guidelines for the Depleted Uranium Study Area of the Transonic Range, Aberdeen Proving Ground, MD", is the basis for the volumetric DCGLs to be followed by this Decommissioning Work Plan. Army Regulation EM 385-1-80 provides the basis for surface DCGLs. The ALARA target DCGL for the soil at APG transonic range is 105 pCi/gm. For the associated structures of the transonic range the DCGL is 1000 DPM/100 cm^2 for loose surface contamination (alpha-beta emissions), 5000 DPM/100 cm^2 for fixed surface contamination (alpha-beta emissions), 15,000 DPM/100 cm^2 for fixed surface

contamination (alpha-beta emissions).

Soil samples will be sent to Stan Cohen and Associates Laboratory or an equivalent certified laboratory for analysis.

The hydrology for the area is that the water flows generally in a north to south direction. The area is low and several surrounding marsh areas are found adjacent to the range. The soil is most sandy loam indigenous to the area.

5. FUNDING

This section was prepared in accordance with NRC Regulatory Guide 3.66, "Standard Format and Content of Financial Assurance Mechanism Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72.

The majority of planning and preparation costed in the tables is accomplished by the submittal of this document. The characterization for the site was performed by General Physics Corporation, "Transonic Range, Depleted Uranium Study Area, Radiological Characterization Report". The unit cost of 'workers' associated with the project for a yearly basis along with the overhead rate and total worker cost on an annum basis. The cost estimations for major portions of the decommissioning work effort is presented. Major equipment cost is shown. The cost of waste containers (intermodals) is shown. The transportation cost associated with the disposal of the waste is provided. The disposal cost of the waste at the burial site is also provided. No restoration cost are provided as restoration will not be performed. The projected costing for the final radiation surveys is shown. No site stabilization or long term surveillance costing is provided as this will not be required. Finally, a summary table of all costing is provided.

The estimated amount of remediated waste is 2500 ft^2 with a X 1.25 contingency growth factor amounts to 3125 ft^2. It is assumed that the waste will be shipped from APG to Waste Control Specialist's Disposal Facility in Andrews, TX. The mileage incurred is 1803 miles per trip. The cost of disposal is $9.15 per cubic foot. It will require 9 internodal containers to dispose of the waste.

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 1

PLANNING AND PREPARATION

TASK	Work Days					
	Project Mgr	Foreman	HP	Clerical	Total	Total Cost
1. Preparation of Documentation for Regulatory Agencies	5	5	5 (CHP)	2	17	$6,335
2. Submittal of Decommissioning Plan to the NRC when required by 10 CFR 30.36(c)(2), 40.42(c)(2), or 70.38(c)(2)	1	-	1	1	3	$745
3. Development of Work Plans	5	5	5 (CHP)	3	18	$6,465
4. Procuring Special Equipment	1	1	-	1	3	$745
5. Staffing	2	2	-	2	6	$1,490
6. Characterization of the radiological condition of the facility (including soil sampling and analysis and ground water analysis)	5	5	60	0	70	$10,800
7. Other	-	-	-	-	-	-
8. Total	19	19	70	9	117	$26,580

Notes: 1. These columns show a 1.25 contingency growth.
2. All labor rates are unburdened.

COST ESTIMATE TABLES

**ABERDEEN PROVING GROUND
TRANSONIC RANGE**

TABLE 2

UNIT COST FOR WORKERS

Position	Basic Salary	Overhead Rate (%)	Worker Cost ($/yr)
Health Physicist	124,800	52.5	$190,320
Project Manager	76,000	52.5	115,900
Health and Safety Manager	52,000	52.5	79,300
Supervisor	52,000	52.5	79,300
UXO Specialist	52,000	52.5	79,300
Waste Broker	52,000	52.5	79,300
Technician	37,440	52.5	57,096
Laborer	29,120	52.5	44,408
Decon Technician	29,120	52.5	44,408

2. Decontamination and/or Dismantling of Radioactive Facility Components*

Glove boxes	_____ _____ NA__(m^3)	Amount of Floor Space	__155__(m^3)
Fume Hood	_____ _____ NA__(m^3)	Ventilation Ductwork	__N/A__(m)
Hot Cells	_____ _____ NA__(m^3)	Amount of Wall Space	__342__(m^2)
Lab Benches	_____ _____ NA__(m)	Other	__N/A
Sink & Drain	__N/A__ _____ __(m)		

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 3
WORK DAYS

Task	Manager	Super-visor	Tech-nician	UXO Specialist	Lab-orer	Total	Total Cost
1. Decon/Dismantle Major Components and/or Processing and Storage Tanks	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2. Decon/Dismantle Laboratories, Fume Hoods, Glove Boxes, Benches, etc.	N/a	n/a	n/a	n/a	n/a	n/a	n/a
3. Decon/Dismantle Waste Areas - Radwaste Areas - Scrap Recovery Areas - Other (Note 1)	5	5	15	5	20	50	$66,638
4. Decon/Dismantle Service Facilities - Maintenance Ship - Decontamination Areas - Ventilation Systems - Other	5	5	15	5	20	50	$66,638
5. Decon/Dismantle Waste Treatment Facilities and Storage Areas on the Site (Including exhume and package contaminated soil and tailings, if any) - Fluoride Lagoons - Nitrate Lagoons - CaF2 Waste Recovery - Ground Water Restoration - Other (Note 1)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6. Monitor for compliance, reclean and monitor, if necessary (Note 1)	2	2	10	n/a	10	24	$29,320
7. Other (e.g., contractor fees)	5		5			10	$23,415

NOTE: All Labor Rates are unburdened.

1. This table shows X 1.25 contingency growth.

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 4

EQUIPMENT COSTS

Equipment Supply	Quantity	Cost
Loader/Backhoe	1	$5,425
Transport Van	1	$10,000
Front End Loader	1	$5,425
Cutting Torch	1	$1,170
Generator	1	$900
Scabblers	2	$250
Compressor	1	$4532
Containments	1	$315
Protective Clothing	100 pr.	$1250
Diesel Fuel Tank	1	$250
TOTAL:		**$29,517**

Note: This table shows a X 1.25 growth contingency

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 5

WASTE CONTAINER COSTS

Waste Type	Volume (m^3)	Number of Containers	Type of Containers	Unit Cost of Containers	Cost of Containers
depleted uranium	38.5	9	Internodal	$4625	$41,625
Total	88.5	9	-	-	$41,625

Notes: The volume figures include a 1.25 contingency factor

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 6

SHIPPING COSTS

Distance Shipped 1803 miles

Unit Cost for Shipment 3700

Additional Charges

Overweight: None
Surcharges: None

Waste Type	Number of Trucks	Unit Cost for Shipping	Distance Shipped	Surcharge	Transportation Cost
depleted uranium	9	3700	1803	0	$33,300

Note: This table shows a X 1.25 growth contingency

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 7

BURIAL CHARGES

Burial Charges	28,594 ($/ft^3)
Surcharges	N/A ($)
per Container Disposal	$3177 ($/ft^3)

Waste Type	Burial Volume	Unit Cost of Burial	Surcharge	Burial Cost
LLRW/Debris	3125	9.15/ft^3	N/A	$28,594

Notes: The tabulated waste volume of 3125 ft^3 represents a 1.25 contingency over characterization based volume estimate.

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 8

RESTORATION OF CONTAMINATED AREAS ON FACILITY GROUNDS

	Work Days						
Task	Manager	Supervisor	HP	RSO	Clerical	Total	Total Cost
							$0.00

Note: 1. Based on the characterization data, the Transonic Range will require limited excavation of radioactive soils. No specific funds are committed to restoration of the range.

2. The decontamination of the Transonic Range Associated Structures will require no restoration.

COST ESTIMATE TABLES

**ABERDEEN PROVING GROUND
TRANSONIC RANGE**

TABLE 9

FINAL RADIATION SURVEY

Work Days

Task	Manager	Supervisor	HP	UXO	Laborer	Total Days
Layout of Site Areas for MARSSIM Survey by Class. Gridding of areas. Final Surveys and samples of area.	10	10	30	10	40	100

TOTAL COST $133,276

Notes: 1. All labor rates are unburdened
2. This table shows a 1.25 contingency growth

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 10

SITE STABILIZATION, LONG-TERM SURVEILLANCE

	Work Days						
Task	Manager	Supervisor	HP	RSO	Clerical	Total	Total Cost
							$0.00

Notes: 1. The Army's decommissioning objective for the Transonic Range and Associated Structures is to release these areas from control as radioactive, the facility is within an area which is controlled for unexploded ordnance and thus cannot be released for unrestricted use by the public.

COST ESTIMATE TABLES

ABERDEEN PROVING GROUND
TRANSONIC RANGE

TABLE 11

SUMMARY OF COSTS

TABLE	TITLE	TOTAL
TABLE 1	PLANNING AND PREPARATION	$ 26,580
TABLE 3	WORK DAYS DECON/DISMANTLE WASTE AREAS DECON/DISMANTLE SERVICE FACILITIES MONITOR FOR COMPLIANCE, RECLEAN & MONITOR OTHER	 $ 66,638 $ 66,638 $ 29,320 $ 23,415
TABLE 4	EQUIPMENT COST	$ 29,517
TABLE 5	WASTE CONTAINER COST	$ 41,625
TABLE 6	SHIPPING COSTS	$ 33,300
TABLE 7	BURIAL CHARGES	$ 28,594
TABLE 8	RESTORATION OF CONTAMINATED AREAS ON FACILITY GROUNDS	$ 0
TABLE 9	FINAL RADIATION SURVEY	$ 133,276
TABLE 10	SITE STABILIZATION, LONG-TERM SURVEILLANCE	$ 0

6. PHYSICAL SECURITY PLAN AND MATERIAL CONTROL AND ACCOUNTING

PLAN PROVISIONS IN PLACE DURING DECOMMISSIONING

The existing security system for the facility is adequate to handle any contingency that may arise during decommissioning and remediation activities. There is no cause in the Decommissioning Work Plan, as written, for which the existing site security should be modified.

ATTACHMENT 1

TRANSONIC RANGE - DU STUDY AREA SURVEY LOCATIONS

ATTACHMENT 2

PERSONNEL RESUMES

SUMMARY

Mr. Terrence J. Keane, CM, is a Certified Professional Manager with over 30 years experience in progressive levels of management in technical environments. This experience covers small and large companies, public and private utilities, government contractors (DOD and DOE), and general industry. He has served as an engineering and management consultant to major clients in public and private utilities, DOE contractors, and the petro-chemical industry in the fields of radiological and industrial safety/hygiene, training assessment and development, environmental remediation, emergency management, and organizational/situational management.

Mr. Keane has developed and implemented radiological protection programs compliant with 10 CFR 20, 10 CFR 20 as revised, 10 CFR 835, and the regulations of several Agreement States. This development has included graded programs designed with a "smart standards" and "intent of the law" approach. He has served as the Radiation Protection Manager (RPM) under 10 CFR 50 (Nuclear Power Plant) licenses and as the Radiation Safety Officer (RSO) under 10 CFR 20 and Agreement State licenses.

He has provided services for training program assessment and development, program accreditation, lesson plan development, and instruction in the areas of Radiation Protection, Power Plant and Refinery Systems, Radiography, General Employee Training, Advanced Rad Worker Training, Emergency Preparedness, Industrial Safety / Industrial Hygiene, Right-to Know, Fitness-For-Duty, Supervisory Behavior Observation, Management Philosophy, and Regulatory changes.

EXPERIENCE

ALLIED TECHNOLOGY GROUP, INC.
Project Supervisor
September 1998 - April 1999

As Project Supervisor, Mr. Keane was directly responsible for the supervision of ten personnel for ATG's remediation of an active firing range contaminated with Depleted Uranium (DU) and lead at the Lake City Army Ammunition Plant. Mr. Keane's responsibilities also included assisting the Project Manager with mobilization, demobilization, procurement of equipment, supplies, coordination of project vendors and subcontractors, development and oversight of the Project Work Plan, Health & Safety Plan and Quality Assurance Plan, radiation protection measures and controls, project documentation review and approval, preparation of final reports, supporting documentation and final release recommendations.

AMERICAN TECHNOLOGIES, INC.
Manager, Radiological Services
1995 - 1998

As Manager of Radiological Services, Mr. Keane had responsibility for ATI's D&D projects; ES&H Staff Augmentation; Radiological Engineering/Health Physics related projects; ATI's radioactive material licensed activities; ATI projects at Mound, Hanford, and Rocky Flats; CROET support, and ES&H support of other departments and divisions within ATI.

In this capacity he was responsible for the development of the Radiation Protection Program designed for independent operation of the K-1401 D&D/Asset Recovery project, the OMI support of leased space on the Oak Ridge facilities, and the program for the current ATI license application for a D&D facility at the former K-25 facility.
Prior to assuming this position Mr. Keane served as a project/office manager responsible for the operation

of ATI's Miamisburg, Ohio office and projects serviced by that office.

- *Project Manager and Lead Engineer for the review and revision of the EG&G Mound Emergency Management Facility Hazard Assessments.*

- *Field Manager and Lead Engineer for the upgrade of the EG&G Mound Radiological Protection Program for compliance with 10 CFR 835 including the Site Rad Con Manual, Technical Basis Documents, and Operational Program, Policy, and Procedure development.*

KEANE NUCLEAR CONSULTANTS
Self Employed Consultant
1988 - 1995

Prior to joining ATG, Mr. Keane was self-employed as a management and engineering consultant. He provided services in the areas of organizational management / structure, project management, management and technical training assessment and development, regulatory analysis, safety analysis, outage management, industrial safety, radiological engineering and oversight, quality assurance, emergency preparedness and hazard assessment, staff augmentation, and program development including 10 CFR 20 upgrades, 10 CFR 835 upgrades, and agreement state NORM requirements. During this period he served as the Radiation Protection Manager for a BWR full scope pipe replacement, as a training development specialist for a mid-western utility, and as management consultant / advisor and RPM during a PWR, multi-unit power plant outage. He also developed radiological and industrial safety programs for a refinery "turn-around".

DUKE POWER COMPANY
Supervising Scientist
March 1986 - March 1988

Mr. Keane served as a corporate manager with programmatic responsibilities for 3 nuclear stations, 10 fossil power plants, and a laboratory / training complex including program direction and oversight, program assessment, personnel dosimetry, licensing, and QA Radiography operations and the Physical Science Laboratories for Duke Power Company. During his tenure, Mr. Keane also provided services to other utilities including Radiation Protection Management response to the TMI accident and maintenance engineering support for major steam generator repairs. Qualified Lead Auditor in accordance with ANSI/ASME N45.2.23. Served as the RSO (or alternate RSO) for all company radioactive material licenses.

DUKE POWER COMPANY
Rad Protection Manager
March 1976 - March 1986

Mr. Keane served as Radiation Protection Manager (RPM) for a 2-unit nuclear power plant. His responsibilities there covered the technical aspects ranging from the environmental program to radioactive waste management and included industrial safety; and the management aspects ranging from budget preparation / control to personnel administration, including salary program administration, for an engineering and technical staff of up to two hundred individuals. He was also responsible for radiological training and GET program assessment and oversight and served as the RSO for state and NRC licenses held by the plant, including radiography.
TODD SHIPYARDS CORPORATION
Field Office Manager / Nuclear Program Supervisor / Health Physics Supervisor

August 1969 - March 1976

Served as a field service manager for a support contractor providing maintenance, radiological protection, and quality assurance / quality control support to utilities and general industry. Outside projects included initial reactor core load engineering and quality assurance, decommissioning of a nuclear fuel fabrication facility, radiography and general license audits, and utility outage support. In-house projects included support of the operation and decommissioning of the Nuclear Ship Savannah including lay-up chemistry and radiochemistry, operation and decommissioning of the shore side support facility for the NS Savannah including shipment of the spent nuclear fuel, and operation of the National Maritime Research Center - Gulf Coast.

GENERAL DYNAMICS CORPORATION
Rad Engineering / Technical Assistant / Health Physics Monitor
April 1965 - August 1969

Mr. Keane began his career working in Health Physics and Radiological Engineering for a shipyard that provided construction and overhaul of submarines for the Naval Nuclear Program.

EDUCATION

BS Management Science, Limestone College, Gaffney, SC, 1985

CERTIFICATIONS / SPECIALIZED TRAINING

Various Professional/Technical/Management Courses	1964 to Present
Certified Professional Manager	1985
NC Governors Award for Excellence in Waste Management	1983
Mecklenburg Council, North Star Dist., BSA, Scouter of the Year	1979
BSA, Eagle Scout	1960

REFERENCES

Available Upon Request

SUMMARY

Mr. Leffew has extensive training and experience in the waste reduction and environmental remediation fields which include the following responsibilities:

- Health and safety oversight on construction, demolition, and environmental remediation projects.
- Hazard identification and assessment of work practices, procedures, and conditions.
- Industrial hygiene sampling for projects at DOE sites.
- Providing safety training and daily health and safety briefings.
- Record keeping of daily events, training, industrial hygiene sampling, instrument calibration, and safety issues.
- Responsible for regulatory compliance and enforcement.
- Utilizing innovative techniques for volume reduction of nuclear waste.
- Working on components with high levels of radiological contamination while using various decontamination techniques.
- Taking precautions to ensure a safe working environment through engineering controls.

EXPERIENCE

ALLIED TECHNOLOGY GROUP, INC. Oak Ridge, TN and Aiken, SC
Health and Safety Officer
August 1998 - Present

- Provide health and safety oversight on two consecutive construction contracts at the Savannah River Site
- Coverage of two consecutive Department of Energy environmental restoration and inventory projects at the Oak Ridge National Laboratory Facility X-10.
- Maintenance of industrial hygiene equipment including instrument calibration, maintenance of air monitoring devices for lead and asbestos sampling, noise monitoring, and confined space entry.
- Daily health and safety briefings, training of subcontractors.
- Daily and weekly job site inspections, trenching and excavation inspections.
- Interaction with regulatory groups including Westinghouse, Bechtel, Lockheed Martin Energy Systems, FEB, Health and Safety personnel and the Department of Energy.
- Daily documentation of activities, health and safety record keeping, chain of custody forms, attention to detail of the Work Clearance Permit(s) and industrial hygiene sampling.
- Responsible for ATG Respiratory Protection Program including maintenance, storage, and issuance of respirators as well as determining correct respiratory protection for hazards present.
- Provision of health and safety coverage for crane operations including critical lifts.

KELLY SCIENTIFIC, OAK RIDGE NATIONAL LABORATORY
Industrial Hygiene Technician
March 1998 - August 1998

- Provide a hazardous materials review.
- Perform hazardous materials inventory.
- Responsible for barcode tracking system and computer input, utilizing Microsoft Excel and Access.
- Update date files for hazardous materials.

ALLIED TECHNOLOGY GROUP, INC.
Industrial Hygiene Technician, Decontamination Technician, Health and Safety Officer
May 1998 - Present

- Provided health and safety oversight at a Department of Energy (DOE) environmental restoration and inventory reduction project.
- Performed industrial hygiene instrument calibration and maintenance.
- Performed industrial hygiene monitoring including lead sampling, noise monitoring, and confined space monitoring.
- Provided daily health and safety briefings and inspections.
- Interacted daily with regulatory groups including Lockheed Martin Energy Systems health and safety personnel, environmental protection personnel, and DOE oversight.
- Documented daily activities, health and safety record keeping, instrument calibration, chain of custodies, and industrial hygiene sampling.
- Responsible for the ATG Respiratory Protection Program which includes the maintenance, storage, and issuing of respirators as well as determining the correct respiratory protection for the hazards present.
- Containerize, label, and document hazardous materials and waste.
- Assisted health and Safety manager with safety oversight on demolition and remediation projects.
- Performed industrial hygiene sampling including air monitoring and noise monitoring.
- Provided daily health and safety briefing in conjunction with the Health and Safety Manager.
- Performed calibration and maintenance on all industrial hygiene monitoring equipment.
- Removed, packaged, documented, and labeled hazardous waste.
- Remediated hazardous waste including lead, asbestos, PCBs, and radiologically contaminated materials.
- Performed demolition activities utilizing various power tools, torch equipment, and heavy machinery.

CRYO DYNAMICS
Senior Decontamination Technician
January 1997 - May 1997

- Utilized CO_2 blasting and grinding to lower or eliminate smearable and non-smearable radiation from sea-lands, robots, and various other materials and equipment.

SCIENTIFIC ECOLOGY GROUP, INC.
Decontamination Technician
1996

- Utilized various techniques to process and decontaminate mixed hazardous wastes.
- Performed volume reduction to low-level radiologically contaminated waste.
- Used instrumentation to monitor radiation levels.

EDUCATION AND ASSOCIATED TRAINING

- Associate of Applied Science in Environmental Health Technology, Industrial Hygiene, Roane State Community College, Harriman, TN
- Associate of Applied Science in Environmental Health Technology, Waste Management, Roane

State Community College, Harriman, TN

- All general employee training for Lockheed Martin Energy Systems facilities
- 40 hour OSHA Hazardous Waste Operations and Emergency Response with current 8 Hour update
- 24 Hour OSHA Hazardous Waste Operations and Emergency Response
- 30 Hour OSHA Construction Safety with current 8 Hour update
- Radiation Worker II Training
- Environmental Sampling
- Lead Training
- Asbestos Awareness
- Environmental Instrumentation I and II
- Occupational Safety and Protection
- Environmental Laws and Regulations
- Fire Awareness
- Confined Space Trained
- Fork Truck Certified
- Respirator Fit Tested and Trained
- Hazardous Energy Lockout Training
- Work Clearance Permit Training

EXPERIENCE

ALLIED TECHNOLOGY GROUP, INC.
Director of Regulatory Affairs
January 1999 - present

Mr. Palmer is responsible for the oversight and operation of the Radiation Control, Health and Safety, Quality Assurance and Environmental Compliance programs for ATG, Inc. at the Richland WA and Oak Ridge, TN sites

CHASE ENVIRONMENTAL GROOUP
Corporate Radiation Safety Officer
September 1996 - January 1999

Mr. Palmer was responsible for implementing corporate radiation safety program, licenses and permit applications. He wrote a radioactive materials license application and supporting procedures that resulted in issuance of a D&D license. Other projects included writing and implementing two radiation protection programs in accordance with 10 CFR 835 for remedial investigations at the Paducah Gaseous Diffusion Plant; writing and implementing site characterization and remediation plans per MARSSIM and NUREG-5849 for the SM1 Reactor Site in Fort Greely, AK; Hoechst-Marion-Roussel Pharmaceutical Research Center in Cincinatt, OH; TRW depleted uranium test firing range in Port Clinton, OH; Phillips Research Centerin Barlesville, OK; Iowa State University in Ames IA; and Navy Training Station, Libertyville, IL. He also prepared the technical analysis in support of disposing the Trojan Nuclear Plant irradiated core hardware in an integrated package with the Reactor Vessel and prepared a Transportation Emergency Response Plan for CSX Transportation in support of waste shipments from Fernald to Envirocare of Utah.

Mr. Palmer established the Chase Environmental Group Knoxville, TN office and hired operating and professional staff. This included developing and implementign bsiness plans, obtaining business permits and licenses, and, preparing proposals, bids and contract documents.

U.S. ECOLOGY, INC.
Director, Technical Support Services / Health Physics Manager / Corporate Radiological Safety Officer
June 1991 - September 1996

Mr. Palmer was responsible for radiological controls, environmental monitoring, and licensing & compliance programs for the low-level radioactive waste disposal sites in Beatty, NV, Richland, WA, and Sheffield, IL and the radioactive waste processing facility in Oak Ridge, TN. His work has included facility license application development, administration, and renewal; performing dose assessments for waste disposal practices; assisting customers with waste characterization; and maintaining regulatory interfaces. This work has involved preparation of submittals under RCRA, NEPA, and NESHAPS using a variety of codes such as MICROSHIELD, COMPLY and RESRAD. He has also developed the regulatory basis for several innovative approaches for waste disposal including large nuclear reactor components and unrestricted release of materials.

GPU NUCLEAR - THREE MILE ISLAND
Radiological Field Operations Manager / Radiological Controls Engineer / Technician
June 1980 - August 1987
Over an 11 year period Mr. Palmer held a series of positions of steadily increasing responsibility in the

GPU Nuclear Radiological Controls program. These included responsibility for the operation of power plant field health physics organization including a staff of up to 70. His activities included organizing the Field Operations department during TMI-1 restart, developing and implementing special radiological programs for steam generator repair, containment building entries at power, and radioactive waste processing. His responsibilities also included maintaining emergency preparedness and counting room management.

U.S. NAVY NUCLEAR POWER PROGRAM
Engineering Laboratory Technician
June 1974 - May 1978

Mr. Palmer served as an Engineering Laboratory Technician onboard a nuclear powered submarine and as a radiation control monitor onboard a submarine repair ship. His duties included maintenance of power plant primary and secondary chemistry programs as well as radiological controls during reactor system repair and operation.

EDUCATION AND ASSOCIATED TRAINING

Machinist Mate "A" School, U.S. Navy	
Nuclear Power School/Prototype, U.S. Navy	
Engineering Laboratory Technician School, U.S. Navy	
B.S. Physics, Lebanon Valley College,	1987
M.B.A., Pennsylvania State University	1991
Radioactive Material Classification and Shipping	
Advanced Radiological health Physics, University of Lowell	
Human Performance Evaluation System, INPO	
Certification Review for Health Physicists, University of Lowell	
Canberra HPGE/GeLi Counting System Operations and Management	
Control of Occupational Exposures in Nuclear Power Plants, Harvard	
National Registry of Radiation Protection Technologists	1982
American Board of Health Physics, Comprehensive Certification	1989
Recertification	1993, 1997

SUMMARY

Mr. Young has eighteen years of experience in the related fields of health physics, industrial hygiene, and safety. His primary experience involves all phases of project development, management of radiological characterization and decontamination & decommissioning projects, and the development of the field services business.

EXPERIENCE

ALLIED TECHNOLOGY GROUP, INC.
Senior Project Manager
July 1996 - Present

Staff senior project manager responsible for the successful lead development, technical proposal concept and cost derivation, and effective execution of awarded contracts in both the commercial and government decontamination and decommissioning arenas. Also responsible for comprehensive project planning, including the development of the project Work Plan and HASP. Serves as the start-up project manager and RSO/H&S Officer as necessary, and ensures the technical adequacy and effective management through completion and final reporting. Experiences include:

Lead Development, Formation of Technical Team, Proposal Author & Key Presenter for Creation of New Service Line of On-site Treatment of Incident Related Material (K061 + Cs-137) for the Steel Industry;
Proposal Author and Project Manager for the HEPA Courtyard Radiological Characterization for Westinghouse Spartanburg Service Center;
Proposal Author and Technical Lead for the Surplus Material Sort / Survey Project at theTower Shielding Facility for LMES, ORNL;
Proposal Author and Technical Lead on the Characterization and Site Remediation for Findlay Properties, Ann Arbor, MI;
Lead Developer and Proposal Author for NORM Waste Removal Project, J.M. Huber Corp., Macon, GA;
Developer and Project Manager for Mixed Waste (K061/Cs-137) Repackage and Transportation Effort at Auburn Steel, Auburn, NY, for Zhagrus Environmental, Inc. / Envirocare;
Project Manager for NORM Consulting to the China Clay Producers Association, Georgia;
Project Manager for 11e.(2) Material (FUSRAP) Removal and Interim Site Storage Cell Construction for GIFREHC Property, 9150 Latty Avenue, St. Louis, MO.

NES, INC.
Section Manager
March 1995- July 1996

Manager of local satellite office which supplements corporate NES decontamination and decommissioning (D&D) endeavors. Responsible for business development in both the government and commercial arenas, emphasizing turnkey D&D and site radiological characterization service lines. Additional responsibilities include: Tracking potential project leads and attending site pre-bid tours; Authoring both the technical and cost proposals; Staffing key project specific positions; Serving as start-up Project Manager and/or technical director; Ensuring that the project direction is consistent with the client/contracted scope of work, corporate NES policies on radiological control, Quality Assurance, Health & Safety, and applicable site specific regulations; Preparation and presentation of project reports; and, review and approval of client invoices. Experiences included:

Served as the on-site Project Manager and Health & Safety Officer during the Decommissioning

and Removal of 8 Sanitary Package Treatment Facilities for Bechtel Savannah River, Inc., Aiken, SC;
Served as the Risk Assessment Team Leader and Radiological Specialist for the Retired Facilities Risk Assessment - Annual Update for Bechtel Hanford, Inc., Richland, WA;
Radiological characterization and removal of affected subsurface drain lines during D&D of GE Chemical Plant, Cleveland, Ohio.

AMERICAN ECOLOGY RECYCLE CENTER
D&D Field Services Manager
September 1994 - March 1995

Responsible for development of the radiological characterization and remediation services business to compliment existing waste processing and disposal product lines within the corporation. Responsibilities include: Tracking potential project leads, performing site prebid tours, and authoring both the technical and cost proposals; Staffing technical and labor project specific positions from in-house and/or contract vendors as required; Providing initial on-site technical support and serving as the project manager for maintaining the correctness of direction and cost tracking; Ensuring the development and implementation of site health and safety plans, radiological characterization schemes, and appropriate procedures; Preparation and presentation of project reports; and, review and approval of client invoices.
Experiences included:

Development of combined radiological characterization/remediation plan for Frome Investment Co., Detroit, MI;
Site investigation, remediation plan development, and NORM packaging, shipment, and disposal for Worthington Steel Company, Monroe, OH;
Development of decontamination and decommissioning plan for Philips Elmet Corporation, Lewiston, ME;
NORM removal, packaging, shipping, disposal, and site verification for Aviation Concepts, Sunrise, FL;
Affected subsurface drain-line removal and packaging for off-site treatment and disposal (mixed: characteristic/Haz +LLRW) for AT&T, Clark, NJ.

QUADREX RECYCLE CENTER
Senior Project Manager, Assessment
October 1991 - August 1994

Responsible for the management and overall technical direction of the radiological assessment process supporting field decontamination and decommissioning projects. Responsibilities include: Assuring the technical adequacy and correctness of the development of the client's source term, sampling and measurement program to evaluate the source term, and general radiological support activities for ongoing field D&D activities; Managing technical personnel assigned to field radiological surveillance activities; Development of proposals for field D&D projects including preparation of sampling/analysis plans and cost estimates for those activities; and, preparation and presentation of project reports summarizing radiological assessment activities. Experiences included:

Technical oversight for $2M D&D project, including radiological and mixed-waste characterization, material segregation, treatment and disposal options, procedure development, and final report writing, Eastman-Kodak, Rochester, NY;
Site visit, successful proposal writing, procedure development, staffing, project tracking, and report writing for the radiological characterization of Sterling Winthrop Pharmaceuticals, Rensselaer, NY;

Principal for all phases of emergency response-type decontamination project for EPA laboratory (Ni-63), Athens, GA;
Site visit, cost estimating, successful proposal writing, and technical oversight for $.25M reactor room decontamination and decommissioning, University of Texas, Austin, TX;
Interim Radiation Safety Officer for Quadrex Recycle Center, Oak Ridge, TN;
Proposal writer, project manager, and technical director for the radiological characterization and decommissioning of laboratory 1036, Fisons Pharmaceutical, Rochester, NY;
Project manager and technical director on the license termination effort for Sterling Winthrop Pharmaceuticals, Rensselaer, NY;
Proposal writer, project manager, and report author for the radiological investigation of an occupied five-story building, subcontracted to Civil & Environmental Consultants, Inc. (CEC), Pittsburgh, PA;
Project manager and technical director for decontamination and release of a steel mill which had inadvertently melted a Cs-137 source, Austeel Lemont, IL.

SEG, INC.
Project Manager
July 1989 - August 1991

Project manager for SEG on the Bloomfield decommissioning project, Westinghouse Electric Corp., Bloomfield, N.J. Responsible for all aspects of project management for the initial twenty-five months ($7.4M) including: scheduling/planning, technical review (health physics/industrial hygiene), client interface, reporting, cost tracking, and staffing. Supervised crew of nineteen, plus provided technical support to subcontractors at the multihazard site, which included: Uranium, thorium, radium, cross-contaminated asbestos; and, mixed-waste as PCB/thorium contaminated oil, mercury/thorium contaminated soil. Experiences included:
Project manager/HP/IH on the multifaceted and complicated task;
HP/IH/Engineer during recharacterization, designing, and implementation of the decontamination plan for a variety of site challenges, including a 60' incinerator stack, 5-story elevator shaft, and a RR spur;
HP and shipper of 53 loads of LSA waste, including 8500 CF of cross-contaminated ACM; and,
Primary investigator in resolving the mixed-waste problems on-site.

IT CORPORATION
Health Physicist
June 1985 - July 1989

Responsible for managing decontamination projects including the design and implementation of radiological safety procedures, and coordination of activities toward the effective unconditional release of client sites. Responsibilities included: Designing and reviewing radiological safety procedures for company operation and client field activities; Coordinating decontamination activities and interfacing with regulatory bodies and client; Reviewing proposed contracts for adequate health and safety practices; Working as a field site Health Physicist and/or site Health and Safety Coordinator; and, Authored and served as the Radiation Safety Officer (RSO) on Tennessee and Texas Radioactive Material Licenses and responsible for all regulatory concerns. Experiences included:
HP during D&D at a major pharmaceutical company, Philadelphia,PA
IH during removal of radiologically contaminated asbestos at the Shippingport Station Decommissioning Project (SSDP), Shippingport, PA
HP/IH during decontamination of NORM on barges, pumping the material back down-hole for

Chevron, Venice, LA
HP/IH (RSO) during demonstration for DOE on the use of thermal desorption for treating (separating) Uranium and PCBs in soil, Oak Ridge, TN
HP during D&D of TRU hot cells and facility for Monsanto, Dayton, OH
Project Manager on multiple sites of failed 3M Co. static eliminators (Po-210) including Puerto Rico, Houston, Boston, Pasadena, Miami, and Buffalo
Project Manager/HP on D&D and license termination of three in-house TN licensed nuclear facilities.

APPLIED SCIENCE LABORATORY
Health Physicist
June 1984 - June 1985

Responsible for management of nuclear facility decommissioning and review of routine radiological safety procedures. Responsibilities included: Performing preliminary site reviews with federal and state officials; Designing decommissioning plans and coordinating site decontamination efforts; Developing procedures to ensure compliance with applicable regulations; and, Performing release surveys and reporting findings.

Experiences included being the sole D&D team in the decommissioning of:
Gulf Nuclear, Signal Hill, CA, Ir-192/Cs-137 Source Fabrication / Hot Cell Facility
Gamma Industries, Port Norris,NJ, Co-60 Source Fabrication / Hot Cell Facility and Grounds
Gamma Industries, Houston,TX, Cs-137/AmBe/Ir-192/Co-60 Source Fabrication / Glove Box Facility

QUADREX CORPORATION
Senior Health Physics Technician
December 1982 - June 1984

Responsible for management of the radiological health program at a nuclear recycle center (initially, only HP on-site and license). Responsibilities included:
Supervising and training health physics technicians in all phases of radiation protection
Implementing health physics quality assurance program
Maintaining state and federal compliance with effluent release criteria
Monitoring personnel exposure
Performing routine and special surveys.

OAK RIDGE ASSOCIATED UNIVERSITIES
Safety Technician
November 1981 - November 1982

Responsible for protection of employees in the areas of health physics, industrial hygiene, and industrial safety. Responsibilities included:
Performing routine and special surveys (radiation, chemical, electrical, and industrial hygiene);
Report area activities and correlating report results to safety office and personnel who were responsible for areas surveyed;
Providing assistance and instruction on radiation and the use of radioactive materials;
Calibrating radiation detection and measuring instruments;
Decontaminating areas and equipment; and,

Was a member of the Health Physics Response Team of Radiation Emergency Assistance Center/Training Site (REAC/TS).

OAK RIDGE ASSOCIATED UNIVERSITIES
Health Physics Technician
August 1980 - November 1981

Responsible for conducting environmental surveys, sponsored by the NRC and DOE, on former Manhattan Project sites. Responsibilities included:

Calibrating and operating a variety of radiation detection and counting equipment to monitor environmental radiation levels in different types of materials, processes, and facilities; Collecting environmental samples and conducting radiological assays; Analyzing data; and, Comparing converted data to established standards to note significant trends and deviations.

EDUCATION & ASSOCIATED TRAINING

M.S.,Occupational Health and Safety, University of Tennessee, Knoxville,Tennessee; 1983
B.S., Biology, East Tennessee State University, Johnson City, Tennessee; 1978
Graduate, Coastal School of Deep Sea Diving, Oakland, California; 1979
Hazardous Waste Operations Training, 40-Hour; Phoenix Safety Associates; 1990
Hazardous Waste Operations Supervisor Training, 8-Hour; RSCC, 1990; G&S Safety 7/92
Hazardous Waste Operations,8-Hour Refresher Training; ATG, 12/97
RCRA,CERCLA,SARA,NEPA, 24-Hour Overview; RSCC; 5/91
Environmental Monitoring, 40-Hours; O.R.A.U.; 9/92
Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), 8-Hour Overview; SEC; 5/98
Rad Worker II Training, Hanford, August, 1995; ORNL, November, 1997
American Red Cross First-Aid & CPR, Current Certification, 9/98
General Employee Training (GET) for Badging, Savannah River Site, December, 1995
GET, GEAT at ORNL; Currently Badged (9/98)
National Health Physics Society
HP Society, East Tennessee Chapter
International Society for Decontamination and Decommissioning Professionals
American Nuclear Society

ATG, INC.

ABERDEEN PROVING GROUND

Aberdeen, Maryland

EXCAVATION AND DISPOSAL OF RADIOACTIVE MATERIALS AND CONTAMINATED SOILS

TRANSONIC RANGE AND ASSOCIATED STRUCTURES

QUALITY ASSURANCE PLAN

Revision 0

September 1999

Allied Technology Group, Inc.
669 Emory Valley Road
Oak Ridge, Tennessee 37830

ALLIED TECHNOLOGY GROUP, INC.

ABERDEEN PROVING GROUNDS
TRANSONIC RANGE AND ASSOCIATED STRUCTURES

QUALITY ASSURANCE PLAN

APPROVAL PAGE

September 1999

Concurrence:
Frank Whitaker, Project Manager Date

Concurrence:
_ Joel Cehn, Project QA Manager Date

Approval:
Mike Styvaert, IOC Health Physicist Date

ABERDEEN PROVING GROUND TRANSONIC RANGE AND ASSOCIATED STRUCTURES
QUALITY ASSURANCE PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

Allied Technology Group (ATG) has been contracted by Industrial Operations Command (IOC) Radioactive Waste Disposal Office, Rock Island, IL, for the remediation of depleted uranium contaminated soils at the Aberdeen Proving Ground (APG) Transonic Range in Aberdeen, Maryland. As a supporting part of the overall work plan for the project, this Project Quality Assurance Plan has been integrated into the Project Decommissioning Work Plan to provide the necessary controls to successfully complete the contract requirements.

1.2 Project Scope and Objectives

The Project Decommissioning Work Plan has been developed to meet the applicable regulations and requirements and to assure compliance with the regulations and requirements of the Remediation Work Plan, Specifications for the Decommissioning Plan, and the Project Health and Safety Plan.

The Project Decommissioning Work Plan is a compliation of the Remediation Work Plan, Specifications for the Decommissioning Plan, the UXO Aviodance Plan, Health and Safety Plan , and this document, the Project Quality Assurance Plan.

Management and supervisory personnel will be on site to provide instruction and guidance to project personnel in the implementation of this plan.

2.0 QUALITY ASSURANCE PROGRAM

2.1 Project Quality Assurance Plan

The Project Quality Assurance Plan is committed to ensuring that all activities to be performed during this decommissioning project which affect quality are prescribed by and performed in accordance with procedural requirements. The Project Quality Assurance Plan is implemented for the activities specified in the Decommissioning Work Plan, APG Transonic Range Project. The Project Quality Assurance Plan highlights project specific aspects of the applicable quality assurance elements. The specific quality assurance tasks are defined in the plan.

2.2 Quality Assurance Training

The ATG Project Manager or designated alternate will perform the initial quality assurance training of all project personnel at the start of the project.

If additional personnel are added to the project, they will receive quality assurance training prior to participation in the project activities. Quality assurance training will consist of a review and discussion of the Decommissioning Work Plan and supporting documents which shall include ATG's Field Operating Procedures and any additional procedures referenced in the Decommissioning Work Plan, Health and Safety Plan and the Quality Assurance Plan. Special emphasis will be placed on documentation of work, quality control checks, equipment performance, identification and control of radioactive material and safety procedures.

Each participant shall acknowledge that he/she has received training and that he/she understands the quality assurance requirements relevant to the project by signing and dating the Training Record, ATG Form 027.

2.3 Technical Training and Personnel Qualifications

Allied Technology Group management will review written statements of qualification and resumes with reference to the position descriptions as defined in the Decommissioning Work Plan, Section 2.5, Organization Chart, Position Descriptions and ATG Personnel Resumes", to establish personnel capabilities and qualification to perform the assigned task.

The ATG Project Manager or designated alternate shall review all personnel qualifications and determine the type of training or experience required to ensure that an individual is qualified to perform the work. This review will be documented on the Review of Personnel Qualification, ATG Form 103. If comparison of personnel qualification, including education, experience, and training do not fulfill the requirements of the position description to meet project needs, appropriate training including "read and study" and "on-the-job" training will be performed or other appropriately qualified individuals will be assigned to perform the task.

Personnel records shall be maintained in the quality assurance record file and shall include; a record of the initial qualifications, documentation of review by the ATG Project Manager or designated alternate and acceptance of current qualifications or the need for additional training and a record of the completion of training. Project management shall monitor the performance of individuals involved in activities affecting quality and shall determine if there is a need for retraining or replacement. Retraining or replacement of individuals will be initiated immediately upon identification of the need for such actions. The following guidelines shall be used to determine the proficiency and ability of the workers assigned to this project:

2.3.1 Qualification Requirements:

2.3.1.1 Physically capable of performing the work tasks.

2.3.1.2 Demonstrated capability to perform the specific function in accordance with approved procedures.

2.3.1.3 Familiarity with technical aspects of the equipment and procedures, and capability to verify that the equipment is in proper working condition.

2.3.2 Capability Demonstration:

2.3.2.1 The ATG Project Manager or designated alternate shall determine the type of training or experience required to determine if personnel are qualified to perform the specific tasks.

2.3.2.2 The individual workers shall review the approved Decommissioning Work Plan.

2.3.2.3 The individual workers shall demonstrate their understanding of the Decommissioning Work Plan.

2.3.3 Support Personnel

2.3.3.1 Minimum personnel will be used to support the cleanup.

2.3.3.2 All support personnel at the Aberdeen Proving Ground project will be trained on the Applicable hazards on which they are working. This training shall be documented on Training Record ATG Form 027.

2.3.3.3 All support personnel involved in the cleanup activities shall be monitored for exposure and a bioassay analysis performed at the beginning and the completion of work.

2.3.3.4 All support personnel involved in the cleanup activities shall be under the direct surveillance of ATG Radiation Protection Personnel while performing work.

3.0 ORGANIZATION

The Project Quality Assurance Plan oversight will be performed by Headquarters, Industrial Operations Command as the licensee. ATG's Quality Assurance Manager will report independently of the On-Site Project Management. Industrial Operations Command will perform unannounced inspections to include a review of ATG QA/QC procedures and their implementation on site during the decommissioning activities.

The QA Manager is responsible for assuring that the Project Quality Assurance Plan is implemented and is adhered to on site. All project records and documents will be submitted to the QA Manager for final approval.

The ATG Project Manager reports to the QA Manager and will act as an on site quality auditor. The on site audit reports and records will be submitted to the QA Manager. Quality items that will impact the performance of the contract will be immediately submitted to IOC. Copies of all reports, records or correspondence will be maintained on site for review by the ATG Project Manager.

4.0 CONTROL OF DATA

4.1 Planning

The work tasks necessary to complete this contract will be performed in a planned, systematic manner. To assure adequate project planning, the Decommissioning Work Plan will be approved prior to the start of work. The Decommissioning Work Plan will specify the required data collection and records to verify that the contract commitments have been met.

4.2 Data Collection

Data collection will be performed by the individual performing the tasks or their supervisor. Data collection will be performed in accordance with the Decommissioning Work Plan and all pertinent sections of this document.

4.3 Documentation

Data collection shall be fully documented on the appropriate data records and daily project logs. All records shall be as complete and thorough as possible. All hand written entries on documents and the like will be legible and in dark ink. Personnel making a change to a record shall cross out the old entry with one line, add the new information and initial and date the change. Under no circumstances shall the old entry be scratched out, whited out, erased or otherwise removed or made illegible. When applicable, an explanation should accompany the change or correction.

4.4 Quality Control Checks

All data shall be reviewed and checked by a technically qualified person such as the Corporate Health Physicist, the ATG Project Manager or the ATG Project Supervisor. The ATG Project Supervisor reports to the ATG Project Manager and is responsible for the implementation of on-site field activities. If the ATG Project Manager or ATG Project Supervisor does the Quality Control check, then he/she shall not review their own work. These checks shall be made to ensure that both the technical, operational and quality assurance requirements have been met.

The following guidelines will be used to perform the quality control checks:

4.4.1 Verify that the record contains;

4.4.1.1 The project name or task description

4.4.1.2 Name or initials of the performer

4.4.1.3 Date of performance

4.4.1.4 Page number if pertinent.

4.4.2 And, if pertinent, that the record has;

4.4.2.1 Conformed with the appropriate procedures

4.4.2.2 Instrument calibration data (instrument identification, calibration date, certificate of calibration, etc.) of survey instruments used is current and up to date.

4.4.2.3 Completeness and adequacy of the performance of all activities and thorough documentation is presented.

4.4.2.4 Accuracy of material documented.

If the material being checked conforms to the guidelines, the individual performing the quality control check shall sign and date the record. If the material is rejected, it shall be handled in one of two ways:

4.4.3 Discuss and correct minor deviations with responsible personnel resulting in subsequent acceptance or, (step 4.4.4)

4.4.4 Initiate corrective action procedures in the form of a Nonconformance Report, Form ATGF-108.

4.5 Management Review

The ATG Project Manager or designated alternate shall review all data records prior to submitting them to the QA Manager. The same steps shall be taken with the review that are taken with the quality control checks.

5.0 PROCUREMENT DOCUMENT CONTROL

Procurement or acquisition of project supplies, protective clothing, safety equipment and radiological survey equipment, etc. may be needed to perform the work tasks. The procurement documents and packing lists will be reviewed upon receipt by the ATG Project Manager or designated alternate to verify that appropriate quality assurance and technical requirements have been met. These records will be maintained with the other project records.

6.0 DECOMMISSIONING WORK PLAN

The Decommissioning Work Plan for the activities at APG and the associated supporting documents shall be reviewed and approved by Allied Technology Group management, IOC, and the Nuclear Regulatory Commission.

The Decommissioning Work Plan will have systematically numbered steps and pages, a cover page and an approval page. Distribution of copies to pertinent personnel will be accordance with Section 7, Document Control.

If revisions to the Decommissioning Work Plan are required during the performance of the project, the licensee shall submit any major changes to the decommissioning plan to the NRC for approval. Minor plan revisions or minor field changes that do not affect the quality of work, objectives, or cause a potential health and safety impact will not require submittal to the NRC for approval. Major changes include revisions that would result in an unreviewed safety question or a change in a license condition. In accordance with Administrative Procedure AROP No. 102, 'Revisions to the Operational Procedures' and the use of Form 104, 'Project Work Plan Change Request', the licensee's Project Manager or designated alternate will review all proposed changes to determine if the change is significant. All changes will be documented and highlighted by change bars in the right margins of the text.

7.0 DOCUMENT CONTROL

The Decommissioning Work Plan and associated supporting documents shall be issued as a controlled document to assure that the current approved revision is in use. Controlled copies of these documents will be issued to project personnel by the ATG Project Manager or designated alternate who will maintain a distribution list of the controlled copies. Personnel assigned controlled documents will be required to acknowledge receipt of the document and all subsequent revisions to the document.

A document Distribution Record, ATG Form 105, shall be maintained to assure that current documents are distributed. When issuing a current document or document revision, a Document Transmittal Record, ATG Form 106 shall be submitted to the recipient. This record will demonstrate that current documents have been issued and are in use. The transmittal record shall be acknowledged and returned to the Director.

The recipient of the controlled document shall return the document to the Director when the requirements for it's use ends. Upon return of the controlled document, the Director shall enter the date of return on the Document Distribution Record.

8.0 INSPECTIONS

All quality-affecting work activities datum shall be reviewed and checked by an independent Quality Assurance person, per Section 4.4, Quality Control Checks, to verify that they meet project requirements. For radiological measurements, quality control inspections will be performed by randomly verifying survey techniques and survey meter results.

The ATG Project Manager or designated alternate will be responsible for completing the Daily Quality Control Checklist, ATG Form 107. The checklist is designed to account for Decommissioning Work Plan activities that pertain to project tasks and radiation protection concerns.

Unsatisfactory items will be immediately rectified to bring the item to a satisfactory condition. The checklist is to be completed at the end of each shift for that day's activities.

9.0 CONTROL OF MEASURING AND TEST EQUIPMENT

Measuring and test equipment shall be controlled and properly maintained to assure that the indicated results are accurate. Measuring and test equipment will not be used for any other purpose than the purpose the manufacturer intended. The equipment shall be stored, when not in use, in a controlled area so that environmental or physical damage does not occur. Only personnel qualified to use the equipment will be allowed to perform work with the equipment.

Measuring and test equipment that do not perform properly or do not provide good, reproducible results shall be taken out of service. The equipment shall be tagged with an "out of service" tag and removed from the normal equipment storage area.

9.1 Calibration

Radiological survey instrumentation will be supplied from the ATG Oak Ridge Technical Support Office. All instrumentation used by ATG, Inc. are calibrated by a certified calibration facility at a minimum frequency of 12 months.

Copies of the primary calibration certificates will be sent with the meters to the job site. In addition, survey meters have an attached calibration sticker that indicated the calibration date and the calibration due date. Radiation survey instrumentation performance testing and maintenance will be performed in accordance with the Radiation Survey Procedure.

10.0 HANDLING, STORAGE AND SHIPPING

All radioactive material will be packaged, handled and stored according to the appropriate health and safety procedures. Packaging contaminated soil shall conform to the procedures detailed in the Decommissioning Work Plan. Packages shall meet the Department of Transportation (DOT) regulations and burial site requirements. Shipping shall meet all applicable DOT, State and Low Level Radioactive Waste Compact Commission regulations or the approved burial or disposal site criteria.

The shipment will be manifested using the appropriate disposal site Waste Shipment Manifest and continuation pages. The ATG Project Manager (or designated ATG Senior Broker) shall inspect and sign off the shipping manifests.

11.0 CONTROL ON NONCONFORMANCE ITEMS

Procedures have been established and documented to control equipment and activities that do not conform to work plan requirements or whose quality does not meet the intended use. Nonconforming items, including reviewed data, shall be identified, documented, segregated or disposed of as appropriate. Nonconformance includes noncompliance with the technical procedures, contract documents or errors in documented analyses or results. Nonconformance reports shall be prepared, including a description of the nonconformance and the proposed corrective action or disposition such as to accept, reject, repair or rework. Nonconforming items or data shall be marked as nonconforming and shall not be used in any further activity until corrective action has been satisfactorily completed or an acceptable disposition approved by the ATG Project QA Mangaer.

Persons determining corrective action or disposition shall have demonstrated competence, have an adequate understanding of the requirement, and have access to pertinent background information. Proposed corrective action or disposition and completion of corrective action shall be reviewed and approved in accordance with Section 12.0, Corrective Action.

11.1 Identification and Reporting of Non-conformances

A nonconformance exists if there is a deviation from or noncompliance with the Decommissioning Work Plan or contract specifications. Non-conformances also include major errors in documented analysis, data or results and deficiencies in documentation or any other aspect of the project that affects quality. Personnel who identify a nonconformance shall report the condition by,

11.1.1 Completing Part A of the Nonconformance Report, ATG Form 108,

11.1.2 Request a nonconformance number from the ATG Project Manager or designated alternate,

11.1.3 Distribute the nonconformance report to IOC, the ATG Project Manager or designated alternate, and the ATG Project QA Manager.

11.1.4 Notification of all non-conformances and copies of all Nonconformance Reports will be provided to the IOC Health Physicist/Project Manager and the responsible NRC Representative.

11.2 Evaluation of Nonconformance Reports

IOC and the ATG Project QA Manager will review the nonconformance report to determine if any of the following conditions exist and document the findings by completing Part B of the Nonconformance Report.

11.2.1 IOC may elect to evaluate the nonconformance item with the ATG Project Manager or designated alternate, and ATG Project QA Manager to determine if the nonconformance item could invalidate the results of ongoing work. If the nonconformance(s) incident in any way affects the health of workers and/or the environment, it shall be reported to all appropriate facility personnel. If work is stopped, it shall be so noted on the nonconformance report. All affected work shall be immediately stopped and the Project QA Director notified. Work shall not be restarted until corrective action is approved and work authorized to restart by IOC.

11.2.2 If the nonconformance constitutes a significant condition adverse to quality, determine the cause of the condition. Examples of significant conditions adverse to quality include significant failures to implement the Decommissioning Work Plan or major errors in data or analysis which had previously been approved.

11.2.3 If the nonconformance has any impact on previously obtained data or reports submitted to the Aberdeen Proving Ground Representative, or the IOC representative, the ATG Project Manager or designated alternate shall note the impact in the remarks section of the nonconformance report and notify in writing all individuals and organizations that may be affected by the nonconformance and resulting data.

11.3 Tracking Nonconformance Reports

The Project QA Director shall monitor nonconformance reports to determine if trends adverse to quality are developing. If such trends are developing, such as, repetitive reports related to a particular activity, a written report will be submitted to all project personnel identifying the particular problem. The Director will evaluate the identified problem and propose and implement a written corrective action program to prevent recurrence of the nonconformance.

12.0 CORRECTIVE ACTION

Corrective action for conditions adverse to quality will be determined and implemented in a timely manner. Conditions adverse to quality are any of the following: failures, malfunctions, deficiencies, defective items and non-conformances. A significant condition adverse to quality is one which, if uncorrected, could have a serious effect on safety, operability or validity of data. The cause of the condition will be determined and action taken to preclude the recurrence of the nonconformance item. IOC shall verify that the corrective action has been implemented and, if necessary, that the Decommissioning Work Plan has been revised.

12.1 Recommendation of Corrective Action

The project personnel that recommend the corrective action will document the recommendation on Part C of the Nonconformance Report. In the case of a nonconformance which is a significant condition adverse to quality, the corrective action shall be such as to preclude recurrence of the non-conformance. The recommended corrective action will be reviewed and approved by IOC.

12.2 Corrective Action Implementation and Verification

The approved corrective action shall be implemented by the appropriate project personnel. When implementation is verified by IOC, the ATG Project QA Manager, and the ATG Project Manager, Part D of the Nonconformance Report will be completed. The completed nonconformance report will be maintained on site with the nonconformance record log in the project file.

13.0 QUALITY ASSURANCE RECORDS

A quality assurance records system for the project will be implemented and maintained. Records shall be in ink, legible, identifiable and retrievable. The quality assurance records will be sufficiently detailed to properly reflect all work activities in the performance of this contract.

These records may be in the form of data sheets, notes, graphs, comments, computations and other graphic or written data generated in connection with the work activities. Records will be considered valid only if the individual completing the record has initialed or signed and dated the record. If revisions or changes to the quality assurance records are required, the changes will be made to the original records by crossing out the old entry with one line, adding the new information and initialing and dating the change.

The ATG Project Manager or designated alternate will be responsible for maintaining and protecting the records. The records will be maintained on site with the project files. File access will be limited to project personnel and authorized contract personnel. At the completion of the project, the ATG Project Manager or designated alternate will submit all project QA records to the QA Director. A copy of all project documents will be provided with the Final Report to the Aberdeen Proving Ground Representative, IOC Health Physicist/Project Manager, and IOC Contracting Officer, Mr. Robert Matthys.

14.0 QUALITY ASSURANCE AUDITS

No formal quality assurance audits are planned for this activity. A quality assurance audit may be performed if the Director deems necessary. Quality Assurance records will be evaluated and audited by the Director at the end of the project.

15.0 REFERENCES

15.1 U.S. Code of Federal Regulations, Title 10, "Energy", Part 19 and Part 20.

15.2 U.S. Code of Federal Regulations, Title 29, "Labor", Part 120.

15.3 U.S. Code of Federal Regulations, Title 40, "Protection of the Environment".

15.4 NRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors".

15.5 NUREG/CR 2082 "Monitoring for Compliance with Decommissioning Termination Survey Criteria".

15.6 NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination", Draft June 1992.

15.7 NUREG/CR 5512, "Residual Contamination from Decommissioning".

15.8 NRC Decommissioning and Regulatory Issue Branch Technical Position, "A Summary of NRC & Interim Radiological Cleanup Criteria and Current Dose Bases" (November 1992).

15.9 U.S. Nuclear Regulatory Commission Division of Industrial and Medical Safety, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material (August 1987)".

15.10 Allied Technology Group "Health and Safety Plan for Aberdeen Proving Ground Remediation Transonic Range and Associated Structures".

15.11 Allied Technology Group "Decommissioning Work Plan for Aberdeen Proving Ground Remediation Transonic Range and Associated Structures".

16.0 FORMS

16.1	ATGF-027	Training Attendance Record
16.2	ATGF-103	Review of Personnel Qualifications
16.3	ATGF-104	Project Work Plan Change Request
16.4	ATGF-105	Document Distribution Record
16.5	ATGF-106	Document Transmittal Record
16.6	ATGF-107	Daily Quality Control Checklist
16.7	ATGF-108	Non-Conformance Report

Aberdeen Proving Ground
Aberdeen, Maryland

DECONTAMINATION AND DECOMMISSIONING OF DEPLETED URANIUM CONTAMINATED MATERIALS AND SOILS

Transonic Firing Range

HEALTH AND SAFETY PLAN

March 1, 2000

Allied Technology Group, Inc.
669 Emory Valley Road
Oak Ridge, TN 37830

Allied Technology Group, Inc.

DECONTAMINATION AND DECOMMISSIONING
of
DEPLETED URANIUM CONTAINING MATERIALS AND SOILS

ABERDEEN PROVING GROUNDS

TRANSONIC FIRING RANGE

HEALTH AND SAFETY PLAN
APPROVAL PAGE

March 1, 2000

Concurrence: ______________________________ Date:
Lee Young, ATG Project Manager

Concurrence: ______________________________ Date:
S. W. Leffew, ATG Health & Safety Representative

Concurrence: ______________________________ Date:
Joel Cehn, ATG QA Manager

Recommended
For Approval: ______________________________ Date:
Mike Styvaert, IOC Health Physicist

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1.0 INTRODUCTION

The Project Health and Safety Plan incorporates the health and safety procedures and practices to be followed during the activities specified in the Project Detailed Work Plan for Aberdeen Proving Grounds at Aberdeen, Maryland. This Project Health and Safety Plan will be used to support the work activities and will be verified with the guidelines specified in the Allied Technology Group, Inc. (ATG) Corporate Health and Safety Plan. The Project Health and Safety Plan includes radiological, industrial, environmental, and biological health and safety concerns.

ATG is committed to follow the procedural practices detailed in ATG Field Procedures, AD-0004, "Administrative/Regulatory/ALARA Compliance - Policy & Procedure" and AROP 106, "ALARA Guidelines" to ensure ALARA policies and practices are enacted and followed during all decommissioning activities to be conducted at APG thereby ensuring all dose received is maintained as low as reasonably achievable.

2.0 SCOPE OF WORK

Sample collection, monitoring, and work with all radioactive materials will be performed following the guidelines specified in the Project Detailed Work Plan by ATG personnel. For the purpose of this contract, all contaminated material will be handled with radiological, and chemical contamination controls in place. This project involves mobilization, site set up, decontamination and decommissioning of the depleted uranium materials and surrounding areas, radiological surveys (dose rate and contamination readings), sample collection, packaging waste, shipment for burial, and decontamination and demobilization.

No adverse impacts are expected during the performance of this contract. There will be no expected air emissions, liquid releases, personnel exposures or environmental impacts during the removal, or the packaging and shipping of any contaminated material. Work tasks will be performed by trained and qualified personnel. Oversight and monitoring shall be performed by trained and qualified personnel in accordance with the Health and Safety Plan procedures.

3.0 HAZARD ASSESSMENT

Hazard assessment will be evaluated in six categories; unexploded ordnance, radiological hazards, industrial hazards, environmental hazards, bloodbornepathogens and lead hazards. Appropriate personnel protection equipment, monitoring devices and data acquisition will be applied for all hazards.

3.1 Unexploded Ordnance

It is not anticipated that unexploded ordnance will be encountered during work activities, but caution is appropriate. Before digging or excavating any areas on the range, the area(s) will be first cleared by base or ATG Explosive Ordnance Division (EOD) personnel.

3.2 Radiological Hazards

It is expected that an individual performing work on this project will receive an external occupational exposure of less than 24 millirem (mRem), as a conservative estimate (derived as: 12 hrs/day x 20 day x 0.1 mrem/hr). As part of the initial assessment of site conditions, surveys will be conducted and the above estimate will be revised using actual data. The isotopes that ATG expects to encounter during the performance of this work depleted uranium and associated daughter products, based upon previous characterization data from General Physics Corporation. ATG will be surveying and monitoring for broad spectrum analysis during the removal, shipping and disposal process.

The principal internal hazards from depleted uranium, U-238/Th-234, are renal chemical toxicity for soluble compounds and the radiation dose to the lung, bone and large intestines for insoluble uranium compounds. Therefore, personnel working with materials containing uranium require training in radiological control practices. This training will help to assure that the uranium does not become an internal hazard to the workers or to members of the general public. Breathing airborne uranium contaminated dusts will be the most likely method of uranium entering the body and becoming an internal hazard. The airborne concentration of U-238/Th-234 shall be maintained at or below 50% of the Derived Airborne Concentration (DAC) value. The derived airborne concentration for U-238/Th-234 (depleted uranium) is $2x10^{-11}\mu Ci/ml$. Thus the 50% value, which will be the action level for this project, will be $1x10^{-11}\mu Ci/ml$. Breathing the 50% DAC value for U-238/Th-234 (DU) or $1x10^{-11}\mu Ci/ml$ for approximately 120 hours involved in actual physical or airborne producing activities will result in an Annual Level of Intake of less than 1.2 Rem CEDE dose. Thus no organ specific dose calculations should be required in accordance with the guidance of EPA-520. Additional exposure to radiation will come from the reference sources used in performance tests of the radiation detection equipment and from the samples taken to assess the potential hazards. The reference sources, which may include Tc-99, Th-230, Co-60, and U-238/Th-234 will be used by the Radiation Protection Technician and will be maintained in a labeled and locked container. A Department of the Army Permit (DARP) for radioactive material, including check sources, will be obtained at least fifteen working days prior to the sources being brought on site. The DARP Application Form, DA 3777, will be obtained and submitted to the applicable Army Point of Contacts referenced in section 12.9, 'Other Key Personnel', of this procedure. Samples taken to monitor the potential hazards will be sealed and handled appropriately and in as short amount of time as possible. The Radiation Protection Technician will handle and analyze the samples.

3.3 Industrial Hazards

Industrial hazards for this project should be limited to mechanical failures, heavy loads, suspended loads, physical stress and extreme temperature exposure.

Lifting, suspending, moving and packaging of materials could cause wear and tear on the equipment or fatigue to the workers. Mechanical failure will be reduced by using equipment in near new condition and not over-loading the equipment. Equipment will need to be visually inspected prior to each use to reduce the potential for failure. Personnel safety equipment shall be required for field work on this project. Safety shoes, hard hats, and safety glasses will be required for personnel at the discretion of the Project Manager or designated alternate.

Physical stress could occur if an individual tries to lift items that are too heavy or oversized. Individual lifting limits will be 50 lbs. Items that are odd shaped or bulky will be lifted by more than one individual or by mechanical means.

Accidents will be handled on a case by case basis and will be evaluated by the Project Health and Safety Representative or designated alternate to determine if preventive measures can be applied to preclude the accident from recurring.

Complications from high temperature exposure, such as heat stress, will be handled with medical treatment as deemed necessary by the Project Health and Safety Representative or designated alternate.

3.4 Environmental Hazards

Hazards to the environment could most likely occur from abnormal weather, an accident, or from carelessness while performing the work tasks. Controlling the amount of unsealed material, at any given time, will reduce the extent of an environmental impact.

3.5 Bloodborne Pathogens

Bloodborne pathogens are microorganisms in human blood that can cause disease. Although health care workers have long worked with the threat of exposure to bloodborne pathogens, exposure was viewed in a different light once AIDS was recognized.

Because the virus that causes AIDS is said to always be fatal, there has been increased concern about bloodborne pathogens in the last 15 years. AIDS, however, is not the only source of concern; other diseases caused by micro-organisms include malaria, syphilis and hepatitis-B virus (HBV).

The purpose of this notice is to establish requirements with the intent to protect those employees who have a significant potential of exposure to Bloodborne Pathogens which may cause such disease's as Human Immunodeficiency Virus and Hepatitis-B Virus.

Key Definitions:

Bloodborne Pathogens: Microorganisms present in human blood that can cause disease in humans include, but are not limited to, Hepatitis-B virus (HBV) and Human Immunodeficiency virus (HIV).

Exposure Incidents: A specific eye, mouth, other mucous membrane, non-intact skin or penetrable contact with blood or other potentially infectious materials that results from performing required tasks.

Occupational Exposure: A reasonably anticipated skin, eye, mucous membrane or other penetrable contact with blood or other potentially infectious material that might result from performing required tasks.

Penetrable Contact: A Piercing of mucous membranes or the skin barrier by means of a needle stick, human bite, cut and/or abrasion.

Potentially Infectious Materials: Materials that might be present in a first-aid emergency, including blood, vomit, urine or other body fluids.

3.6 Lead

If the presence of lead is identified, specific measures will be taken for its characterization. The results will be used to upgrade existing protective measures and personnel monitoring. The principle hazard for lead as with any heavy metal, is renal chemical toxicity. Personnel exposure to lead contamination shall be controlled by wearing protective gloves and clothing while handling the material. Internal contamination may be possible through inhalation.

Lapel air samples will be taken for lead activity to monitor individual exposure during the course of remediation efforts where airborne activity could be generated. These lead breathing zone samples will be sent to a laboratory for analysis during the project.

Toxicity Characteristic Leaching Procedure (TCLP) samples will be performed on any waste material generated during remediation to identify the presence of lead in the soil.

3.7 Unknown Hazards

Should any unknown hazards be discovered during work activities at Aberdeen Proving Grounds (i.e, unmarked drums, discoloration in the soils, odorous soils,etc.) all work activities will be stopped. The Project Manager and/or Health and Safety Representative or designee(s) shall be notified immediately. Actions will be taken to stabalize the area, notify the appropriate personnel, contain the area and prevent any unauthorized personnel from entering the area (thus minmizing exposure and contact), until the nature of the hazard can be determined. Once an investigation of the situation is complete, modifications to the health and safety plan will be performed if deemed necessary and a recovery plan will be formulated.

4.0 WORKER PROTECTION

4.1 Personnel Protection

For worker protection, the buddy system will be required. All personnel must remain in visual or voice contact with at least one other team member while working in the Contamination Zone. The Contamination Zone will be applicable to the Transonic Firing Range, Work Plans and will be referred to in these documents as the Affected Area. Controlled areas shall be established to provide the specific radiological controls necessary for this project. Personnel protection equipment will vary depending on the area and type of work being performed. Work outside the radiologically controlled areas may require additional personnel protection as deemed necessary by the Project Health and Safety Representative or designated alternate.

Personnel Protective Equipment (PPE) will be worn by employees when performing work on-site. The ATG personnel will be trained in the proper use of the PPE required on-site. Visitors to the site will be required to wear proper PPE in the work area. PPE will be issued by the ATG Health and Safety Representative or designated alternate and proper training documentation must be provided.

Tyveks

Tyveks will be worn while performing work in the remediation/work area(s) at the discretion of the Project Manager or designated alternate and under the guidance of the Radiation Work Permit (RWP). The tyvek will prevent the worker's skin and clothing from coming in contact with contaminated dirt or dust. The tyvek will be properly disposed of after each use.

Respirators

Based on ATG's similar experience with depleted uranium at other sites, e.g., Lake City Army Ammunition Plant Firing Range, it is not expected that the decommissioning activities at the APG Transonic Range will generate any airborne contamination values that approach the action level of 1×10^{-11} µCi/cc. It is not anticipated that work activities will require the use of respirators for soil remediation. If airborne levels approach the action level of 1×10^{-11}, the use of respiratory protection will be evaluated.

For decontamination of structures, the use of respiratory protection is expected. Should this be the case, a full-face respirator with Type-H cartridges will be available and issued. Personnel must be able to provide documentation that they are properly trained, medically qualified, and fit tested for that specific respirator brand, type, and size.

The respirator will be properly inspected prior to donning and will be cleaned and decontaminated after each use. The respirator wearer will perform negative- and positive-pressure checks once the respirator is donned and prior to entering the work area. Nothing will interfere with the seal of the respirator such as, but not limited to, facial hair, eyeglasses, and other PPE.

If respirators are required, on-site documentation required for respirator use will be maintained in accordance with 29 CFR 1910.134. Although respirators may be worn to mitigate internal exposure to airborne activities no protection factors will be claimed for the respirator usage.

If airborne contamination values reach 50% of the DAC for uranium (1×10^{-11} µCi/cc), the Project Manager or designated alternate or the Health and Safety Representative or designated alternate will take appropriate measures to include determining the causes for the airborne activity and initiating corrective measures to correct these causes. All air sample calculation data will be appropriately documented in accordance with ATG Field Procedure, HPS-OP-010, "Air Sampling and Analysis' on the applicable forms associated with this procedure. Documentation of exposure to the concentrations of airborne activity for each individual so exposed and all air samples obtained will be performed. The Project Manager, the IOC Point of Contact/Project

Manager and the NRC will be notified as soon as possible of this occurrence. The inhalation dose to each affected individual will be calculated and documented and added to their Total Effective Dose (TEDE). If repeated (two or more) air samples occur during the remediation effort which approach or exceed the action level of $1x10^{-11}\mu Ci/ml$, then a determination will be made to place air samples at the firing range site perimeter to monitor for effluent airborne activity to ensure the limits of 10CFR20 Appendix B for the general public are not reached. No personnel other than those actually involved in the remediation project will be allowed in the immediate vicinity of where D&D work is being performed. In addition, a Radiation Work Permit (RWP) will be used to identify which personnel are allowed in specific areas during remediation activities. Personnel access and control to other areas of the firing range will be coordinated with the ARL RSO and APG Firing Range Control Officer.

Hard Hats

Hard hats will be worn when any overhead work is being performed. Hard hats will be stored outside the work area to decrease the chance of contamination when not in use. The hard hat must be worn properly with the brim facing forward.

Hearing Protection

Hearing protection will be provided and worn if noise levels reach or exceed 85 dBA. Hearing protection must be able to lower noise levels to below 85 dBA. Ear plugs will be discarded after each use unless they are fitted to an individual or are designed for reuse, in which case an individual may reuse their own ear plugs. Ear muffs may be reused after proper cleaning and decontaminated. Ear muffs will be stored outside the work area when not in use.

Anti-Contamination Gloves

Standard rubber/cloth anti-contamination gloves may be worn in the work area depending on the nature of the work, the requirements of the Radiation Work Permit and at the discretion of the Project Manager or designated alternate. Cotton liners may be worn under anti-contamination gloves to absorb wetness, but are not considered PPE. Anti-contamination gloves must be secured to the tyvek with duct tape. Anti-contamination gloves must be discarded after each use.

Work Gloves

Work gloves must be worn when removing soil or materials in the work area.

The gloves must be puncture-resistant to glass, sharps, or other objects that may be encountered during removal. The gloves cannot interfere with the workers dexterity. Work gloves may be reused. Prior to removal from the work site posted radiological controlled area, gloves will be surveyed.

Steel-toed Shoes

All contract personnel involved in actual work activities must wear steel-toed shoes. The shoes must be surveyed prior to leaving the work area to determine if contamination is present.

Work Boots

Work boots will be worn over steel-toed shoes when in the work area(s). The boots will be decontaminated after each use or discarded if no longer useable.

Safety Glasses

Safety glasses should be worn in the work area(s) when respirators are not worn and at the discretion of the Project Manager or designated alternate. Safety glasses must be cleaned and decontaminated periodically. Safety glasses must be stored outside the work area when not in use.

Fall Protection

Fall protection must be worn when performing work from a manlift or from scaffolding where handrails cannot be used. Safety harnesses must be inspected prior to each use and stored away from moisture and off the ground. Worker protection requirements will be followed as outlined by 29 CFR 1926.104. If scaffolding is used during containment tent construction or removal, guidelines outlined in 29 CFR 1926.451 will be followed.
Several conditions of the site could cause potential hazards. These conditions must be made aware of by the personnel on-site. Proper precautions must be taken to avoid exposure to these hazardous conditions.

4.1.1 Insects and Animals

There is the potential of exposure to insects (e.g., deer tick) or animals at the site which may present a personal hazard during work operations. ATG will provide insect repellents to employees and subcontractors as well as protective equipment when deemed necessary. Any animals that come on the work site are to be avoided by personnel whenever possible.

4.1.2 Extreme Temperature Exposure

It may be very hot in the work area during the excavation activities or soil wash activities. Gatorade or an equivalent electrolyte rich beverage will be provided. Worker rotation may be necessary to prevent heat stress. Appropriate breaks may be necessary depending upon the temperature and the work involved. Personnel will be closely monitored to prevent overheating.

4.1.3 Personnel Dose

Whole body doses over the course of the project are expected to be less than 24 mrem, as a conservative estimate (derived as: 12 hrs/day x 20 day x 0.1 mrem/hr). As part of the initial assessment of site conditions, surveys will be conducted and the above estimate will be revised using actual data. However, as a conservative measure, ATG shall require dosimetry for project personnel.

4.1.4 Radiation Work Permit

The Radiation Work Permit (RWP), Form ATGF-002 for work at Aberdeen Proving Grounds will state the personal protective clothing that is to be required to be worn while performing specific project activities in specifically controlled areas. Protective clothing to be worn in other areas will be determined by the hazard encountered, consistent with the guidelines set forth in the Health and Safety Plan.

4.1.5 Overhead Power Lines

Power lines may be over sections of the work area and need to be taken into consideration if a crane or manlift are used when constructing, moving, or dismantling the containment structure. A safe clearance distance of 20 feet must be maintained between equipment and overhead power lines at all times.

4.1.6 Debris

The work area contains broken bottles, nails, and other debris on the surface and possibly subsurface. The workers need to be aware of these conditions prior to entering the site.

4.1.7 Underground Utilities

Underground utilities need to be identified if they are present before performing any excavation at the site. If any underground utilities are encountered during excavation, work will stop immediately and the work area will be evacuated until those utilities have been identified and disconnected by the proper authorities. All permits, licenses, and/or rights-of-entry required by state, local, and/or installation authorities will be coordinated through the utility company(ies) or by the appropriate installation personnel.

4.1.8 Weather Conditions

The weather conditions may include possible thundershowers during the anticipated work schedule. If the potential for lightening is present, work will be stopped and personnel will move to a safe sheltered area until weather conditions improve. Any other severe or adverse weather conditions may require work to be stopped and personnel to move to a sheltered area.

4.1.9. Inadequate Lighting

Work performed on-site must have adequate lighting. If daylight does not provide the adequate 5-foot candle requirement (29 CFR 1910.120) then artificial light must be provided or all work must stop in time for personnel to exit the area during adequate daylight.

4.1.10 Good Housekeeping

Personnel will be expected to maintain good housekeeping within and around the work site. Materials or equipment that could be potential trip hazards will be moved out of walkways. Uneven walkways will be cleared or have restricted access. Materials will not be stacked in such a way that they may fall on personnel or equipment. Open pits will be roped off and labeled to prevent falls.

4.1.11 Electrical

Only power sources rated to handle the load required for equipment on-site will be used. Power sources will be required to have ground fault circuit interrupters unless the equipment has built in ground faults. Ground faults will be tested daily prior to using electrical equipment. Electrical equipment, plugs, and extension cords will be used and stored away from water sources. Electrical equipment that is not properly grounded, damaged, insulated, or have exposed wiring will be taken out of service and marked "Do Not Use". Extension cords with frays, exposed wire, damaged or missing prongs, or not insulated will be taken out of service and marked "Do Not Use".

Electrical equipment cords and extension cords can not be taped to cover damaged areas or for any other reasons. Metal or conductive ladders will not be used near energized electrical lines or equipment.

4.1.12 Dust

Work operations will be designed as to generate little or no dust. Airborne concentrations will be monitored. Personnel will wear the proper PPE in accordance with RWP requirements if dust is generated.

4.1.13 Noise

Heavy equipment used on-site may generate elevated noise levels and will require hearing protection. Noise levels will be monitored and noise-suppression will be used when possible. If noise levels reach or exceed 85 dBA, hearing protection will be required and the area should be posted "Hearing Protection Required". The hearing protection provided must be able to lower noise levels below 85 dBA when worn.

4.1.14 Motor Vehicles

ATG personnel will abide by all traffic laws on base as well as pedestrian right-of-ways. Speed limits will be adhered to and seat belts will be worn by all passengers in the vehicle.

Drivers will have a current drivers license and will not drive under the influence of drugs or alcohol. Special precautions will be taken in the event that road conditions become hazardous.

4.1.15 Hazardous Material Storage

No more than 10 gallons of flammable/combustible materials will be stored on-site unless these materials are stored in an approved flammable storage cabinet. Chemicals stored together must be compatible. Containers must be stored in an area that has limited traffic and little chance for containers to be broken, toppled, or spilled. A spill kit will be kept on-site in the unlikely event that a spill were to occur. Appropriate personnel at Aberdeen Proving Grounds will be notified immediately in the event of a spill. Containers should be placed in a designated posted area. The storage area should be diked if possible. The fire department must be aware of where the storage area is located and what it contains. Flammable and/or combustible materials must be stored away from ignition sources. All containers must be properly labeled and a MSDS must be on-site for the material. Gas cylinders must be secured in an upright position with a cap over the valve when not in use.

4.1.16 Fire Awareness

Fire extinguishers will be on-site in a designated area readily accessible to personnel. Combination ABC fire extinguishers will be provided and inspected by a qualified person on a monthly basis or as needed. Personnel will be trained in the proper use of a fire extinguisher. Exits will be clearly marked to the containment tent in the event of a fire. Directional arrows will be placed around the lower portion of the tent to guide personnel to the closest exit. The fire department will be notified immediately in the event of a fire.

4.1.17 First Aid

A first aid kit will be on-site in a designated area clearly identified by a "First Aid" sign. The first aid kit will be readily accessible to personnel and visitors to the site. A minimum of two personnel trained in first aid/CPR will be present at the site at all times work is being performed.

4.1.18 Blood-borne Pathogens

ATG has conducted a thorough evaluation of the processes and tasks which are performed in relation to Contractual Field Projects and has determined the potential for employee exposure to be minimal. However, because of the potential for accidents and injuries resulting in the possible contact of body fluids, ATG shall require additional training. The following is the ATG policy for field operations:

Training

All ATG personnel who receive Basic First-Aid training and are designated as Emergency Medical Response personnel shall receive additional training in Occupational Blood-borne Pathogen awareness.

Vaccinations

All ATG personnel trained in Basic First-Aid shall be offered the Hepatitis-B series of inoculations at no cost to the individual. This shall be offered on a voluntary basis and because the risk is minimal and First-Aid treatment of others is voluntary, no statement of refusal of the vaccine shall be required.

All ATG personnel who are designated and certified as Emergency Medical Technicians shall be required to receive the Hepatitis-B inoculations. This shall be at no cost to the individual.

Handling of Sharps

All ATG personnel handling materials containing sharps (i.e. needles, syringes, cutting edges, etc.) shall be required to wear puncture resistant gloves. Any injuries received while working with such materials shall be reported to their immediate supervisor. In addition, personnel exposed to blood or other body fluids while aiding an injured individual, no matter how minor, shall report to their immediate supervisor. The supervisor shall then promptly log and report the incident to the Health and Safety Representative and Project Manager.

Protective Equipment

Protective equipment such as gloves, masks, and respiratory barriers are provided in each first-aid kit. All personnel responding to a first-aid situation in which there is a potential for exposure to blood or other body fluids are expected to use these devices for protection of both themselves and the personnel they are aiding.

4.1.19 Site Control

The immediate work site and areas under ATG's control will be clearly marked and access will be limited to ATG personnel and authorized visitors. In addition, a Radiation Work Permit (RWP) will be used to identify which personnel are allowed in specific areas during remediation activities. Personnel access and control will be coordinated with the ARL RSO and APG Firing Range Control Officer. Walkways and paths will be rerouted as necessary to limit access to the area. Postings will be in place to notify personnel of access restrictions, physical and radiological hazards, and PPE requirements.

4.2 Procedures

4.2.1 Confined Space Entry

A confined space is any space that has a limited means of egress and is subject to an accumulation of toxic or flammable contaminants or has an oxygen-deficient atmosphere. Confined spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation, or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open-top spaces more than four feet in depth such as pits, tubs, vaults, and vessels.

A confined space will not be entered until atmospheric conditions are monitored and the area is verified safe. A valid "Confined Space Entry Permit" must be posted, reviewed, and in effect prior to entry. Fuel operated equipment will not be used in or near the opening or air intake for a confined space due to the potential for carbon monoxide build up. Confined space blowers will be used if necessary to ventilate the area and refresh the air. All entrants and spotters must review the rescue procedures before entry. All personnel entering the confined space must wear a safety harness with a secured lifeline in the event they need to be pulled out of the area.

A spotter will remain in continuous visual and voice contact with personnel in the confined space. The spotter must account for all entrants and will not leave the post unless relieved by a competent person. The area will be continuously monitored while personnel are in the confined space due to the potential of changing atmospheric conditions.

4.2.2 Excavations

An "Excavation Permit" or equivalent document must be obtained prior to digging. Shoring and sloping for excavated sites will be performed in accordance to the guidelines set forth in 29CFR 1926 Subpart P.

Any excavations which affects an existing structure, support, or building, must be approved prior to excavation by a Professional Engineer. If underground utilities are present, hand tools will be used to determine their exact location before heavy machinery is used. Personnel will not enter an excavated site unless proper shoring or sloping is in place and air monitoring has been performed. Personnel will not place themselves between underground storage tanks that are not secured within an excavated site due to potential ground shifting that could cause a tank to tip or roll. Excavated area 3 feet or deeper will have a stairway, ladder, ramp, or other safe means of egress located within 25 feet of personnel in the excavated site.

Excavated areas will be barricaded to prevent pedestrians and vehicles from entering the area. The area must be barricaded prior to the excavation of the site. Excavation, dirt, equipment, or materials must be at least two feet from the edge of the excavation.

All shoring must be inspected daily and more often in wet weather. The excavation walls must be inspected after a heavy rain or thaw. All excavations and trenches must be inspected daily by a competent person.

Personnel working in an excavation will not be permitted to be within five feet of the swing or extension radius of any power shovel, backhoe, loader, etc. Personnel will not be allowed below any material being removed or placed. Tag lines will be used to maintain distance from materials being removed or installed with a crane.

4.2.3 Hazardous Energy Control

All personnel that work on or near energy sources should have completed and documented Site Training which covered this subject. Danger tags are used only to prevent operation of a switch, valve, or piece of equipment in cases where someone may get hurt or equipment may be damaged. Lockout/Tagout procedures will be used to prevent energy sources from becoming energized while personnel or equipment are in the area. The personnel working in the hazardous energy area must personally lock and tag the energy source out. A signed and dated tag will be placed on the system after it is locked out.
The system must be tested after locking to ensure it is de-energized prior to starting work. Prior approval must be obtained before de-energizing a system.

Only the person that placed the lockout/tagout on a system can remove it and only after all personnel are clear from the work area. All personnel that are working in the area must have their own lockout/tagout in place on the system. Personnel cannot remove a lockout/tagout that was put in place by someone else. Once a tag is removed it must be destroyed and a new one used each time a system is locked out.

All electrical components will be treated as if they are energized regardless if lockout/tagout procedures are in place. Personal protective equipment will be inspected and worn when working on energy systems. Test equipment will be used to ensure systems are de-energized. Grounding equipment will be applied after the system has been deenergized. Caution must be used when removing enclosure covers, panels, or opening doors to expose electrical systems. Work on or near electrical circuits will only be performed by qualified personnel who have been authorized to do the work.

Non-metal frame safety glasses are required when performing electrical work. Other conductive items such as metal hard hats, rings, watches, necklaces, earrings, etc. will not be worn when working on or near electrical systems. Electrical rated rubber gloves must be inspected for cracks, punctures, tears, etc. prior to wearing them.

Hand tools and power tools rated and insulated for electrical work will be used on or near power sources. Drills and penetrating equipment must be grounded so that accidental contact with an unexpected energized electrical source will be cleared quickly by the circuit protective device. Double insulated equipment cannot be relied on to provide protection when accidental contact is made with energized circuits.

4.2.4 Welding and Burning

All flammables and combustibles must be removed from the work area. A dry chemical fire extinguisher must be readily available before any welding or burning work is performed. Atmospheric conditions must be checked to ensure no explosive levels are present. Welding leads and burning hoses will be kept clear of walkways and roadways. If leads or hoses are to be elevated, they must be a minimum of seven feet above passage ways and cannot hang from conduit, process lines, sprinklers, etc.

All U-fittings, couplings, and connections must be tight. Fumes generated from the welding or burning process must be avoided by ventilation or use of a respirator.

No welding or burning will be performed on a vessel or tank that has not been cleared of any residual material they may have contained. Hoses and leads will be disconnected at the end of each shift. Fireproof screens or partitions will be put up if welding or burning is being performed near other people. Personnel will not lubricate caps, valves, or gauges. A fire watch will be present during, and a half hour after welding and burning. Welders and attendants will wear eye protection, goggles, or welding hood.

4.2.4.1 Welding (Electric)

When performing welding, all work must have a separate and adequate ground. The return current lead must be connected directly from the machine to the work location. A rod must not be left in the electrode holder when it is laid down and the stub ends must be placed in the proper container. The machine must not be left on at the end of a shift. An approved welding helmet with no less than a #10 filter plate with a safety plate on both sides must be worn. Electric welding cannot be performed form a metal ladder. Welding cables will be free of cracks, breaks, bare conductors, and frayed insulation. Tape cannot be used as an insulator.

4.2.4.2 Burning (Gas)

Before connecting regulators to cylinders, the cylinder valve will be opened slightly to blow out any foreign particles. Once the regulator is connected, the valve will be opened slowly with the person standing to one side of the gauge. The second stage of the regulator will be closed before opening the cylinder valve. Oxygen cylinder valves will be wide open while fuel gas cylinders will be opened one-half only. When using acetylene, 15 psi will not be exceeded on the torch side of the gauge. The fuel gas valve on the torch will be opened before the oxygen valve when lighting a torch. Only an approved spark lighter will be used to light a torch.

Burning rigs will be broken down at the end of a shift by removing regulators and securing protective caps. Oil and grease will not be used no oxygen regulators, hose and fittings. Grease covered tools and equipment will not be stored in the same area as the oxygen equipment.

All hoses, gauges and torches will be inspected quarterly and prior to use. All inspections will be documented. Approved burning goggles with at least a #3 filter with safety lens on both sides must be worn. A torch will not be left in a vessel, tank, or other closed container due to the potential for leakage. Oxygen will not be used in pneumatic tools to pressurize a container, to blow out lines, or substituted for compressed air or other gases. Compressed air will not be used to clean clothing, blow off debris, or clear the work area.

Cylinders and hoses will be placed away from sparks and slags generated from burning. Gas cylinders will not be taken into a confined space.

4.2.5 Tools

Equipment and tools will be used for their specific design and not rigged for purposes other than those specified by the manufacturer. Tools will not be used beyond their designed capacity. Tools will be inspected prior to each use. Damaged or worn tools will not be used and will be taken out of service. Tools taken out of service will be marked with a "Do Not Use" tag or sticker until they can be properly disposed of or repaired. Tool subject to impact will be dressed to prevent flying steel fragments. Tools cannot be brought into or out of a radiological area without prior approval from a health physics technician.

4.2.6 Portable Power Tools

Power tools will not be operated by personnel that are not familiar with the manufacturer's requirement for the safe use of that tool. Precautions will be taken to prevent tools from binding up. Moving parts will be directed away form the body and there shall be no physical contact with a powered part unless the power source is disconnected. Personnel working with power tools must be aware of personnel around them. Power tools will not be running when moving from one work area to another.

Prior to each use, power tools will be inspected for damaged parts, loose fittings, and frayed or cut electric cords. Defective tools will be taken out of service and marked " Do Not Use". Electrical tools will be unplugged prior to performing maintenance or switching out parts.

Air pressure will be bled down before disconnecting air-powered tools. Electrical power tools must be grounded with a three prong plug. All hoses exceeding ½ inch inside diameter will have a safety device at the source of supply or branch line to reduce pressure in case of hose failure. Only manufacturer authorized safety clips or retainers will be installed on all hose connections to prevent accidental disconnection of the tool from the hose connection. All fuel-powered tools will be shut off prior to refueling. Proper guards or shields will be in place. A control lock on a hand-held power tool will not be permitted. Electrical tools will not be raised or lowered by the power cord.

4.2.7 Ladders

Ladders will be inspected prior to each use. Ladders will not be painted except to be marked with an identifier. If ladders must be placed in a doorway, the door will be barricaded and warning signs will be posted. If the doorway is a marked exit, then the door cannot be barricaded and a spotter must be used. A hand line will be used to raise or lower tools or materials so personnel do not carry anything in their hands when ascending or descending a ladder. The ladder position will be changed as often as necessary to prevent excessive leaning or stretching on a ladder. When working from a ladder, both feet will be kept on the rungs and the person will be facing the ladder. If it is necessary to work backwards from a ladder, then the person must wear a safety belt and be tied off to a secure area and not to the ladder. Only one person is allowed on a ladder at one time unless "two-man" stepladders are being used. Metal ladders will not be used for electric welding or near any electrical lines or services. Ladders may be used on scaffolds only if secured and the user is tied off with a safety belt. If a ladder must be built to use on-site, it must conform with established OSHA standards and be approved by the Health and Safety Representative or designated alternate. Areas around the top and base of the ladder must be cleared of tripping hazards. Ladders will not be placed against moving objects. Broken or damaged ladders will not be used. Ladders to be repaired must be tagged out and taken out of service. Step off distance from ladders must not exceed one foot.

4.2.7.1 Straight and Extension Ladders

Straight and extension ladders must be placed using a 4:1 ratio (for every 4 feet in height from the ground to the point of contact on the supporting surface, the ladder base must be placed 1 foot away from the supporting surface). Ladders must extend at least 3 feet beyond the supporting object. The ladder must have non-skid safety feet and be secured. When the extension ladder is raised to the desired height, the safety dogs or latches must be engaged and the extension rope secured to a rung on the base section of the ladder. Extension ladders must overlap a minimum of three rungs.

4.2.7.2 Stepladders

Stepladders must have all four feet on a level surface. The spreaders must be locked in place. Stepladders will not be used as a straight ladder. Tools or materials will not be placed on steps or the platform. The maximum height for stepladders without a safety platform is 12 feet and with a safety platform is 16 feet. If a ladder is over eight feet in height, it will be tied off.

4.2.8 Scaffolding

When assembling scaffolding guardrails, midrails, toeboards, and complete decking must be in place. Each frame post must have a locking pin. Personnel cannot climb on or work from the guardrail, midrail, or brace members of a scaffold. Ladders must be used as a means of access or egress.
Scaffolding will be erected level and plumb on a firm base with base plates provided by the manufacturer. If a scaffold's height exceeds three times its minimum base dimension, it will be secured to a secure structure at the second vertical frame/section and at every other frame/section. Scaffolding will be secured horizontally to a secure structure every 30 feet. If the scaffold cannot be secured when required, outriggers will be used to stabilize the structure.

Scaffold platforms will be equipped with approximately 42 inch high rigidly secured guardrails and approximately 21 inch high midrails. The scaffold will be completely decked with wood planks or manufactured scaffold decking and rigidly secured toeboards on all four sides.

Properly and completely assembled scaffolding will have a "Green" tag attached. Incomplete scaffolding will have a "Red" tag attached and cannot be used. Do not use untagged scaffolding. The weight load of the scaffolding will not be exceeded. Scaffolding will not be altered by means of welding, burning, cutting, drilling, or bending. Scaffolding will be kept clear of debris, materials, etc. If personnel are required to work under the scaffolding, a screen of 18 gauge, ½ inch mesh or equivalent protection will be used between the toeboard and the top guardrail.

Scaffold access ladders will not be erected with an unbroken climbing height greater than 20 feet. A landing platform, fully protected by guardrails, midrails, and toeboards will be provided at least every 20 feet which requires the person to leave one ladder and walk to the next. Openings in platforms may be filled with 3/4 inch plywood, provided one dimension is less than 18 inches. Otherwise, 2 inch scaffold grade lumber or double 3/4 inch plywood is required. Filler material will be secured from movement and supported on all sides by scaffold grade lumber or the bearers of the platform.

Mobile scaffolding must not be moved when personnel are on the scaffold. All the wheels must be locked in place before personnel can climb on or work from the scaffold. All tools and materials on the scaffold must be secured prior to moving.

4.2.9 Manlift

The manlift must be inspected prior to each use. The tires, hydraulic system, booms, baskets, upper and lower controls, brakes, drive chain, and safety equipment must be checked each day prior to use. The operator must be trained and qualified before operating the equipment. Wheel chocks must be in place when performing work on an incline. If outriggers are used, they must be positioned on pads or a solid surface and the brakes set. A maximum of two people will be allowed in the basket at one time. The total weight of personnel, material, and tools in aerie platforms will not exceed the load limit set forth by the manufacturer. Personnel must wear a safety belt and lanyard attached to the basket or platform. Personnel will not sit or climb up on the guardrail or enclosure. The platform must be placed in its lowest position and shut off for mounting and dismounting. A manlift cannot be used to hoist materials. Work will not be performed from a manlift when winds exceed 20 miles per hour.

4.2.10 Heavy Machinery

Personnel operating heavy equipment must be familiar with the proper use of that equipment. The operator must know how to properly inspect the equipment prior to each use and know that equipment's limitations. Personnel will abide by guidelines set forth by the ATG Corporate Health and Safety Plan and by the manufacturer. Back-up alarms must be in place and operable on all heavy machinery. All equipment must be operated at safe speeds. Lights must be used during low visibility conditions. Seat belts must be worn by the operator.

Forklifts will not be operated where there is the potential of overturning. When loading where there is a probability of dangerous slides or movement of material, the wheels or treads of loading equipment must be turned in a direction which would facilitate escape in case of danger, except in a situation where this position of the wheels or treads would cause a greater operational hazard. Spotters should be used to help the operator be aware of the surroundings. Personnel working around the area in which a fork lift is being used must maintain visual contact with the equipment in order to remain a safe distance from the work being performed. The fork lift will only be used for loads it is rated to lift.

Cranes used by the contracted personnel must be operated within the guidelines set forth in 29 CFR Part 1910.180. ATG personnel must maintain a safe distance from the crane operations. Only trained personnel will be allowed to assist in the lift operations. Crane permits must be obtained prior to use on site.

4.3 Personnel Monitoring

ATG personnel will be continuously monitored during this project. Monitoring for this project will be supplied by ATG using the following procedure.

4.3.1 Occupational Exposure Guides

ATG Administrative Control Levels per calendar year:

Whole Body	1.0 Rem
Extremities	5.0 Rem
Skin	5.0 Rem

The ATG Corporate Health Physicist or his/her designee shall approve any authorization for exposure above the annual control levels. This approval shall be given only if the dose is necessary and shown to maintain collective dose on the project ALARA.

4.3.2 Site Registration Form

All personnel assigned to work on the project must complete a Site Registration Form (ATG Form 109) prior to starting work. Completed Site Registration Forms will be retained with the personnel exposure files.

4.3.3 Occupational Radiation Exposure History

Before an individual will be permitted to work in a controlled area, a U.S. Nuclear Regulatory Commission (NRC) Form 4 or equivalent, must be initiated and reviewed by the Project Manager (or designated alternate) or Radiation Protection Supervisor. Exposure results shall be listed on the NRC Form 4.

4.3.4 Thermoluminescent Dosimetry (TLD)

TLDs shall be the permanent record of an individual's occupational

radiation exposure. The TLDs used by ATG are supplied and evaluated by a National Voluntary Laboratory Accreditation Program (NVLAP) approved vendor. All personnel assigned to the project will be issued a TLD for the job or on a monthly/quarterly basis as the work requires.
The individual's name, social security number, issue date, and a date of return are to be recorded on the monthly TLD Issue Log. In the event of a lost TLD, immediate notification to the Radiation Protection Technician or Supervisor is required. A Lost Badge Report (ATG Form 111) will be completed and filed in the individual's exposure file. Monthly TLD results will be documented on the Personnel Radiation Exposure Record, (ATG Form 112).

This record will be updated when the TLD results are received and will be maintained in the individual's exposure file.

4.3.5 Radiation Work Permits

All personnel in the work area must be assigned to a specific Radiation Work Permit (ATG Form 002) applicable to the job being performed. A Radiation Work Permit Sign-In Sheet (ATG Form 023) will be attached to each Radiation Work Permit.

All personnel assigned to a job, requiring a Radiation Work Permit, shall sign the RWP Sign In Sheet prior to starting work. Personnel shall sign off on the RWP at the completion of work.

4.3.6 Occupational Radiation Exposure History Letter

An Occupational Radiation Exposure History Letter, (ATG Form 047) will be completed for all personnel assigned to the job. Copies of this letter are sent to the individual and the ATG Corporate office in Fremont, CA., within 30 days of obtaining the monitoring results.

4.4 Industrial Hygiene Monitoring

4.4.1 Purpose

The purpose for performing industrial hygiene monitoring is to establish PPE guidelines, determine the potential for exposure, and to establish atmospheric conditions. If contaminants in the work area are unknown, then monitoring must be performed to determine what, if any, contaminants are present. The level of the contaminants present will dictate the PPE required such as respiratory protection.

4.4.2 Air Sampling

As stated previously in this plan, ATG does not expect to generate any airborne contamination that approach the action levels established in 10 CFR Part 20, Subpart H for respirators. ATG will not allow any member of the public, including Aberdeen Proving Grounds employees, to enter the work area during decommissioning activities to preclude them from being exposed to a potential airborne event during this remediation. The limit for radiological airborne activity in the work area has been established at 50% of a Derived Air Concentration Value for U-238/Th-234 (DU) or $1x10^{-11}\mu Ci/ml$. If this value is approached or exceeded during remedial work activities then complete documentation of all airborne radiological air samples and internal exposure tracking of all personnel exposed to this airborne activity will be performed. Determination of the cause of the airborne activities will be made and corrective measures taken to prevent recurrence.

Two or more occurrences of radiological air samples which approach or exceed the work site airborne action level will result in the placement of airborne monitoring around the perimeter of the firing range. These air samples will be situated in such a manner as to account for shifts in wind direction. These samples will be monitored to verify that no member of the public was subjected to radiological airborne activity above the airborne effluent levels established in 10CFR20, Appendix B. No personnel will be allowed access to the firing range during remediation activities except personnel directly involved in the work activities and approved on the site radiation work permit for the remediation.

Air sampling will be performed to determine the contaminants present and what the potential is for exposure. Area samples will be collected near the work area during operations to gather a representative sample.

At a minimum, two air samples will be placed in a downwind direction from the work area to gather a representative airborne sample of the work area airborne environment. In order to see the action level of $1x10^{-11}\mu Ci/ml$ of radiological airborne activity, a minimum of 450 cubic feet must be collected on the sample media. In order to see 0.1 DAC or 2×10^{-12} $\mu Ci/ml$ an eight hour air sample must be taken to pass enough representative air through the filter media for this determination. Personnel lapel pin samples may be used to collect representative breathing zone air samples of the personnel performing the work operations.

If the presence of metals is identified, specific measures will be taken for its characterization. The results will be used to upgrade existing protective measures and personnel monitoring. Lapel air samples will be used to collect airborne lead samples for laboratory analysis to determine airborne inhalation of lead activity. Normally, one member of the work crew will wear a lapel air sampler to determine breathing zone air activity value.

Note: Due to the low flow rate of the lapel air sampler (3 LPM) and the work time for the crews (nominally no more than 4 hours) the 0.5 DAC value or $1 \times 10^{-11} \mu Ci/ml$ may not be seen. These air samples will represent a day to day trend of the airborne activity for the workers breathing air zone.

Lapel air samplers will be calibrated prior to sampling and upon completion of sampling. The pre- and post-calibration data will be averaged to determine the flow rate. The calibration data, start and stop time, date, flow rate, and location of the sample will be documented for all air samples.

Prior to shipping the samples to be analyzed, the sampling cassettes will be surveyed and smeared to determine if radiological contamination is present. Chain of custody forms will be completed and sent with the samples. The samples will be shipped according to regulatory guidelines and will be packaged in a manner that will not interfere with the integrity of the samples.

4.4.3 Confined Space Monitoring

Prior to personnel entering a confined space, atmospheric monitoring will be performed. Monitoring will determine oxygen level, carbon monoxide content, and the Lower Explosive Limit (LEL).

If any of the levels are not within regulatory guidelines, a confined space blower will be used to ventilate the area. Proper PPE will be worn in the confined space as required. Atmospheric conditions will be monitored initially and periodically during work operations unless the potential for abrupt atmospheric changes are present, then continuous monitoring will be performed.

4.5 Training

Individuals assigned to this project will be trained and qualified radiation workers. Training records will be supplied and kept on-site as part of the Project Quality Assurance Plan. Training specific to the project will be performed prior to the start of work by the Health and Safety Manager or designated alternate, and recorded on the Training Record (ATG Form 027).

Requirements of the Project Detailed Work Procedure, Project Quality Assurance Plan and the Project Health and Safety Plan will be covered in the on-site training.

All personnel for the Aberdeen Proving Ground project shall have completed the 40 Hour Basic Hazardous Waste Training Program and, if needed, the 8 Hour Refresher. Supervisory personnel shall have completed the 8 Hour Supervisory Training Program as mandated by 29 CFR 1920.120. All personnel directly involved in this project will be required to provide evidence of current OSHA Training (29 CFR 1910.120 e.6) and Medical Certification (29 CFR 1910.120.f). All respirator wearers will be trained and have proper documentation required of respirator use (29 CFR 1910.134).

All personnel operating heavy equipment must be trained on the proper use of that equipment. The operator must know how to properly inspect the equipment prior to each use and know that equipment's limitations.

Personnel will abide by guidelines set forth by the ATG Corporate Health and Safety Plan and by the Manufacturer.

Daily briefing training meetings will be held prior to each work day to discuss activities that will be performed that day. Radiological and safety concerns will be discussed, as well as proper PPE and contamination controls. These meetings will be conducted by the Project Supervisor and the Health and Safety Representative or designated alternate, and be documented on the Pre-Job Briefing Checklist for Health Physics (ATG Form 026) and the Pre-Job Briefing Checklist for Industrial Hygiene/Safety (ATG Form 025). Personnel will document their attendance to these meetings on the Training Record (ATG Form 027).

Visitors who request entry into the exclusion zone will be required to attend the daily health and safety briefing or an equivalent briefing and document attendance on the appropriate forms. Compliance with state, local, and installation motor vehicle laws will be covered in the daily briefing training meetings.

4.6 Decontamination

Contamination control barriers will be established and personal protective equipment will be required to minimize the potential for areas or personnel to become contaminated. In the event that personnel contamination is detected, the following procedures will be used to remove or contain the contamination.

4.6.1 Explanation

This section describes the procedures to follow when it has been determined that personnel, personal equipment and/or clothing has been contaminated and the necessary records required to document and complete the decontamination process. The surface contamination limits identified here in Sect. 4.8.4 and Table 5.2 of the Decommissioning Plan will be applied for this purpose, as they are identical to U.S. NRC Criteria (Ref. 11.10). For personal clothing and skin, the ALARA objective will be to decontaminate to non-detectable levels, as opposed to just meeting the criteria.

4.6.2 Decontamination Methods

4.6.2.1 Personnel Decontamination

When contamination is found on the worker, the worker shall notify a Radiation Protection Technician immediately and inform him that he/she has become contaminated. The worker will indicate where he/she believes the contamination occurred, and the route taken to where the surface contamination was detected. This information will assist the Radiation Protection Technician in determining which areas to survey to avoid the contamination of other personnel. After notifying the Radiation Protection Technician, the individual who is contaminated shall, if possible, isolate the contaminated item or items by the use of clean plastic bags and remain in the personnel survey area.

Any method of decontamination used will require monitoring and documentation of the results for each step in the procedure. All liquids used for decontamination purposes, will be considered contaminated and handled as radioactive waste. A spray solution of Radiac-Wash or equivalent mild detergent solution should be used as the primary agent to remove skin contamination. Radiac-Wash foam will be sprayed on the contaminated area, allowed to soak for a few minutes, then wiped clean. Radiation surveys will be performed between each wash.

NOTE: UNDER NO CIRCUMSTANCES WILL THE SKIN BE ABRADED WITHOUT DIRECT MEDICAL SURVEILLANCE. NOTIFY THE ATG RADIATION SAFETY OFFICER AND THE CORPORATE HEALTH PHYSICIST SHOULD THIS BE RECOMMENDED.

Additional washing may be required if the affected area contamination levels are not reduced to below acceptable limits. If needed, lava soap, a soft brush and small amounts of water can be used with light pressure to produce a heavy lather. Only wash 3 times for about 2 minutes each. Rinse and monitor. Use care not to scratch or erode the skin. Apply lanolin or hand cream to prevent chapping. Continued washing will abrade the skin. Any additional decontamination techniques shall be approved by the Radiation Safety Officer on a case by case basis.

4.6.2.2 Clothing Decontamination

When contamination is found on clothing, the worker shall immediately notify a Radiation Protection Technician and inform him of the situation, including where the worker believes the contamination occurred and the route taken to where the contamination was detected. This information will assist the Radiation Protection Technician in determining which areas to survey to avoid the contamination of other personnel.

The contaminated clothing shall be removed, taking special care not to further contaminate additional clothing or personnel. The item(s) shall be surveyed to determine the degree of contamination.

Depending on the source of contamination, decontamination methods such as using tape to adhere the contamination to or scraping a shoe with a knife may be used. If the contaminated item cannot be easily decontaminated without using soap and water methods, the item shall be disposed of as radioactive waste.

4.6.3 Documentation

In order to fully assess the degree of contamination, the skin dose to personnel and to critique the incidents to improve future procedures, documentation is necessary. Documentation of the event should start and continue from the initial detection of contamination to the final release. Personnel contamination will be classified in two categories, skin and clothing.
A separate form shall be used for each, along with a Contamination Report Index, (ATG Form 116) to chronologically categorize all personnel contamination. A Personnel Contamination Report, (ATG Form 117), and a Clothing Contamination Report, (ATG Form 118) shall be completed by the individual performing the decontamination and submitted to the Project Manager and/or the Health and Safety Representative or designated alternate(s) for evaluation and filing. The Contamination Report Index shall be maintained by the Project Manager or designated alternate. The contamination reports shall be maintained in the individual's exposure file.

4.7 Bioassays

ATG personnel are monitored for internal contamination on a routine basis. For the purposes of this project all ATG personnel will have pre and post job bioassay samples analyzed for depleted uranium.

4.8 Radiological Surveys

4.8.1 Purpose

The purpose of this procedure is to set guidelines for ATG personnel to maintain control of the radioactive materials.

The limits established for survey and release are established in *"Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material and Personnel Release Limits".*

Designated work areas will be established to maintain an efficient material flow path. During the work operations, routine and periodic assessments are needed to assure that control of the radioactive material is maintained. The routine assessments are in the form of radiation surveys and periodic assessments are an accumulation of surveys and other data from other procedures. The designated areas requiring radiation surveys will be on a routine or special survey basis, depending on the work operation being performed.

Routine surveys are required on a daily basis in accordance with Radiation Work Permit requirements. RWP surveys are only required if work operations are to be performed in the area described on the RWP. Special surveys shall be required when the Project Manager (or designated alternate) or operation procedures deem necessary. Types of surveys needed to make the regular assessments may include; dose rate surveys, contamination surveys or airborne contamination surveys. Individuals performing routine and special surveys will be appointed by the Project Manager or designated alternate and will be trained in radiation survey techniques.

4.8.2 Performance Test

Radiological survey instruments are required to be calibrated at a yearly interval or sooner if necessary. All instrumentation used on site will be calibrated by an independent laboratory, such as Ludlum Measurements, Inc., Sweetwater, TX. Instruments and appropriate probes, depending on their use, are calibrated to TH-230 for alpha detection; Tc-99 and /or C-14 for beta detection; Am-241, Cs-137 and/or Co-60 for gamma detection. In the field, ATG will use a Cs-137 or Co-60 source for beta-gamma instrumentation daily response checks. A Th-230 source will be used for alpha instrumentation daily response checks. Primary instrument calibration certificates and reference source certificates will be supplied with all radiological survey equipment. Calibration certificates and documentation will be kept on site. When the count rate and dose rate meters are returned from calibration, a reference check shall be performed prior to placing the instrument in use with one or more of the designated reference sources.

The reference tests will be performed using sources that are intact and appropriate to evaluate instrument response. The primary calibration reference data will be used to determine if the meter will pass or fail the daily performance tests. A performance check shall be performed on meters that are in use prior to each day and intermittently during continuous use.

4.8.3 Dose Rate Surveys

Routine dose rate surveys will give the radiation worker and supervisory personnel an indication of the amount of external occupational radiation exposure the worker will receive while performing routine work operations.

Special dose rate surveys are needed to determine the disposition of radioactive material or if engineering controls are needed to reduce the exposure to the worker. Routine and special dose rate surveys shall be performed using the Ludlum Model 19 or equivalent micro R meter.
Prior to using a meter, the individual performing the survey shall verify that the meter is in calibration and the batteries are in good working condition and that the meter performance test has been completed in accordance with HP-IP-002, Operation and Calibration of the Model 19.

While performing dose rate surveys, consideration must be given to the types of radiation that are present in the work area so that hazards to personnel in the work area can be identified. Occupational external radiation doses to personnel are attributable to gamma rays and beta particles. Usually the gamma ray contribution is the greatest. Dose rates from beta particles are usually more limiting as an extremity hazard for close work with contaminated equipment or radioactive material.

Documentation of the survey results shall be recorded as mR/hr (microRoentgen/hr). General work area dose rates will be recorded on the Radiological Survey Form (ATG Form 001).

4.8.4 Contamination Surveys

Radioactive contamination surveys are an important part of the radiation protection program. Based on results of radioactive contamination surveys that are performed in the various work areas, assessments can determine the controls for radioactive material and to establish radiation protection requirements for personnel working in an area or on equipment.

There are two basic types of radioactive contamination; fixed and smearable (removable). Radioactive contaminants are only external

exposure hazards as long as the contamination remains fixed. Smearable radioactive contaminants represent both external and internal exposure hazards. Routine contamination surveys are primarily conducted to determine smearable levels while special contamination surveys are for smearable and fixed.
Usually contamination surveys are performed in conjunction with dose rate surveys. Documentation of contamination survey results will be recorded on the Radiological Survey Form (ATGF 001) by the individual performing the survey. All smear results will be recorded in disintegrations per minute per 100 square centimeters (dpm/100 cm^2) unless otherwise indicated on the Radiological Survey Form. A drawing of the survey area or item shall be completed by the surveyor. The individual survey point shall be numbered and the number circled, indicating a smear location on the drawing. Principally, radioactive contamination consists of beta-gamma emitters. Smear surveys are performed by wiping a surface (floor, wall, tool, drum, etc.) with a disposable smear pad, using moderate but even pressure, and wiping an area of 100 cm^2 (approximately 4" x 4").

The smears will be counted on a Ludlum Model-2929 Dual Channel Scaler or equivalent. The use of large area smears may be appropriate in some instances. In this case the smear will be counted with a Ludlum Model-18 Analyzer with an attached Model 43-68 100 cm^2 gas proportional probe or equivalent. Any detectable activity on the large area smear (i.e., masslin wipes) will be further investigated and augmented with 100 cm^2 smears to determine the exact extent of the loose contamination and determine if decontamination of the equipment, tool, etc. is required.

Counting instrumentation to be used for fixed beta-alpha contamination surveys shall consists of a 100 cm^2 gas proportional Ludlum Model 43-68 or equivalent, attached to a count rate meter, a Ludlum Model-18 Analyzer or equivalent. For beta-gamma determination a 15 cm^2 Geiger Muller detector attached to a count rate meter may be used.

Care must be taken to avoid damage to the probe. Detector speed should be no greater than ½ probe width per second and, at a distance of ½"or less for beta-gamma, 1/4" or less for alpha detection from the surface. Audible indicators should be on. The total indicated counts per minute, minus the background counts per minute, multiplied by the efficiency factor, will equal the disintegrations per minute of the smear area.

$$A_S = (C_S - C_b) \times F_e$$

where: A_S = Smear Activity (dpm)
C_S = Sample Count Rate (cpm)
C_b = Background Count Rate (cpm)
F_e = Efficiency Factor (dpm/cpm)

Personnel contamination surveys shall be performed by any individual exiting from a contamination controlled area. The background count rate in these areas shall be less than 200 cpm. A fixed frisking point shall be established by the step off pad area. In addition to personnel, all items leaving a contamination area shall be surveyed and will be free of contamination upon release.

Any time a vehicle exits a contamination controlled area, a smear survey shall be performed on the tires and forks.

All items with smearable contamination levels below 1,000 dpm/100cm^2 beta-alpha will be considered non-contaminated. All items with smearable contamination greater than 1,000 dpm/100cm^2 beta-alpha shall be considered contaminated and will be handled in a manner as to prevent the spread of contamination. All items surveyed for unconditional release from the restricted area shall be less than the following limits per guidance "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear

Material", and US Nuclear Regulatory Commission Branch Technical Position Statement, "A Summary of NRC's Interim Radiological Cleanup Criteria and Current Dose Bases; Decommissioning and Regulatory Issues Branch US NRC", November 1992.

Smearable beta-alpha <1,000 dpm/100cm^2

Fixed beta-alpha not more than 15,000 dpm/100 cm^2 or 5,000 dpm averaged over 1 square meter.

Documentation of acceptable survey results shall be performed on the Unconditional Release of Equipment or Items Report (ATG Form 010).

If contamination survey results indicate a release of material or breach of containment barriers, a special environmental survey shall be performed to evaluate the levels and extent of the spread of contamination. Results of the special environmental survey shall be immediately reported to the Radiation Safety Officer.

4.8.5 Airborne Contamination Surveys

Airborne contamination surveys are a convenient method of determining the amount of radioactive material suspended in air at the time of the sample. Air sampling must be performed in conjunction with specific aspects of work operations to achieve representative results.
Because of this, quantities and frequencies of air samples cannot always be predetermined.

All air samples will be issued an identification number. The Radiation Protection Technician will maintain the Air Sample Identification Record (ATG Form 048) to account for all air samples taken. All air samples will be documented on the Air Sample Data & Analysis Form (ATG Form 030) for the specific day and time of day the air sample was taken. The RWP will determine the minimum quantities needed to make a thorough evaluation. During work activities that have the potential to generate airborne contamination, a general area air sample will be taken. For specific tasks which may generate airborne activity, such as burning, welding, or grinding, a lapel air sample will be taken in addition to a general area air sample to represent the worker's breathing air zone. All air samples and the reason for drawing the air sample will be documented.

Airborne contamination surveys consist of two components, sampling and analysis. Each component is unique and need certain guidelines to ensure uniformity of results. Any deviation from the guidelines shall be noted to aid in the overall evaluation.

4.8.5.1 Sampling

Air samplers are instruments that pull a known quantity of air through a filter media at a known rate. The airborne contaminants are trapped on the filter media for future evaluation. The air filter media will be F&J Specialty, Inc. #FP47 or equivalent fiber filters capable of collecting particles with a diameter of 0.3 micrometers at an efficiency of 99%.

Air samplers are calibrated on an annual basis. Air samplers are calibrated to ensure the quantity of air pulled through filter media is known. Air samplers are not to be used if the calibration has expired. Prior to use, an inspection of the air sampler shall be performed to ensure the rotometer is functioning, clean filter media is used and the calibration is current.

For sample collection, the air sampler head, which holds the filter media, should be placed to represent the breathing zone of the workers in the respective work area.

Starting time, starting flow rate, time off, and ending flow rate are to be recorded and maintained with the filter media for analysis. A minimum of 450 cubic feet of air must be pulled through the filter media to obtain an adequate representative air sample or an air sample which will see the action level of 50% of a DAC for U-238/Th-234 (DU) or $1x10^{-11}\mu Ci/ml$. A minimum of eight hours of collection time is required to draw enough volume across the filter media to see 0.1 DAC or $2x10^{-12}\mu Ci/ml$. The air samplers will operate continuously throughout the work day.

All samples shall be removed from the sampler head very carefully to prevent loss of sample material. The samples will be separately packaged to prevent damage and ensure proper evaluation of sample activity at the analysis station.

4.8.5.2 Analysis

Counting instrumentation shall consist of a Ludlum Model 2929 Dual Channel Scaler or equivalent, attached to a Model 43-10-1 probe or equivalent. The probe shall be placed in a shielded area and be positioned over a slide tray for planchettes.

For routine air sample counting, the counter background shall not exceed 50 counts per minute (beta). Counting background and counting efficiency data shall be recorded on the Air Sample Data & Analysis Form (ATG Form 030). Supporting data required to obtain air sample results shall also be recorded on the Air Sample Data & Analysis Form.

Counting air samples for alpha or beta activity will require the determination of loading which will cause self shielding of the alpha/beta emissions. Samples with particulate buildup will require a correction, since only the alphas or betas emitted from or near the surface of the sample may be seen by the detector. The determination for a loaded filter will be made by visual indication of dust loading on the filter and weighing the filter before and after sampling. Any air sample filter which exhibits this property will be counted for alpha and beta activity to determine the airborne radiological content. The alpha airborne activity will be considered less reliable than the beta airborne activity determination in these cases. The beta airborne activity will have a self correction factor applied as determined by section 6.8.5 of HP-OP-010, 'Air Sampling and Analysis'. The self correction factor E' will be placed in the formula for Sscf. This factor will correct for the low-energy beta absorption on the filter and media that are not seen on the detector.

Information required for analysis includes; date, sample weight, counter background, counter efficiency, sample identification and location, time the sample was started and stopped, average flow rate, count start time, total count time, and total counts of the counter. Calculated results will be recorded in microcurie per cubic centimeter (μCi/cc) or (μCi/ml which are equivalent units), unless otherwise indicated.

Samples shall be carefully removed from the packaging to prevent loss of sampled material. Counting a sample consists of placing the filter paper in a planchet and positioning the planchet directly under the counter probe. Counting time will be ten minutes unless rapid evaluations are needed for unusual situations. A rapid evaluation could be assessed by using a count rate meter, but must be approved by the Project Manager and/or the Health and Safety Representative or designated alternate(s).

All air sampler filter papers will be submitted to the Radiation Safety Officer when initial sample results have been obtained.

The following formulae shall be used to calculate air sample activity levels (uCi/mL):

$$\{Tc/Tc_t\} - Bkg = Ccpm$$

$$\text{Activity} = \frac{Ccpm \times Sscf}{Ns_t \times Fl_r \times Eff \times Fe \times 2.22E{+}6 \times 2.83E{+}4}$$

Where: Tc	=	Total Counts
Tc_t	=	Total Count Time, min.
Bkg	=	Background Counts per minute
Ccpm	=	Corrected counts per minute
Ns_t	=	Net Sample Collection Time
Fl_r	=	Sample Flow Rate, cfm
Fe	=	Filter Collection Efficiency
2.83E+4	=	Conversion Factor for cubic feet to milliliters
2.22E+6	=	Number of dpm per uCi.
Eff	=	Instrument Efficiency, unitless
Sscf	=	Self-shielding correction factor, unitless

4.8.5.3 Action Levels

Action Levels of air sample results cannot always be readily attainable. All situations must be considered along with follow-up sampling and counting to aid in the final assessment. A background air sample station shall be established weekly to aid in determining the work area airborne contamination levels. The background air sample results shall be used as baseline data for determining airborne radioactivity concentrations.

If the work area airborne contamination exceeds 1.0×10^{-11} uCi/cc (50% of a DAC for U-238/Th-234) when respirators are not being worn, an evaluation must be made and comparisons to background air samples will take place to determine if a stop work condition exists. Evaluations must be made by the Site Radiation Protection Supervisor. If a stop work condition does exist, follow-up sampling shall be performed and evaluated prior to allowing work to continue. All air samples with results greater than 2.0×10^{-12} uCi/cc shall have a half life determination performed. Monitoring or count rate instrumentation used to determine the airborne activity will be operated such that the Minimum Detectable Activity (MDA) is of no greater than 2.0×10^{-12} uCi/cc -3δ.

The half life determination formula used is:

$$T_{1/2} = \frac{-0.693 \times t}{\ln (Ccpm_2/Ccpm_1)}$$

where: $T_{1/2}$ = Sample half-life (min)
t = Decay time between $Ccpm_1$ and $Ccpm_2$ (min)
$Ccpm_1$ = Corrected count rate at the start.
$Ccpm_2$ = Corrected count rate at the end.
ln = natural logarithm

If the half-life of the radionuclides on the filter paper is less than 75 minutes then short lived radionuclides of the Radon-222 family are assumed to be present.

Control measures should minimize the concentration that personnel are exposed to, to minimize internal dose. If the half-life of the radionuclides on the filter paper is greater than 75 minutes a more thorough assessment is required and the results brought to the attention of the Project Manager or designated alternate for documentation.

4.8.6 Soil Samples

Soil samples shall be collected following excavation of the subject areas to determine the total activity and the extent, if any, of migration of DU in the area(s). Samples shall contain approximately 1000 grams of soil from selected locations. The soil shall be placed in plastic bags, weighed, and labeled. At the time of collection, a Sample Status Log (ATG Form 049) shall be completed by the individual collecting the sample. A Chain of Custody Form shall also be initiated. The 1000 gram sample will be sent to Southeastern Environmental Laboratory (SC&A) in Montgomery, Alabama for analysis. This sample will be split into two 500-gram samples after being crushed and collated. One sample will be documented and saved. These samples will have either a gamma spectroscopy analysis, alpha spectroscopy analysis or both performances performed for the determination of U-238/Th-234 (DU) activity in the sample.

The Sample Status Log will be maintained by the Project Manager or designated alternate to track the soil samples.

Soil Sample analysis will be performed by SC&A's Southeastern Environmental Laboratory, located in Montgomery, Alabama, or equivalent certified radionuclide and hazardous materials laboratory. Sample results will be reported in picocuries per gram (pCi/gm). The detection limits for analysis shall be set at 8.75 pCi/gm minus the uncertainty value determined by the lab for DU (U-238/Th-234) for composited samples.

4.9 ALARA (As Low As Is Reasonable Achievable)

It is the intent of all radiological work practices that the efforts performed will be done in such a manner as to subject the individual to the lowest possible dose. Practices that will ensure this are compliance to the Project Work Plan, Health and Safety Plan, and Quality Assurance Plan. Also, compliance to procedural practices detailed in ATG Field Procedure , AD-004, 'Administrative/Regulatory/ALARA Compliance - Policy and Procedure' and in procedure AROP No. 106, 'ALARA Guidelines' as found in Appendix 8 and ATG Field Procedures. All radiological work activities will be performed under radiation work permits. Morning 'tailgate' meetings will be held to discuss safety issues and brief all personnel on the daily scheduled work activities and the performance of these tasks. These tailgate meetings will be documented. All equipment will be tested before being used in the field. All individuals involved in the performance of work task have 'stop work authority'. If for any reason a job is not being performed safely or correctly the job may be stopped and management notified until the situation may be remedied.

5.0 SAFETY RULES

5.1 Purpose

The purpose of the safety rules section is to provide a code of conduct which will allow for a smooth operation of the job site with as little time loss as possible due to violation of Safety Rules and Regulations. The safety rules apply to both the workers assigned to the project and visitors.

5.2 General Rules

Compliance with the Safety Rules is considered a condition of employment, and as such, disciplinary action may be taken for violations as necessary. Safety rule violation and disciplinary action will be determined by ATG management. All workers have the responsibility to report safety violations to their supervisor.

5.3 Safety Rules

The following safety rules have been compiled and reviewed by ATG management and will be accepted by all employees prior to employment. A copy of the Safety Rules and Regulations will be available at the job site and will be made available to any employee requesting a personal copy.

5.3.1 Employees must be in working clothes and ready for work at the designated starting time.

5.3.2 Employees may take lunch breaks only during designated times and must eat in the assigned area while on the job site. There will be no smoking, eating or drinking while handling any hazardous materials or within the work site.

5.3.3 Personnel will not quit work before the time designated for the conclusion of the work shift. There will be sufficient time allocated for removal of protective clothing or work clothes.

5.3.4 Employees must report to work each regularly scheduled work day. One hour call in time will be allowed to notify your superior of an absence. Excessive absentees will not be tolerated.

5.3.5 No employee will report to work under the influence of alcohol or drugs. Likewise, it is forbidden to carry or use alcohol or drugs on the job site or company property.

5.3.6 Personnel must comply with both verbal and written instructions from the project supervisor.

5.3.7 All personal work injuries must be reported to the Project Supervisor or Health and Safety Representative (or designated alternate).

5.3.8 All unsafe conditions, or unsafe acts must be reported to the Project

Radiological Controls Supervisor or the Health and Safety Representative (or designated alternate).

5.3.9 Any required personal protective devices and clothing must be properly worn by all personnel while on the job site.

5.3.10 Radiological monitoring equipment such as air samplers must not be tampered with or altered.

5.3.11 Good housekeeping by all personnel is considered mandatory.

5.3.12 Employees will not engage in malicious horse play, practical jokes or mischief while on the job site.

5.3.13 Fighting or attempting bodily injury to another employee while on the job site is not permitted.

5.3.14 Carrying a concealed weapon on the job site is expressly forbidden.

5.3.15 Falsifying company records or falsifying data will not be tolerated and will result in disciplinary action.

5.3.16 Equipment marked "Out Of Service" or "Do Not Use" shall not be used.

5.4 Disciplinary Actions

The following steps will be administered in a fair and nondiscriminatory manner:

5.4.1 All Disciplinary actions will be documented and maintained in the employee's personnel file.

5.4.2 Supervisory personnel are responsible for giving appropriate and specific safety instructions and are responsible for assuring that the instructions are clearly understood.

5.4.3 A violation of the safety rules will be promptly corrected. The violations will be documented by the supervisor and the employee will be given a copy of the written violation report.

5.4.4 Individual safety rule violations will be assessed on their merit with appropriate consideration given to the seriousness of the violation, the effect on the other employees, the employee's prior work record and previous safety violations. Any disciplinary action to be taken will be approved by the Project Director.

5.4.5 There may be some situations where the safety rule violation is so serious that modification or total disregard of the steps may be warranted. In these situations the employee may be suspended or terminated. It is suggested that in cases of this type, the employee be suspended pending the outcome of a full investigation of the incident and the employee's previous safety history. When this method is followed, the results of the investigation should determine the severity of the discipline to be administered.

6.0 STOP WORK CONDITIONS

During the performance of this contract, certain conditions may be encountered that will require specific work tasks to be immediately halted. Conditions such as; discovery of explosive materials, excessive contamination levels in a non-controlled environment, high wind speeds, extreme high or low temperatures, severe storms or flash floods. Depending on the specific work task that is being performed at the time on such an adverse condition, work may be halted until a safe condition exists to restart the task.

If time permits, the Project Manager or designated alternate will communicate with the Government representative to determine the appropriate action to be taken at a given time. The following guidelines will be used to aid in determining stop work conditions.

6.1 Discovery of any unexploded ordinance is a direct threat to personnel at the site and these materials must be avoided by all personnel. It has been stated by the Safety Office at Aberdeen Proving Grounds that there is little likelihood that this will be a problem, but caution is appropriate.

6.2 Excessive Contamination Levels in non controlled areas means that contamination levels in excess of 1000 dpm/100 cm^2 have been detected in non-contamination controlled areas. The non-contaminated areas that will be surveyed on a daily (shiftly) basis at a minimum are the entrance and exit points to the contamination zones and any other potential contamination escape paths or routes. All work tasks will immediately be halted and a concerted effort will be made to clean the affected area. The Radiation Safety Officer will be immediately notified of such conditions and work will not restart without his approval. This activity will be documented in the Daily work log and by survey documentation.

6.3 The guidance for the determination of working conditions for heat stress will be determined per the guidance given in the American Conference of Governmental and Industrial Hygienists (ACGIH), "Threshold limit values for Chemical Substances and Physical Agents and Biological Exposure Indices" under the Heat Stress Section. Working conditions will be explained to the workers each day by the Health and Safety Representative or designated alternate during the safety meetings and documented in the Final Report.

6.4 High Wind Speed means a steady wind speed in excess of 25 mph or wind gusts of 40 mph that seem to be ongoing throughout the day. Unsealed sources of radioactive material may be spread to non controlled areas if wind speeds are excessive. During high wind speeds the soil packaging activity will be performed inside a sheltered area but may still be affected by steady winds or wind gusts. If excessive winds are encountered, the soil packaging activity will cease and the soil containers will be sealed and the remaining soil covered with plastic. Other work activities may be halted at the discretion of the Site Coordinator.

6.5 Extreme High Temperatures means in excess of 105 degrees. Heat stress to the workers may occur (reference section 12.2.7). When high temperatures are occurring, specific work tasks that are hampered will be halted. Work tasks that require physical work or work tasks that protective clothing is required may be affected. The Project Manager or designated alternate will evaluate the conditions and determine if work tasks will be halted.

6.6 Extreme Low Temperatures means less than 10 degrees. When low temperatures are occurring, specific work tasks that are hampered will be halted. The Project Manager or designated alternate will evaluate the conditions and determine if work tasks will be halted.

6.7 Severe Storms or Flash Floods could cause all work tasks to be halted. Water damage to the controlled areas and wind barriers will cause all work tasks to be halted until the areas can be repaired. Should these type of conditions occur, the equipment and areas will be secured and evacuated. Prior to the restart of work, the Site Coordinator will receive approval from the contract administrator or the Radiation Safety Officer.

6.8 Natural Disasters will be handled on a case by case basis. Depending on the type and magnitude of the disaster, work operations will be determined by the Site Coordinator.

6.9 Discovery of unidentified underground utilities could cause all work tasks to be halted until the utilities are identified and disconnected by the proper authorities.

6.10 Unauthorized person(s) entering the exclusion zone would constitute work to be stopped and the proper authorities notified. The incident would be properly documented.

7.0 ACCIDENT REPORTING

NOTE: All accidents, injuries, fires, or any emergency incidents will be reported following the guidance of the Section 3.0 EMERGENCY PLAN.

7.1 Insurance

ATG's Worker Compensation Carrier has the responsibility for the following:

7.1.1 Making sure that every claimant is entitled to a fair investigation of his/her claim and a prompt decision as to its merit.

7.1.2 Determining how much a particular liability case is worth and negotiating a settlement within that range.

7.1.3 Making sure that cases of no liability, tenuous liability or those tainted by fraud are vigorously resisted.

7.1.4 Consulting with the company's Controller on all claims requiring settlement in excess of $5,000.00.

7.1.5 Consulting with the company's President or Vice President on all claims requiring settlement in excess of $10,000.00.

7.1.6 Maintaining the risk management reporting system, the risk detail report and forwarding monthly report updates to the company's President or Vice President.

7.2 Accident or Injury Reporting Requirements

All injuries shall be promptly reported to the ATG Project Manager, ATG Health and Safety Representative or designated alternates, and Aberdeen Proving Grounds Safety Office.

To make sure that each incident is properly and appropriately reported and recorded, the Foreman's Report of Injury or Illness (ATG Form 133) is required. The Foreman's Report of Injury or Illness will provide all of the information to generate the employees first report of an injury. It can also be used as the company's medical authorization. The Foreman's Report of Injury or Illness must be completed in detail for every accident, injury or illness which occurs to an ATG employee, visitor or subcontractor either in connection with or on company property or on a contracted job site. Every effort should be made to complete this form as quickly as possible following notification of the incident. The injured worker's foreman is responsible for completing this form. Once completed, the form should be reviewed and signed by the Health and Safety Representative or designated alternate and a copy forwarded to the insurance carrier. Copies shall be provided to U.S. Army Industrial Operations Command.

Accidents resulting in any fatality, lost-time injury or illness, hospitalization of 3 or more personnel, or property damage to government or contractor property (which occurred during performance of the contract) equal to or exceeding $2000.00 must be telephonically reported to USA, IOC as soon as possible, but not later than 2 hours after occurrence and reported in writing within 5 days of occurrence on DA Form 285 (encl). All other accidents/incidents must be telephonically reported to USA, IOC, (309) 782-0880, within 8 hours of occurrence.

7.3 Employee's First Report of Injury

The Project Manager or his/her designee shall report immediately by telephone, or in writing, to the nearest District Office of the Division of Occupational Safety and Health any serious injury, accident or death of an employee. "Immediately" is defined for this purpose to mean as soon as practical but no longer than twenty four hours after the employer knows of or should have known of the death, illness or serious injury. The Project Manager will notify the nearest office of the Division of Occupational Safety and Health whenever a State, County, or Local Fire or Police Agency is called to an accident involving an employee that has suffered a serious injury, illness or death. The injury will be reported using the appropriate form (Employer's First Report of Injury), as required by ATG's Workman's Compensation insurance carrier.

7.4 OSHA Forms

The OSHA Form 200 Log and Summary of Occupational Injury and Illness along with the OSHA Form 101, Supplementary Record, will be completed and maintained at the ATG Corporate office in Fremont, California.

The corporate office has the responsibility to record and report OSHA reportable incidents. All forms are available on request.

8.0 HAZARD COMMUNICATION PROGRAM

8.1 Purpose

The purpose of this written Hazard Communication Program is to comply with the requirements of the Code of Federal Regulations, Title 29, Part 1910.1200, "Hazard Communication". This program is site specific.

8.2 Policy

ATG as an employer engaged in a business within the Standard Industrial Classification, Codes 20 through 39, where chemicals or hazardous materials are either used or are produced for use. This program will assure that the hazards of all chemicals found in the work place will be evaluated and that information concerning their hazard will be transmitted to all affected employees.

The known hazard that will be handled on this project will be radioactive material and potential biological hazards. The hazards have been evaluated in this Project Health and Safety Plan. Communication to the employees will be handled in the project training and verified through the Project Quality Assurance Plan. Identification of the radiological hazard is required by posting radiological controlled areas and labeling containers or items that contain radioactive material in accordance with 10 CFR 20. All potential biological hazards will be properly labeled and the work site will have the proper postings.

Any currently unknown hazards will be handled in the same manner when they are encountered. The Project Manager or designated alternate will be responsible for conducting the evaluation, communication and identification.

Material Safety Data Sheets (MSDS) will be provided for all materials brought onto the site. All MSDS's will be placed alphabetically in a labeled notebook and in a designated highly visible area that is readily accessible for personnel and visitors. A copy of all MSDS's for the materials on-site will be provided to the fire department. The fire department will also be notified of the quantity of the material and the storage location. All personnel will be briefed on the materials on-site, the location of the MSDS's, and the proper way to use the MSDS's.

9.0 PROJECT ROLES AND RESPONSIBILITIES

ATG Project Manager

The ATG Project Manager or his designated alternate will have overall responsibility for ATG's conduct of the project on-site and off-site and will report to the IOC Project Manager/Point of Contact for oversight and management control. He/she will be the primary point of contact. He/she is to assure the project meets the objectives and contracted commitments. He/she has the direct management responsibility and authority for cost, schedule, quality and technical performances of all activities in support of the project. He/she is ultimately responsible for the implementation of all quality related activities. He/she is responsible for implementing and monitoring compliance with the operations plan and implementing corrective actions. The Project Manager, in concurrence with the ATG Health and Safety Representative and Base safety representatives will be authorized to make revisions to the Health and Safety Plan. Notifications of these revisions will be made to the USA-IOC Project Officer, ARL RSO, and APG Safety Officer. Other responsibilities include: selecting project staff and assigning duties, reporting to the project budgets and schedules, and identifying and resolving project specific problems. The Project Manager will assure the tasks are completed in a professional, efficient, and safe manner.

ATG Project Supervisor

The Project Supervisor is responsible for supervising all on-site operations for remedial actions including the coordination of project personnel, labor assignments and direction of subcontractors, administrative, documentation and record/survey activities in assistance to the project Manager, quality control of instrumentation, field assessment of existing radiological conditions and shall assist the Project Manager and Project Health & Safety Representative in conducting Site Specific safety meetings.

ATG Health and Safety Representative

The ATG Health and Safety Representative or his/her designated alternate is responsible for ensuring project activities are conducted according to corporate and site specific health and safety policies. He/she will be primary on-site contact for health and safety issues encountered during the project. The Health and Safety Representative will ensure that project personnel are properly trained and that documentation of their training is available on-site. He/she will ensure that project personnel are medically qualified for the work specified and respirator fit tested. He/she will ensure that the proper PPE is being worn and used correctly. He/she will control access to the site by visitors and unauthorized personnel. He/she will conduct daily safety meetings and perform safety inspections. The Health and Safety Representative, in concurrence with the ATG Project Manager and Base safety representatives will be authorized to make revisions to the Health and Safety Plan.

ATG Field Personnel

ATG Field Personnel will take all reasonable precautions to prevent injury to themselves and to their fellow workers by remaining alert to potential harmful situations. All tasks must be performed in accordance with the Project Work Plan and the Health and Safety Plan. Any unsafe conditions must be reported immediately to the Project Manager and/or Health and Safety Representative (or designated alternates. Personnel must report any medical conditions that may be affected by the work environment. All injuries must be reported - no matter how minor. The Field Personnel must read and comply with all postings and rules at the work site. Spilling and splashing of materials must be kept to a minimum. Good housekeeping must be maintained within and around the work area.

UXO - Unexploded Ordinance Specialist

This is an individual who is a graduate of the U. S. Naval EOD School, Indian Head, Maryland, or has received equivalent training and has practical UXO experience through the military as well as civilian sector. UXO personnel will sweep or walkdown all work areas with whatever equipment is necessary to determine the presence or potential presence of unexploded ordinances.

UXO personnel will give guidance to other personnel while working in a reason the avoidance of areas with unexploded ordinances. UXO personnel will in conjunction with responsible base personnel, coordinate removal and/or disarming UXO materials. UXO personnel have stop work authority to ensure no personnel work in or around ordinance material in a safe manner.

10.0 FORMS

10.1	ATGF-001	Radiological Survey Form
10.2	ATGF-002	Radiation Work Permit (RWP)
10.3	ATGF-010	Unconditional Release of Equipment or Items Report
10.4	ATGF-023	RWP Sign-In Sheet
10.5	ATGF-027	Training Attendance Record
10.6	ATGF-030	Air Sample Data & Analysis
10.7	ATGF-041	RWP Log
10.8	ATGF-047	Occupational Radiation Exposure History
10.9	ATGF-048	Air Sample Identification Record
10.10	ATGF-049	Sample Status Log

10.11 ATGF-109 Site Registration Form
10.12 ATGF-111 Lost Badge Report
10.13 ATGF-111a Badge Issue Log
10.14 ATGF-116 Contamination Report Index
10.15 ATGF-117 Personnel Contamination Report
10.16 ATGF-118 Clothing Contamination Report
10.17 ATGF-133 Foreman's Report of Injury or Illness

11.0 REFERENCES

11.1 U.S. Code of Federal Regulations, Title 10, "Energy", Part 19 and Part 20.

11.2 U.S. Code of Federal Regulations, Title 29, "Labor", Part 120.

11.3 U.S. Code of Federal Regulations, Title 40, "Protection of the Environment".

11.4 NUREG/CR 2082 "Monitoring for Compliance with Decommissioning Termination Survey Criteria".

11.5 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG 1575, EPA 402-R-97-106; 12/97

11.6 NUREG 1505 "A Non-Parometric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys, Draft"

11.7 NUREG 1507 "Minimum Detectable Concentrations with Typical Survey Instruments for Various Contaminants and Field Conditions"

11.8 NUREG/CR 5512, "Residual Contamination for Decommissioning".

11.9 NRC Decommissioning and Regulatory Issue Branch Technical Position, "A Summary of NRC & Interim Radiological Cleanup Criteria and Current Dose Bases" (November 1992).

11.10 U.S. Nuclear Regulatory Commission, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination

of Licenses for Byproduct, Source, or Special Nuclear Material (April, 1993), Office of Nuclear Material Safety and Safeguards (NMSS)".

11.11 ATG "Quality Assurance Plan for LCAAP Remediation"

11.12 ATG "Detailed Work Plan for LCAAP Decommissioning"

12.0 EMERGENCY PLAN

The objective of emergency response actions is to minimize adverse health risks to site workers, the environment, and local community. The Project Health and Safety Manager or designated alternate will be the site emergency coordinator.

The following is a course of action for any accidents or emergencies that may occur during this project and the immediate actions to be pursued. In any situation outside the scope of the work identified in this work plan, the actions taken should be to stabilize the area, notify appropriate personnel, contain the area and prevent unauthorized personnel from entering the area (thus minimizing their exposure and contact), surveying the area for all hazards, and then formulating a plan for recovery from the accident or situation. The following will be performed prior to work on site:

a. Locate the nearest telephone.

b. Confirm and post emergency telephone numbers.

c. Post site map of work areas marked with evacuation routes.

d. Inventory and check site emergency equipment and supplies.

e. If a radio is supplied, ensure it is charged and in good working condition.

Work is expected to be performed by ATG personnel over weekend periods or during installation non-duty hours, special arrangements will be made with the appropriate emergency service organizations.

12.1 Evacuations

In the event of an emergency that requires evacuation of the site, verbal instructions will be given by the Health and Safety Representative or designated alternate. During an emergency evacuation, personnel will proceed to the assembly point designated on the map unless conditions cause the assembly point to be unstable or harmful.
Verbal instructions will be given if evacuation beyond the assembly point is required. Personnel working on-site should not take time to monitor for contamination unless time allows. Contaminated personnel and areas they have been in contact with will be monitored when the conditions are stable and considered safe.

The following conditions would require evacuation:

- Fire
- Chemical Release
- Radiological Release
- Any event that an injury is incurred
- Any other event that would cause the working conditions to be unstable and no longer safe

The Project Health and Safety Representative or designated alternate will account for all personnel, ascertain information about the emergency, and advise further instructions to the on-site personnel. In the event that an evacuation occurs, the following will be performed prior to reentry:

a. The conditions resulting in the evacuation have been corrected.

b. The hazards have been reassessed.

c. The Work Plan and Health and Safety Plan have been revised accordingly and approved by the Project Health and Safety Representative, Project Manager, or designated alternates, and the appropriate facility personnel.

d. Site personnel have been informed on changes to the site and work conditions.

e. Site personnel have been informed on precautions to take and any change in PPE requirements.

f. The Project Health & Safety Representative or designated alternate has given the approval for reentry.

12.2 Medical Emergencies

If a situation occurs that results in the injury of personnel or visitors, the following actions shall be taken:

12.2.1 Stop all work activities. Ensure the area is in a safe condition.

12.2.2 Qualified personnel will provide first aid to the injured person.

12.2.3 In the event the injury is severe, the Project Health and Safety Representative or designated alternate will act as the emergency point of contact. Ensure the emergency personnel are aware that contamination may be present.

12.2.4 For any incident, accident, or injury, notify the Base Security Post at TBE and the ATG Project Manager or designated alternate.

12.2.5 If the injuries and time allow, the injured person will be surveyed for contamination and decontaminated if necessary.

12.2.6 If a hazardous material gets on the person's skin or eyes, the area will be flushed immediately with clean water until medical personnel arrive.

12.2.7 If a person succumbs to heat stress, the following should be used as a guide:

a. Heat cramps: Caused by heavy sweating and inadequate water and electrolyte replacement.

Symptoms: muscle spasms; pain in the hands, feet, and abdomen.

Treatment: drink Gatorade to replace fluids and electrolytes.

b. Heat Exhaustion: Caused by sustained exertion in a heated environment. Lack of acclimatization and failure to properly rehydrate may contribute.

Symptoms: clammy skin; heavy sweating; dizziness; nausea; and fainting.

Treatment: Promptly remove individual to a cooler environment and give water or Gatorade to replace fluids and electrolytes. If medical assistance is needed, contact emergency personnel immediately.

c. Heat stroke: the most serious form of heat stress occurs when temperature regulation fails and the body temperature rises to critical levels.

Symptoms: Red, hot, and dry skin; lack of, or reduced perspiration; nausea; dizziness or confusion; strong rapid pulse; and coma.

Treatment: Immediately summon emergency medical services. While waiting for emergency services to arrive, and if facilities are available, cool person by immersion in cold water or by wrapping in a wet sheet with vigorous fanning with cool dry air. Treat for shock.

12.2.8 High concentrations will be identified by the Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological

Exposure Indices (BEIs) as referenced in the Reference List.

12.3 Radiological Incident

A radiation incident may be defined as an unforseen occurrence, either actual or suspected, involving exposure or radiation. An accident is considered to occur over a short period of time, from seconds up to several days. Chronic occupational or other long-term exposure is not considered accidental.

There are two ways in which humans can be exposed to ionizing radiation:

1. External. The source of ionizing radiation may be outside of the body so that the radiation strikes the individual and is absorbed. Radiation from x-ray generators, particle accelerators, sealed sources of radionuclides, and reactors are examples. The radiation may be beta, gamma, or neutron. Alpha emitters present no significant external hazard.

2. Internal. The source of ionizing radiation may gain entrance into the human body by inhalation, ingestion, injection, or absorption through intact or abraded skin. Radionuclides may also be formed within the body following exposure to an external source of neutrons. All persons who are known or suspected to have been internally exposed to radioactive material will be reported to the Aberdeen Proving Grounds Radiation Protection Office.

SPECIFIC GUIDELINES

In the event of an emergency, the Project Health and Safety Representative or designated alternate will assume control of the situation and direct activities until relieved by proper authority. The exact actions and sequence of actions to be taken will be determined by the nature of the emergency. The following actions are typical responses to emergency situations, however, the sequence of these actions are highly variable.

12.3.1 Stop all work activities

12.3.2 Leave the area in a safe condition

12.3.3 Limit the radiation exposure and the spread of radiation contamination, if undue hazard to personnel does not result. For example:

a. Return sources to shield containers
b. Place absorbent material on spills
c. Turn off ventilation and equipment
d. Extinguish flames, heaters, etc.
e. Restrict access to the area

12.3.4 Perform radiological surveys (airborne, contamination, and radiation) to determine the nature and extent of the release and spread of contamination.

12.3.5 Contain the area with herculite or an equivalent material to prevent the continued spread of radioactive material and/or hazardous material to the environment.

12.3.6 Evacuate and survey all personnel to a identified safe area.

NOTE: In the event of any injury, this will take precedence to evacuate and place the injured individual in a safe condition. Immediate medical attention will be obtained for any injuries occurring during this operation.

All injuries will result in immediate work stoppage and evaluation of the conditions prior to recommencing activities under the direction of the Project Manager or designated alternate.

12.3.7 Radioactively contaminated personnel will receive all necessary medical care and treatment at the earliest practical time.

12.3.8 Radiation and radioactive contamination will not deter medical personnel in efforts to save life or limb, although slightly different techniques must be employed, e.g. rotating medical personnel to minimize exposure to any one individual, keep individual exposures As Low As Reasonably Achievable (ALARA), etc.

12.3.9 Radioactively contaminated personnel will be decontaminated at the earliest opportunity consistent with their medical needs.

12.3.10 Every effort will be made to minimize radiation exposure and the spread of contamination during medical treatment.

12.3.11 The ATG Project Manager or designated alternate will advise the Site RPO (Richard Markland) of the extent of contamination and exposure of the individual.

12.3.12 At the earliest possible time consistent with the patient's medical needs, the attending physician will allow decontamination to begin. Decontamination will be provided under the guidance of ATG Radiation Protection personnel.

12.3.13 All contaminated clothing, equipment, and waste material will be retained by ATG Radiation Protection personnel.

12.3.14 Contaminated valuables will be retained by ATG Radiation Protection personnel who will account for them, and will decontaminate them as soon as the situation permits so that they may be returned or disposed of properly. Valuables and personal property will not be disposed of as contaminated waste without written consent of the owner.

12.3.15 Formulate a recovery plan, obtain approval as required, and commence recovery operations.

12.4 Responsibilities

12.4.1 Personnel

All personnel are responsible for the following:

Become thoroughly familiar with the contents of this regulation prior to using radioactive material.

Take adequate precautionary measures to protect all personnel from unnecessary exposure to radiation.

Seek advice and assistance from ATG Radiation Protection personnel concerning the safety of an operation.

Prescribe rules, procedures, or protocols for the use of radioactive materials under his control to ensure proper and safe use. These will be made available to any radiation worker in the area and will be furnished for review and comment by Allied Technology Group.

Ensure that all rules, procedures, and practices of radiation safety are rigorously followed in the work area.

Report actual or potential emergency situations to the Project Health and Safety Representative or designated alternate.

Promptly contact ATG Radiation Protection personnel. Exposed individual(s) should cooperate in any and all attempts to evaluate his/her radiation exposure.

If working with radioactive material, maintain a current inventory of the quantity of radioactive material on hand to be readily available to the RPO upon request. The inventory will include the radionuclide(s), current activity, and form.

Evacuating the area immediately.

If qualified, provide first aid to the injured.

12.4.2 Management

All supervisors are responsible for the following:

Anticipate hazardous conditions and prevent them from occurring.

Ensure personnel are trained on emergency situations.

Ensure emergency contact numbers are current.

Ensure evacuation routes are clear.

Alert emergency personnel and act as the point of contact.

Account for all personnel.

The overall health and safety of their workers.

Limiting possible radiation exposure to the general public.

Notification of the IOC Project Manager and responsible base personnel if a radiation incident should occur involving contractors.

Generation of a written report of all incidents involving radiological hazards including the following as a minimum:

- The type of radiation incident: internal contamination, external contamination, or exposure.
- The number of contaminated individuals and their condition.

- The type of radioactive material.
- Efforts, if any, that have been made to decontaminate the individual at the accident site.
- Levels of radiation measured on the patient.

12.4.3 The Aberdeen Proving Grounds Radiation Protection Office will respond to all radiological emergencies and will:

Provide technical advice as necessary.

Arrange for additional resources, e.g. personnel, supplies, and equipment.

Provide assistance as needed.

Provide advice and radiation monitoring.

Provide exposure control and monitoring of staff personnel attending the patient.

Direct decontamination of the personnel at the earliest time consistent with medical needs.

If required, make a prompt investigation of the incident.

Issue specific guidance to minimize exposure of the staff or spread of contamination.

Such guidance will be developed on the scene by the Project Manager/RSO.

Make appropriate reports to MEDCOM, the Nuclear Regulatory

Commission (NRC), and other agencies in accordance with pertinent directives.

12.4.4 Medical Personnel

The medical personnel present at the scene of an accident will:

Evaluate the injury

Apply first aid

Take the person to a designated decontamination area

Employ contamination control measures

Follow recommendations whenever possible since radioactive contamination can necessitate very costly decontamination operations and result in the loss of facilities for many days.

Notify the IOC Project Manager and responsible site personnel.

12.5 Safety Signals

Vehicle, tractor, and portable gas-operated horns are used for safety signals as follows:

One Long Blast **WARNING ALARM** - prepare for emergency response

Two Short Blasts **ACTIVATION ALARM** - initiate emergency response activities as directed by Emergency Coordinator

Three Short Blasts **ALL CLEAR** - return to normal activities.

12.6 Emergency Information

Emergencies may include fires, fire hazards, accidents requiring first aid, or other incidents requiring emergency procedures. ATG and its subcontractors will, at all times, minimize potential emergencies. The following section lists emergency phone numbers which should be posted in all work areas:

EMERGENCY PHONE NUMBERS - Use 911 System or:

Emergency Operations Center	(410) 278-4500
Hospital (Emergency Room)	(410) 278-5215
Fire Department	(410) 436-4451
Security/Police	(410) 436-2222
Center for Disease Control (CDC)	(404) 452-4100
RCRA Hotline	(800) 424-9346
Poison Control Center	(619) 543-6000
National Response Center	(800) 424-8802

DIRECTIONS TO HOSPITAL

The nearest hospital is the Kirk U. S. Army Health Clinic which is on route 22 east, left hand side of the road, at the third traffic light.

12.7 Key ATG Personnel

POSITION	NAME	PHONE	PAGER
Project Manager/RSO	Lee Young	(423) 220-8030	(800) 690-6403
Project Supervisor	Terry Keane	(423) 220-8030	(888) 586-1118
H & S Representative	S. W. Leffew	(423) 220-8030	(888) 913-3940
Corporate Health Physicist	Joel Cehn	(800) 227-2840	

12.8 Key Facility Personnel

POSITION	NAME	PHONE
US Army IOC Contract Officer	Robert Matthys	(309) 782-5554

12.9 Other Key Organizations/Personnel

POSITION	NAME	PHONE
POC - U. S. Army APG	Matt Wilherle	(410) 278-0277
US Army IOC Project Manager	Mike Styvaert	(410) 322-6742
APG Health Physicist	Richard Markland	(410) 278-6354
U.S. NRC Region 1 Office	King of Prussia, PA	(800) 432-1156

13.0 SPILL PREVENTION CONTROL

Spill prevention control shall be as follows:

Secondary runoff will be controlled as described in Section 3.11 of the Resources Conservation and Recovery Act (RCRA) Facilities Closure Work Plan.

Decontamination pads (if required) will be constructed to contain all free liquids as described in Section 3.6 of the RCRA Facilities Closure Work Plan.

13.1 Spill Response

If a spill of hazardous material occurs, the following actions will be taken:

Notify the Project Manager, Project Supervisor, or Health & Safety Representative or designated alternates immediately.

Take immediate measures to control and contain the spill within site boundaries.

Keep unnecessary personnel away, isolate the hazardous area, and deny entry.

Stay upwind and keep out of low-lying areas.

Allow no flares, smoking, or flames in the hazard area.
For liquids, keep combustibles away from the spilled material.

Take necessary steps to clean up the spill and all contaminated material.

For acid spills, contain spill and dilute acid with water. Add as much water as possible for dilution. Slowly add soda ash, or other base, to neutralize the acid. Check the pH until neutrality is achieved. Proceed to the cleanup effort.

14.0 ACRONYMS

ACGIH	American Conference of Governmental and Industrial Hygienists
ALARA	As Low As Reasonably Achievable
APG	Aberdeen Proving Grounds
ATG	Allied Technology Group
BEI	Biological Exposure Indices
CDC	Center for Disease Control
CFR	Code of Federal Regulations
DU	Depleted Uranium
EOD	Explosive Ordnance Division
HBV	Hepatitis-B Virus
IOC	Industrial Operations Command
LEL	Lower Explosive Limit
MCI	Medical Center of Independence

MSDS	Material Safety Data Sheet
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety & Health Association
PPE	Personnel Protective Equipment
RCRA	Resources Conservation and Recovery Act
RPO	Radiation Protection Office
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
TLD	Thermoluminescent Dosimeter
TLV	Threshold Limit Value

FORMS

ABERDEEN PROVING GROUND

TRANSONIC RANGE
DEPLETED URANIUM STUDY AREA

DETAILED WORK PLAN
APPENDIX 5

UXO AVOIDANCE PLAN

SEPTEMBER 1999

ALLIED TECHNOLOGY GROUP

1. Purpose

Prescribe policies and procedures for performing ordnance avoidance, removal of debris, possible excavation of contaminated soil, during geo-technical surveys, decontamination, excavation, and soil removal operations.

2. Scope

This Work Plan applies to all agencies and personnel involved with the on-site UXO support activities at Aberdeen Proving Ground, Transonic Range, Depleted Uranium Study Area (DUSA), which have the potential for encountering Ordnance and Explosives (OE). These activities include, but are not limited to, surveying, soil sampling, decontamination, removal of debris, and excavation of contaminated soil.

3. References

DoD 6055.9 - STD	DoD Ammunition and Explosives Safety Standards
ATG	ATG Quality Assurance Program for UXO, OE and OD Projects
OSHA	OSHA Construction Industry Standard 29 CFR 1910.120
TM 9-1300-214	Military Explosives
TM 9-1300-206	Ammunition General

4. Definitions

Ordnance and Explosives (OE) - is an umbrella term to include anything related to munitions designed to cause damage to personnel of material through explosive force, incendiary action or toxic effects, such as bombs, guided and ballistic missiles, artillery, mortar and rocket ammunition, small arms ammunition, antipersonnel and antitank land mines, demolition charges, pyrotechnics, grenades, torpedoes and depth charges, containerized and uncontainerized high explosives and propellants, depleted uranium projectiles, toxic chemical agents, and all similar or related items or components in nature or otherwise designed to cause damage to personnel or material. Soils with explosive constituents will be considered OE if the concentration is sufficient to present an immediate safety hazard.

Unexploded Ordnance (UXO) - is an ordnance item which has been primed, fuzzed, armed, or otherwise prepared for action which has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to friendly operations, installations, personnel, or material and remains unexploded either through malfunction or design or for any other cause.

Chemical Agent - is a substance intended for use in military operations to kill, seriously injure, or incapacite a person through its physiological properties. Excluded from consideration are industrial chemicals, riot control agents, chemical herbicides, smoke, and flame.

Chemical Agent Material - is a quantity of chemical agent, or other substance or material contaminated with a chemical agent.

Inert Ordnance - is an item that has functioned as designed, leaving an inert carrier; an item manufactured to serve a specific training purpose or fragments from a UXO.

Explosive Ordnance Disposal (EOD) - is the detection, identification, field evaluation, rendering safe, recovery, and final disposal of OE.

EOD Personnel - are active duty military EOD individuals.

UXO Personnel - are former EOD individuals employed by a civilian contractor.

5. Policy

It is the ATG and the Department of Defense policy to provide the maximum possible protection to personnel and property from the damaging effects of potential accidents involving ammunition and explosives.

No person shall be required or instructed to work in surroundings or under conditions which are unsafe or dangerous to health.

Only military trained EOD/UXO personnel will handle UXO materials. The ATG UXO personnel shall not perform disposal activities.

UXO work schedules shall normally be based on an 8 hour work day. This may be modified with the approval of the ATG UXO Quality Assurance Officer.

All appropriate training and health certificates will be provided prior to commencing work at this site.

6. Procedures

6.1 Work Site Establishment

As site conditions warrant, the following zones will be established:

Exclusion Zone (EZ) - is the area where UXO/OE could be present. All personnel entering this area will enter and exit through an entry and exit control point. No smoking, eating, or drinking will be allowed in this area.

Contamination Reduction Zone (CRZ) - is that area immediately at the boundary of the entry and exit point in the EZ. This area will be used to control entry and exit and decontamination, as required, of personnel and equipment exiting the EZ.

Support Zone (SZ) - is the staging area for personnel and equipment that are supporting operations in the EZ. The SZ will include the site access control point, the command post, the equipment staging area, sanitary facilities, an area for visitors, and a break area.

NOTE: The boundaries of these zones may or may not coincide with boundaries set up for other purposes, e.g., radiation protection or haz-mat.

Prior to moving into the site, the UXO personnel shall examine the surface of the ground for the presence of UXO items. This reconnaissance shall include locating a clear path for the access and removal of the work crew, vehicles, and drilling/sampling equipment. Boundaries shall be marked to prevent personnel from straying into uncleared areas. No person shall be allowed into the uncleared areas.

Any UXO item that is found will be identified and moved into a safe area if the item is determined to be safe to move. If the item is not safe to move, it will be marked and left in place for handling by an EOD team. This information will be reported to the Government representative. The ATG UXO personnel shall not perform disposal activities.

6.2 UXO Sweeps and Surveys

Any type of activities (foot or vehicle traffic), within an area identified as being suspected of being contaminated with OE, will be preceded by a surface survey for UXO.

UXO support will be performed by one or two UXO persons, depending on the task to be performed.

During investigative activities, such as surveying, sampling, or drilling, UXO personnel will be available on site.

Magnetometer sweeps will precede any investigative or excavation activities, as required. Geophysical surveys (GPR/magnetometer) will be made on foot. Calibration, pre-operation, during-operation, and post-operation magnetometer checks will be made in accordance with manufacturer's instructions and other references, as required.

Surveys will be conducted at the DUSA excavation site(s). Once magnetometer sweeps have been performed, excavation operations may proceed. A UXO person will monitor excavation operations and instruct the equipment operator accordingly. If the magnetometer indicates a subsurface anomaly that the UXO person believes to constitute a UXO hazard, an alternative excavation method will be employed.

Procedures for excavating anomalies, as required, will normally be conducted using the earth moving equipment to gain access to within a foot of the anomaly. At that point the UXO individual will use hand digging instruments to uncover the anomaly until positive identification can be made.

6.3 UXO Support

If a UXO item is discovered, operations in that area will be halted until identification and disposition operations have been performed. UXO personnel will determine the condition of the UXO. If disposal action is required, military EOD support will be requested.

During UXO excavation operations, only those persons critical to the operation should be in the area.

During UXO related operations, the UXO personnel will not wear steel toed shoes or other equipment which could cause the magnetometer to present a false indication.

6.4 Qualifications for UXO Personnel

UXO Team Leader - This individual is a graduate of the US Naval EOD School, Indian Head, MD, and qualified, through past military and civilian experience, to serve as the senior UXO individual on site, during range clearance operations. He or she shall have documented experience in supervising range clearance operations and supervising personnel. He or she shall have at least 10 years of combined active duty EOD and civilian UXO experience.

UXO Specialist - This individual is a graduate of the US Naval EOD School, Indian Head, MD, and qualified, through past military and civilian experience, to serve as a UXO supervisor. He or she shall have at least 5 years of active duty EOD experience.

UXO Technician / Assistant - This individual is a graduate of the US Naval EOD School, Indian Head, MD. He or she has at least 5 years of combined active duty EOD and civilian UXO experience.

Appendix C: Instrument and Source Calibration Certificates

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 295451 / 271487

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 162425

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR 182403

Cal. Date 15-Apr-03 Cal Due Date 15-Apr-04 Cal. Interval 1 Year Meterface 202-848

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 78 °F RH 38 % Alt 700.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity

☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism

☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 900 V Input Sens. Comment mV Det. Oper. 900 V at Comment mV Threshold Dial Ratio ______ = ______ mV

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. ~~750~~ 1500 / 1490 V

COMMENTS:

```
T: 120mv
T: 3.5mv
W: 30mv
L set to simulated light leak
irmware: 390094
```

Calibrated with 6ft cable

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X1000	800kcpm	800	800
X1000	200kcpm	200	200
X100	80kcpm	800	800
X100	20kcpm	200	200
X10	8kcpm	800	800
X10	2kcpm	200	200
X1	800cpm	800	800
X1	200cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

Digital Readout	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*	Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
	800kcpm	798221	798221				
	80kcpm	79863	79863				
	8kcpm	7987	7987				
	800cpm	799	799				
	80cpm	80	80				

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Pu-239 2928-01 ☑ Beta S/N Sr-90/Y-90 4016, Tc-99 NI-EV ☐ Other

☑ m 500 S/N 134709 ☐ Oscilloscope S/N ☑ Multimeter S/N 57390613

Calibrated By: Conrad Galindo Date 15 Apr 03

Reviewed By: Rhonda Harris Date 16 Apr 03

FORM C22A 04/09/2003

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR182403

Order #. 295451 / 271487

Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162425

Beta Input Sensitivity 35 mV

Count Time 1Minute

Beta Window 30 mV

Other

Distance Source to Detector Surface

High Voltage	Background Alpha	Background Beta	Isotope Pu-239 Size 12200 cpm Alpha	Pu-239 Beta	Isotope Sr-90 Y-90 Size 44770 Alpha	Sr-90 Y-90 Beta	Isotope Tc-99 Size 14100 cpm Alpha	Tc-99 Beta
850	0	110	5802	385	2	13110	1	4022
875	0	161	6006	421	0	16757	0	4786
900	0	214	6152	604	3	20357	0	5339
925	0	260	6082	849	5	22934	3	6078
950	3	290	6313	1255	3	23062	1	6520

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Conrad Galindo

Date 15Apr03

FORM C4B 04/09/2003

of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 277968 / 262820

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 162425

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR 182403

Cal. Date 5-Apr-02 Cal Due Date 5-Apr-03 Cal. Interval 1 Year Meterface 202-848

Check mark ✓ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 20 % Alt 707.8 mm Hg

New Instrument Instrument Received ✓ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. Requiring Repair Other-See comments

✓ Mechanical ck. ✓ Meter Zeroed ☐ Background Subtract Input Sens. Linearity
F/S Resp. ck ✓ Reset ck. ✓ Window Operation ✓ Geotropism
✓ Audio ck. Alarm Setting ck. ✓ Batt. ck. (Min. Volt) 2.2 VDC

✓ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 750 V Input Sens. Comment mV Det. Oper. 750 V at Comment mV Threshold Dial Ratio = m

✓ HV Readout (2 points) Ref./Inst. ~~500~~ 498 / 500 V Ref./Inst. 1500 / 1500 V

COMMENTS:

```
Alpha sensitivity = 120mv.
 Beta sensitivity = 3.5mv.
      Beta window =  30mv.
  Firmware number = 390094
Overload set simulating light leak.
High voltage set with detector connected.
```

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	800kcpm	800	800
x1000	200kcpm	200	206
x100	80kcpm	800	800
x100	20kcpm	200	206
x10	8kcpm	800	800
x10	2kcpm	200	200
x1	800cpm	800	800
x1	200cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	800kcpm	800422	800422
	80kcpm	80011	80011
	8kcpm	8008	8008
	800cpm	800	800
	80cpm	80	80

Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

✓ Alpha S/N 4337, Pu 239 ✓ Beta S/N 635/83,Tc99 * 5030,Sr90y90 ☐ Other

m 500 S/N 94940 ☐ Oscilloscope S/N ✓ Multimeter S/N 50100581

Calibrated By: Eliot Crane Date 05-APR-02

Reviewed By: Rhonda Harris Date 5 Apr 02

This certificate shall not be reproduced except in full, without the written approval of Ludlum Measurements, Inc.
FORM C22A 10/31/2001

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test
Failed:

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR182403 Order #. 277968 / 262820

Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162425

Beta Input Sensitivity 3.5 mV

Count Time 1Minute

Beta Window 30 mV

Other

Distance Source to Detector Surface

High Voltage	Background Alpha	Background Beta	Isotope Pu239 Size 15,700cpm Alpha	Beta	Isotope Tc99 Size 14,300cpm Alpha	Beta	Isotope Sr90Y90 Size 6896cpm Alpha	Beta
700	0	34	5527	384	2	1702	0	1594
725	2	68	6289	376	8	2651	0	2246
750	0	112	6956	346	8	3710	0	2989
775	1	136	7100	466	9	4555	0	3785
800	0	115	7237	567	7	5262	1	4727

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.
☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Elias Chavez Date 05-APR-02

FORM C4B 12/09/97

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 212582/279960

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 162426

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR193921

Cal. Date 11-Mar-04 Cal Due Date 11-Mar-05 Cal. Interval 1 Year Meterface 202-848

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 76 °F RH 20 % Alt 706.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 825 V Input Sens. Comments mV Det. Oper. 825 V at comments mV Threshold Dial Ratio = mV

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 1500 / 1500 V

COMMENTS:
Alpha threshold = 120 mV
Beta threshold = 3.5 mV
Beta window = 30 mV
Firmware: 390096
OL set to simulated light leak.
Cal'd with 6' cable.

...ma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	800kcpm	800	800
x1000	200kcpm	200	200
x100	80kcpm	800	800
x100	20kcpm	200	200
x10	8kcpm	800	800
x10	2kcpm	200	200
x1	800cpm	800	800
x1	200cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	800kcpm	801124	801124	Log Scale			
	80kcpm	80112	80112				
	8kcpm	8011	8011				
	800cpm	801	801				
	80cpm	80	80				

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Th-230-5020-03 ☑ Beta S/N Tc-99-NI-EV, Sr-90-4016 ☐ Other

☑ m 500 S/N 132899 ☐ Oscilloscope S/N ☑ Multimeter S/N 82080087

Calibrated By: Josh Boston Date 11 Mar 04

Reviewed By: [signature] Date 15 MAR 04

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed

FORM C22A 10/31/2001

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR193921

Order #. 212582/279960

Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162426

Beta Input Sensitivity 3.5 mV

Count Time 1Minute

Beta Window 30 mV

Other

Distance Source to Detector Surface

High Voltage	Background		Isotope Th-230 Size 2910 cpm		Isotope Tc-99 Size 14400 cpm		Isotope Sr Y-90 Size 43732 cpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
800	1	101	1110	235	2	3547	4	16680
825	0	196	1196	244	7	4656	2	19525
850	0	458	1197	361	2	5473	2	20755

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Josh Boston

Date 11 Mar 04

FORM C48 12/09/97

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 202974/275180

Mfg. Ludlum Measurements, Inc. Model 2929 Serial No. 163827

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR 171322

Cal. Date 8-Sep-03 Cal Due Date 8-Sep-04 Cal. Interval 1 Year Meterface 202-014

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 48 % Alt 701.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☐ Window Operation

☑ Audio ck.

☑ Meter Zeroed Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 825 V = 3.28 on High Voltage dial. High Voltage set with detector connected.

☑ HV Readout (2 points) Ref./Inst. 500 / 502 V Ref./Inst. 2000 / 2002 V

COMMENTS:

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

Alpha Channel Digital Readout	REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
	400K cpm	40143 (0)	40143 (0)
	40K cpm	4006	4006
	4K cpm	402	402
	400 cpm	40	40
	40 cpm	4	4

Beta/Gamma Channel Digital Readout	REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
	400K cpm	40183 (0)	40183 (0)
	40K cpm	4018	4018
	4K cpm	402	402
	400 cpm	40	40
	40 cpm	4	4

Uncertainty within ± 10% C.F. within ± 20%

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N PU-239#2928-01 12.6kCPM ☑ Beta S/N TC-99#NI-EV C14#GV-471 ☐ Other

☐ 500 S/N 54683 ☐ Oscilloscope S/N ☑ Multimeter S/N 70602489

Calibrated By: Duain Jackson Date 8-Sep-03

Reviewed By: [signature] Date 8 Sep 03

FORM C25 04/09/2003

AC Inst. Only ☑ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-10-1 Serial No. PR 171322 Order #. 202974/275180

Customer CABRERA SERVICES

Alpha Input Sensitivity 175 mV

Counter 2929 Serial No. 163827

Beta Input Sensitivity 4 mV

Count Time 1Minute

Beta Window 50 mV

Other

Distance Source to Detector Tray

High Voltage	Background Alpha	Background Beta	Isotope Pu-239, Size 12.6kcpm Alpha	Isotope Pu-239, Size 12.6kcpm Beta	Isotope Tc99, Size 14,100cpm Alpha	Isotope Tc99, Size 14,100cpm Beta	Isotope C14, Size 91.8Kcpm Alpha	Isotope C14, Size 91.8Kcpm Beta
800	1	50	10160	231	3	5334	1	12719
825	1	59	9923	225	0	5998	2	18140
850	1	63	10003	219	1	6755	0	24187

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Duaine Jackson

Date 8-Sep-03

FORM C4B 04/09/2003

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 291453/269534

Mfg. Ludlum Measurements, Inc. Model 2929 Serial No. 163827

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR171322

Cal. Date 21-Jan-03 Cal Due Date 21-Jan-04 Cal. Interval 1 Year Meterface 202-014

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 76 °F RH 20 % Alt 700.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Window Operation

☑ Audio ck.

☑ Meter Zeroed Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 825 V = 3.28 on High Voltage dial. High Voltage set with detector connected.

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2010 / 2000 V

COMMENTS:

Th230 #2748
Current Activity: 6130dpm
Source count minus background: 2772 cpm
Eff: 45 %(4pi)

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

Alpha Channel Digital Readout

REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400K cpm	39994 (o)	39994 (o)
40K cpm	4002	4002
4K cpm	400	400
400 cpm	40	40
40 cpm	4	4

Beta/Gamma Channel Digital Readout

REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400K cpm	40012 (o)	40012 (o)
40K cpm	4001	4001
4K cpm	400	400
400 cpm	40	40
40 cpm	4	4

Uncertainty within ± 10% C.F. within ± 20%

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Th230 #2748 ☑ Beta S/N Tc99 NI-EV, C14 GV471 ☐ Other

☐ m 500 S/N 57885 ☐ Oscilloscope S/N ☑ Multimeter S/N 71300353

Calibrated By: [signature] Date 21-Jan-03

Reviewed By: [signature] Date 22 Jan 03

AC Inst. Only ☑ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

FORM C25 10/31/2001

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-10-1 Serial No. PR 171322 Order #. 291453/269534

Customer CABRERA SERVICES Alpha Input Sensitivity 175 mV

Counter 2929 Serial No. 163827 Beta Input Sensitivity 4 mV

Count Time 1Minute Beta Window 50 mV

Other Distance Source to Detector Tray

High Voltage	Background		Isotope Th 230 Size 6130 dpm		Isotope C 14 Size 240 kdpm		Isotope Tc 99 Size 22.6 dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
775	0	37	2214	196	0	9278	0	5098
800	1	49	2588	187	1	13647	0	6268
→ 825	0	58	2772	232	1	19991	2	7028
850	0	69	2738	281	4	24368	2	7567

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Jeromy [illegible] Date 21-Jan-03

FORM C4B 12/09/97

of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 289386/268534

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 162426

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR 193921

Cal. Date 15-Jan-03 Cal Due Date 15-Jan-04 Cal. Interval 1 Year Meterface 202-848

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 72 °F RH 20 % Alt 709.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 800 V Input Sens. Comm. mV Det. Oper. 800 V at Comm. mV Threshold Dial Ratio ______ = ______ mV

☑ HV Readout (2 points) Ref./Inst. 505 / 500 V Ref./Inst. 1513 / 1500 V

COMMENTS:

Alpha Thshld: 120 mv
Beta Thshld: 3.6 mv
Beta Win: 30 mv
Firmware No. 390096

Cal'd using 5' c/c Cable.
OL Set to Simulate light leak.
efficiency for Th^{230} 5390 dpm is 19% 4π.
(1024 cpm) Th^{230} S/N 1619

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X1000	800kcpm	800	800
X1000	200kcpm	200	200
X100	80kcpm	800	800
X100	20kcpm	200	200
X10	8kcpm	800	800
X10	2kcpm	200	200
X1	800cpm	800	800
X1	200cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	800kcpm	801320 kcpm	801320 kcpm
	80kcpm	80129 "	80129 "
	8kcpm	8013 "	8013 "
	800cpm	801 cpm	801 cpm
	80cpm	80 "	80 "

Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☐ Alpha S/N ______ ☐ Beta S/N ______ ☐ Other ______

☑ m 500 S/N 54680 ☐ Oscilloscope S/N ______ ☑ Multimeter S/N 69101832

Calibrated By: [signature] Date 15-Jan-03

Reviewed By: Rhonda Harris Date 16 Jan 03

FORM C22A 10/31/2001

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed: ______

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR 193921

Order #. 289386/268534

Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162426

Beta Input Sensitivity 3.6 mV

Count Time 1 Minute

Beta Window 30 mV

Other

Distance Source to Detector Surface

High Voltage	Background Alpha	Background Beta	Isotope Pu 239, Size 12,600 cpm Alpha	Isotope Pu 239, Size 12,600 cpm Beta	Isotope Tc 99, Size 14,300 cpm Alpha	Isotope Tc 99, Size 14,300 cpm Beta	Isotope Sr90Y90, Size 44979 cpm Alpha	Isotope Sr90Y90, Size 44979 cpm Beta
750	0	97	4720	347	7	2532	0	11770
775	0	141	5110	370	6	3590	0	15651
— 800	1	197	5472	425	10	4408	3	19451
825	0	269	5673	469	11	5058	2	21624
850	1	322	5744	652	11	5698	2	22583

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature [signature]

Date 15-Jan-03

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CERTIFICATE OF CALIBRATION

CUSTOMER CABRERA SERVICES ORDER NO. 295451 / 271487

Mfg. Ludlum Measurements, Inc. Model 2224-1 Serial No. 162425

Mfg. Ludlum Measurements, Inc. Model 43-93 Serial No. PR 182403

Cal. Date 15-Apr-03 Cal Due Date 15-Apr-04 Cal. Interval 1 Year Meterface 202-848

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 78 °F RH 38 % Alt 700.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 900 V Input Sens. Comment mV Det. Oper. 900 V at Comment mV Threshold Dial Ratio ______ = ______ mV

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. ~~749~~ 1500 / 1490 V

COMMENTS:

```
T: 120mv
T: 3.5mv
W: 30mv
L set to simulated light leak
irmware: 390094
```

Calibrated with 60" cable

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
X1000	800kcpm	800	800
X1000	200kcpm	200	200
X100	80kcpm	800	800
X100	20kcpm	200	200
X10	8kcpm	800	800
X10	2kcpm	200	200
X1	800cpm	800	800
X1	200cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

Digital Readout

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
800kcpm	798621	798621
80kcpm	79863	79863
8kcpm	7987	7987
800cpm	799	799
80cpm	80	80

Log Scale

REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Pu-239 2928-01 ☑ Beta S/N S-90/Y-90 wide, Tc-99 Ni-EV ☐ Other

☑ m 500 S/N 134709 ☐ Oscilloscope S/N ☑ Multimeter S/N 57390613

Calibrated By: Conrad Galindo Date 15 Apr 03

Reviewed By: Rhonda Harris Date 16 Apr 03

FORM C22A 04/09/2003

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR182403

Order #. 295451 / 271487

Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162425

Beta Input Sensitivity 35 mV

Count Time 1Minute

Beta Window 30 mV

Other

Distance Source to Detector Surface

High Voltage	Background		Isotope Pu-239 Size 12600 cpm		Isotope Sr-90 Y-90 Size 44910		Isotope Tc-99 Size 14100 cpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
850	0	110	5802	385	2	13110	1	4062
875	0	161	6006	421	0	16757	0	4786
900	0	214	6152	604	3	20357	0	5339
925	0	260	6082	849	5	22934	3	6078
950	3	290	6313	1255	3	23062	1	6520

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Conrad Galindo

Date 15Apr03

of
Scientific and Industrial
Instruments

POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CERTIFICATE OF CALIBRATION

CUSTOMER CABRERA SERVICES ORDER NO. 277968 / 262820

Ludlum Measurements, Inc. Model 2224-1 Serial No. 162425

Ludlum Measurements, Inc. Model 43-93 Serial No. PR 182403

Cal. Date 5-Apr-02 Cal Due Date 5-Apr-03 Cal. Interval 1 Year Meterface 202-848

Check mark ✓ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 20 % Alt 707.8 mm Hg

New Instrument Instrument Received ✓ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. Requiring Repair Other-See comments

✓ Mechanical ck. ✓ Meter Zeroed ☐ Background Subtract Input Sens. Linearity
F/S Resp. ck ✓ Reset ck. ✓ Window Operation ✓ Geotropism
✓ Audio ck. Alarm Setting ck. ✓ Batt. ck. (Min. Volt) 2.2 VDC

✓ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 750 V Input Sens. Comment mV Det. Oper. 750 V at Comment mV Threshold Dial Ratio = m

✓ HV Readout (2 points) Ref./Inst. ~~488~~ 498 / 500 V Ref./Inst. 1500 / 1500 V

COMMENTS:

```
Alpha sensitivity = 120mv.
 Beta sensitivity = 3.5mv.
      Beta window =  30mv.
  Firmware number = 390094
Overload set simulating light leak.
High voltage set with detector connected.
```

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	800kcpm	800	800
x1000	200kcpm	200	200
x100	80kcpm	800	800
x100	20kcpm	200	200
x10	8kcpm	800	800
x10	2kcpm	200	200
x1	800cpm	800	800
x1	200cpm	200	200

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	800kcpm	800422	800422
	80kcpm	80011	80011
	8kcpm	8008	8008
	800cpm	800	800
	80cpm	80	80

Log Scale	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N 1162 ☐ G112 M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 Neutron Am-241 Be S/N T-304

✓ Alpha S/N 4337, Pu 239 ✓ Beta S/N 635/83,Tc99 * 5030,Sr90y90 ☐ Other

m 500 S/N 94940 ☐ Oscilloscope S/N ✓ Multimeter S/N 50100581

Calibrated By: Elias Chavez Date 05-APR-02

Reviewed By: Rhonda Harris Date 5 Apr 02

FORM C22A 10/31/2001

AC Inst. Only Passed Dielectric (Hi-Pot) and Continuity Test Failed:

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR182403 Order #. 277968 / 262820

Customer CABRERA SERVICES

Alpha Input Sensitivity 120 mV

Counter 2224-1 Serial No. 162425

Beta Input Sensitivity 3.5 mV

Count Time 1 Minute

Beta Window 30 mV

Other

Distance Source to Detector Surface

High Voltage	Background		Isotope Pu239 Size 15,700cpm		Isotope Tc99 Size 14,300cpm		Isotope Sr90Y90 Size 6896cpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
700	0	34	5527	384	2	1702	0	1594
725	2	68	6289	376	8	2651	0	2246
750	0	112	6956	346	8	3710	0	2989
775	1	136	7100	466	9	4555	0	3785
800	0	195	7237	567	7	5262	1	4727

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Elio Chevez

Date 05-APR-02

of
Scientific and Industrial
Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER CABRERA SERVICES ORDER NO. 288694/268183

Mfg. Ludlum Measurements, Inc. Model 2929 Serial No. 171590

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR 174813

Cal. Date 14-Nov-02 Cal Due Date 14-Nov-03 Cal. Interval 1 Year Meterface 202-014

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 72 °F RH 25 % Alt 698.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Window Operation

☑ Audio ck.

☑ Meter Zeroed Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 875 V = 3.47 on High Voltage dial. High Voltage set with detector connected.

☑ HV Readout (2 points) Ref./Inst. 480 / 500 V Ref./Inst. 2004 / 2000 V

COMMENTS: efficiency for Th 230 6130 dpm is 40.6 % 4π.
S/N 2748

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

Alpha Channel Digital Readout

REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400K cpm	400126	400126
40K cpm	40024	40024
4K cpm	4002	4002
400 cpm	400	400
40 cpm	40	40

Beta/Gamma Channel Digital Readout

REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400K cpm	400186	400186
40K cpm	40026	40026
4K cpm	4002	4002
400 cpm	400	400
40 cpm	40	40

Uncertainty within ± 10% C.F. within ± 20%

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Th 230 6130 dpm ☑ Beta S/N C 14 240 Kdpm · Tc 99 22.9 Kdpm ☐ Other

☐ 500 S/N 54680 ☐ Oscilloscope S/N ☑ Multimeter S/N 69101832

Calibrated By: Date 14-Nov-02

Reviewed By: Rhonda Herrin Date 14 Nov 02

FORM C25 10/31/2001

AC Inst. Only ☑ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-10-1 Serial No. PR 174813

Order #. 288694/268183

Customer CABRERA SERVICES

Alpha Input Sensitivity 175 mV

Counter 2929 Serial No. 171590

Beta Input Sensitivity 4 mV

Count Time 1 Minute

Beta Window 50 mV

Other

Distance Source to Detector Tray

High Voltage	Background Alpha	Background Beta	Isotope C^{14}, Size 240 Kdpm Alpha	Isotope C^{14} Beta	Isotope Tc^{99}, Size 22.9 Kdpm Alpha	Isotope Tc^{99} Beta	Isotope Th^{230}, Size 6130 dpm Alpha	Isotope Th^{230} Beta
800	0	46	0	13556	9	6440	2360	221
825	0	57	0	17725	7	7052	2415	234
850	0	55	0	22625	13	7694	2356	264
875	0	68	0	28130	3	8160	2493	292
900	1	76	0	33862	12	8579	2550	371
925	0	63	1	38298	14	8806	2469	390
950	0	86	0	43421	11	8369	2495	527

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature

Date 14-Nov-02

FORM C4B 12/09/97

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CERTIFICATE OF CALIBRATION

CUSTOMER CABRERA SERVICES ORDER NO. 296065 / 271810

Mfg. Ludlum Measurements, Inc. Model 2929 Serial No. 129566

Mfg. Ludlum Measurements, Inc. Model 43-10-1 Serial No. PR 132720

Cal. Date 24-Apr-03 Cal Due Date 24-Apr-04 Cal. Interval 1 Year Meterface 202-825

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 74 °F RH 20 % Alt 695.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☐ Window Operation

☑ Audio ck.

☑ Meter Zeroed Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 700 V = 2.84 on High Voltage dial. High Voltage set with detector connected.

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2000 / 2020 V

COMMENTS:

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

Alpha Channel Digital Readout	REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
	400K cpm	399868	399868
	40K cpm	39984	39984
	4K cpm	3999	3999
	400 cpm	400	400
	40 cpm	40	40

Beta/Gamma Channel Digital Readout	REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
	400K cpm	399918	399918
	40K cpm	39991	39991
	4K cpm	3999	3999
	400 cpm	400	400
	40 cpm	40	40

*Uncertainty within ± 10% C.F. within ± 20%

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Pu-239 2928-01 ☑ Beta S/N Tc-99 Ni-EV , C-14 GV471 ☐ Other

☐ m 500 S/N 134709 ☐ Oscilloscope S/N ☑ Multimeter S/N 57390613

Calibrated By: Conrad Galindo Date 24 Apr 03

Reviewed By: Rhonda Harris Date 24 Apr 03

FORM C25 04/09/2003

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

Bench Test Data For Detector

Detector 43-10-1 Serial No. PR 132720 Order #. 296065 / 271810

Customer CABRERA SERVICES

Alpha Input Sensitivity 125 mV

Counter 2929 Serial No. 129566

Beta Input Sensitivity 4 mV

Count Time 1Minute

Beta Window 50 mV

Other

Distance Source to Detector Tray

High Voltage	Background Alpha	Background Beta	Isotope Pu-239, Size 12600cpm Alpha	Isotope Pu-239, Size 12600cpm Beta	Isotope Tc-99, Size 14100cpm Alpha	Isotope Tc-99, Size 14100cpm Beta	Isotope C-14, Size 91800cpm Alpha	Isotope C-14, Size 91800cpm Beta
650	0	49	9708	310	3	5848	0	11557
675	0	52	9692	307	1	4866	0	17902
700	0	59	9760	316	2	7469	0	24351
725	0	68	9798	318	1	8305	0	31229
750	1	72	9892	370	4	8884	0	37565

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☐ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Conrad Galindo

Date 24Apr03

FORM C4B 04/09/2003

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 3863
P.O.# 02-055

Description of Standard:

Model No. DNS-11 Serial No. 3972-02 Isotope Th-230

Electroplated on polished SS disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2pi alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below, and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated alpha source S/N 2393/91 .

Measurement Result:

The observed alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was:

7,970 ± 398

The total disintegration rate (dpm) assuming 1.5% backscatter of alpha particles from the surface of the disc, was:

15,700 ± 785 (0.00708 µCi)

The uncertainty of the measurement is 5 %, which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: ART REUST Reviewed by: [signature]

Calibration Technician: [signature] Q.A. Representative: [signature]

Calibration Date: 4-29-2002 Reviewed Date: 4-29-02

Analytical Services
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4238
(505) 345-3461 Fax (505) 761-5416
Toll Free (866) RAD-LABS (723-5227)
www.eberlineservices.com

EBERLINE
SERVICES

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# 3759
P.O.# 01-325

Description of Standard:

Model No. DNS-11 Serial No. 2897-01 Isotope Th-230

Electroplated on polished SS disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2pi alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below, and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated alpha source S/N 2393/91.

Measurement Result:

The observed alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was:

11,400 ± 343

The total disintegration rate (dpm) assuming no backscatter of alpha particles from the surface of the disc, was:

22,800 ± 685 (0.0103 µCi)

The uncertainty of the measurement is 3 %, which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: ART REUST Reviewed by: Barbara M. Fu[illegible]

Calibration Technician: Art Reust Q.A. Representative: [illegible]

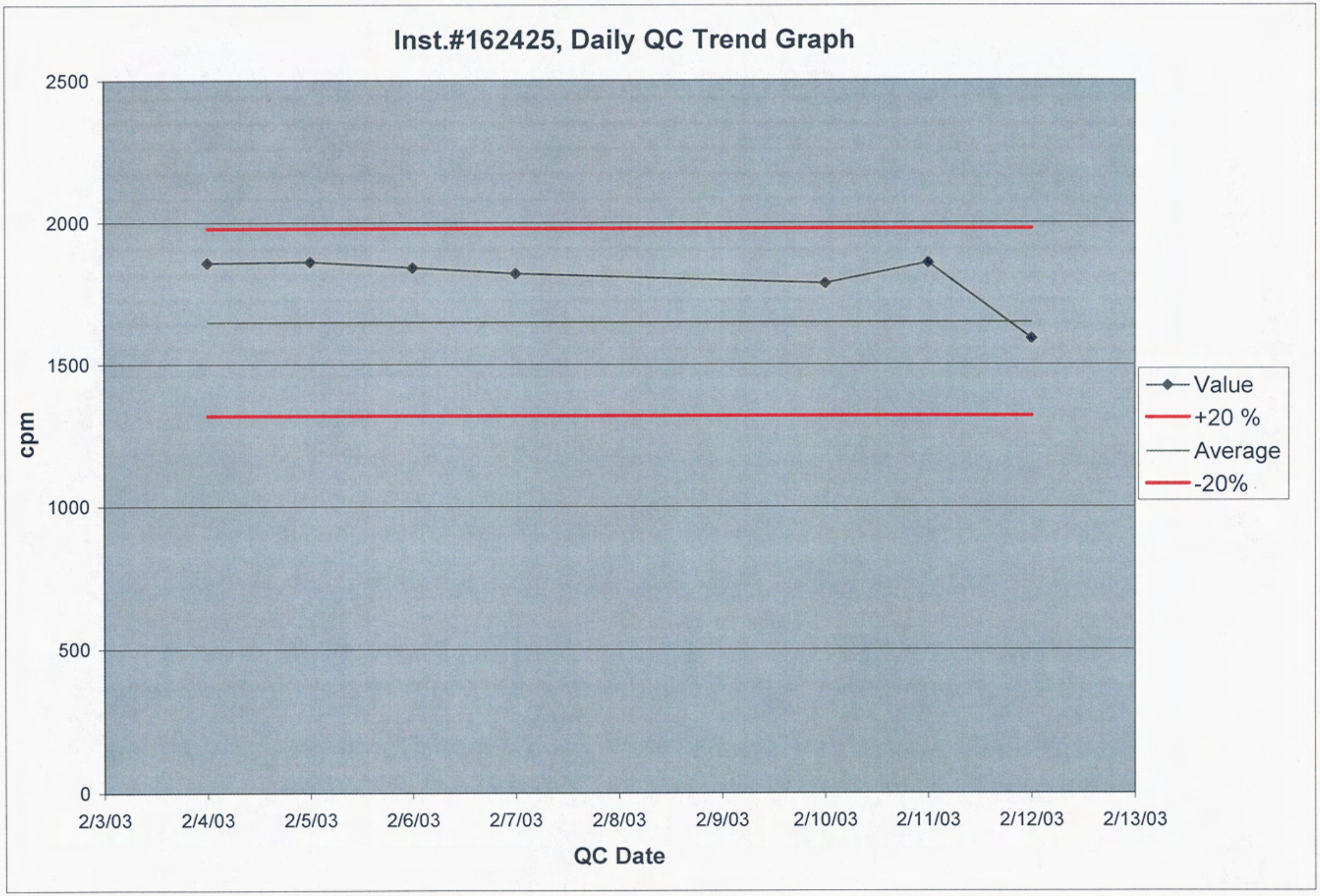
Calibration Date: 6-11-2001 Reviewed Date: 6/11/01

Analytical Services
7021 Pan American Freeway NE
Albuquerque, New Mexico 87109-4238
(505) 345-3461 Fax (505) 761-5416
Toll Free (866) RAD-LABS (723-5227)
www.eberlineservices.com

Appendix D: Instrument Quality Control Worksheets, Survey Unit Worksheets, and Data Summaries

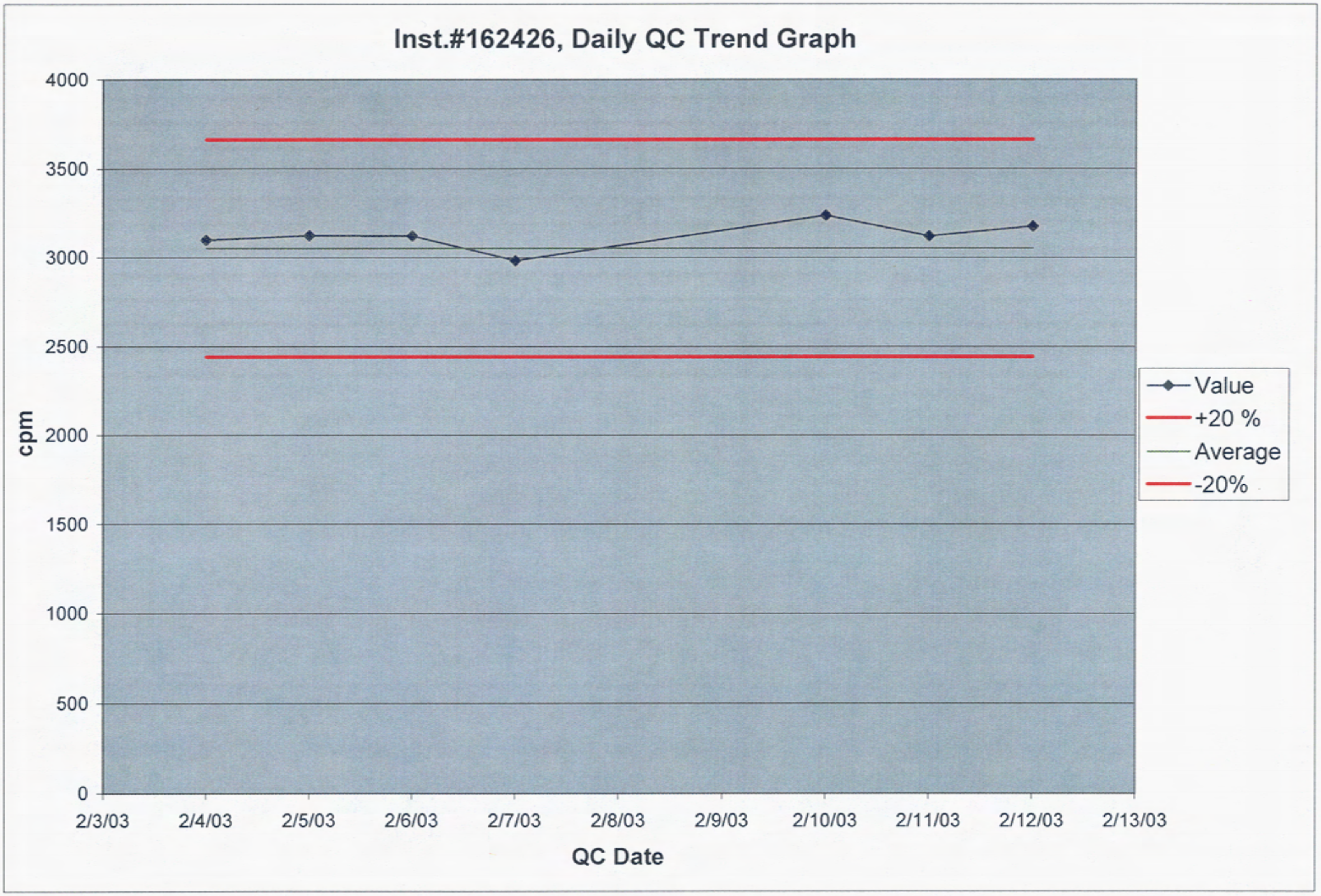
Inst.#162425		
QC Daily Source		
Date	Result (cpm)	P/F
2/4/2003	1858	Pass
2/5/2003	1861	Pass
2/6/2003	1841	Pass
2/7/2003	1820	Pass
2/10/2003	1786	Pass
2/11/2003	1858	Pass
2/12/2003	1591	Pass

Inst.#162425		Source Ser. #	3972-02
Initial Source Readings		Nuclide	Th-230
Date	Result (cpm)		
2/4/2003	1596		
2/4/2003	1647		
2/4/2003	1709		
2/4/2003	1330		
2/4/2003	1554		
2/4/2003	1786		
2/4/2003	1743		
2/4/2003	1731		
2/4/2003	1565		
2/4/2003	1832		
	Average		
	1649		


Inst.#162425, Daily QC Trend Graph
2500
2000
1500
1000
500
0
cpm
2/3/03
2/4/03
2/5/03
2/6/03
2/7/03
2/8/03
2/9/03
2/10/03
2/11/03
2/12/03
2/13/03
QC Date
Value
+20 %
Average
-20%

Inst.#162426		
QC Daily Source		
Date	Result (cpm)	P/F
2/4/2003	3097	Pass
2/5/2003	3124	Pass
2/6/2003	3121	Pass
2/7/2003	2982	Pass
2/10/2003	3235	Pass
2/11/2003	3120	Pass
2/12/2003	3174	Pass

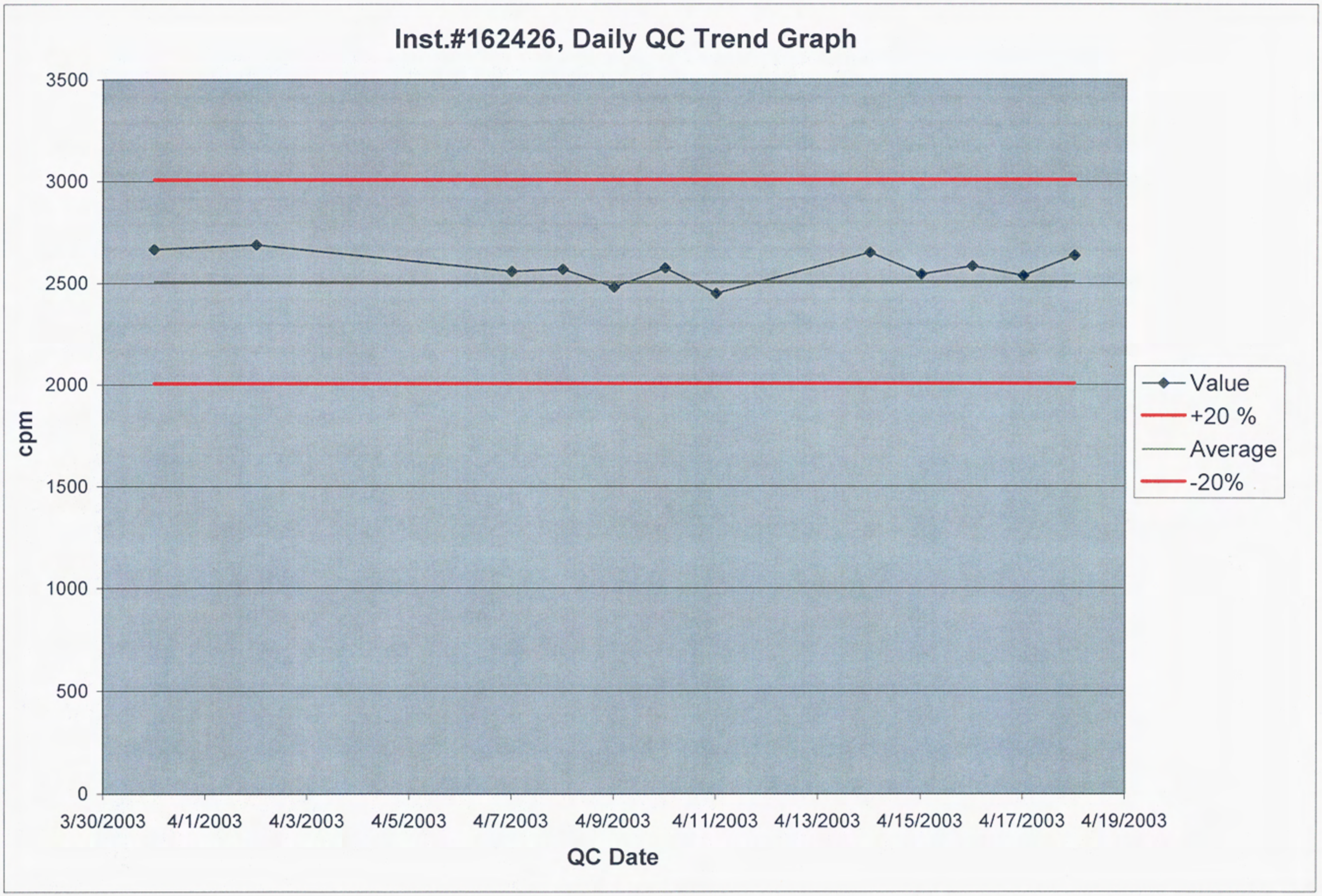
Inst.#162426		Source Ser. #	3972-02
Initial Source Readings		Nuclide	Th-230
Date	Result (cpm)		
2/4/2003	2986		
2/4/2003	3042		
2/4/2003	2993		
2/4/2003	3146		
2/4/2003	3057		
2/4/2003	3134		
2/4/2003	3040		
2/4/2003	3104		
2/4/2003	3028		
2/4/2003	2986		
	Average		
	3052		



Inst.#162426, Daily QC Trend Graph
4000
3500
3000
2500
2000
1500
1000
500
0
cpm
2/3/03
2/4/03
2/5/03
2/6/03
2/7/03
2/8/03
2/9/03
2/10/03
2/11/03
2/12/03
2/13/03
QC Date
Value
+20 %
Average
-20%

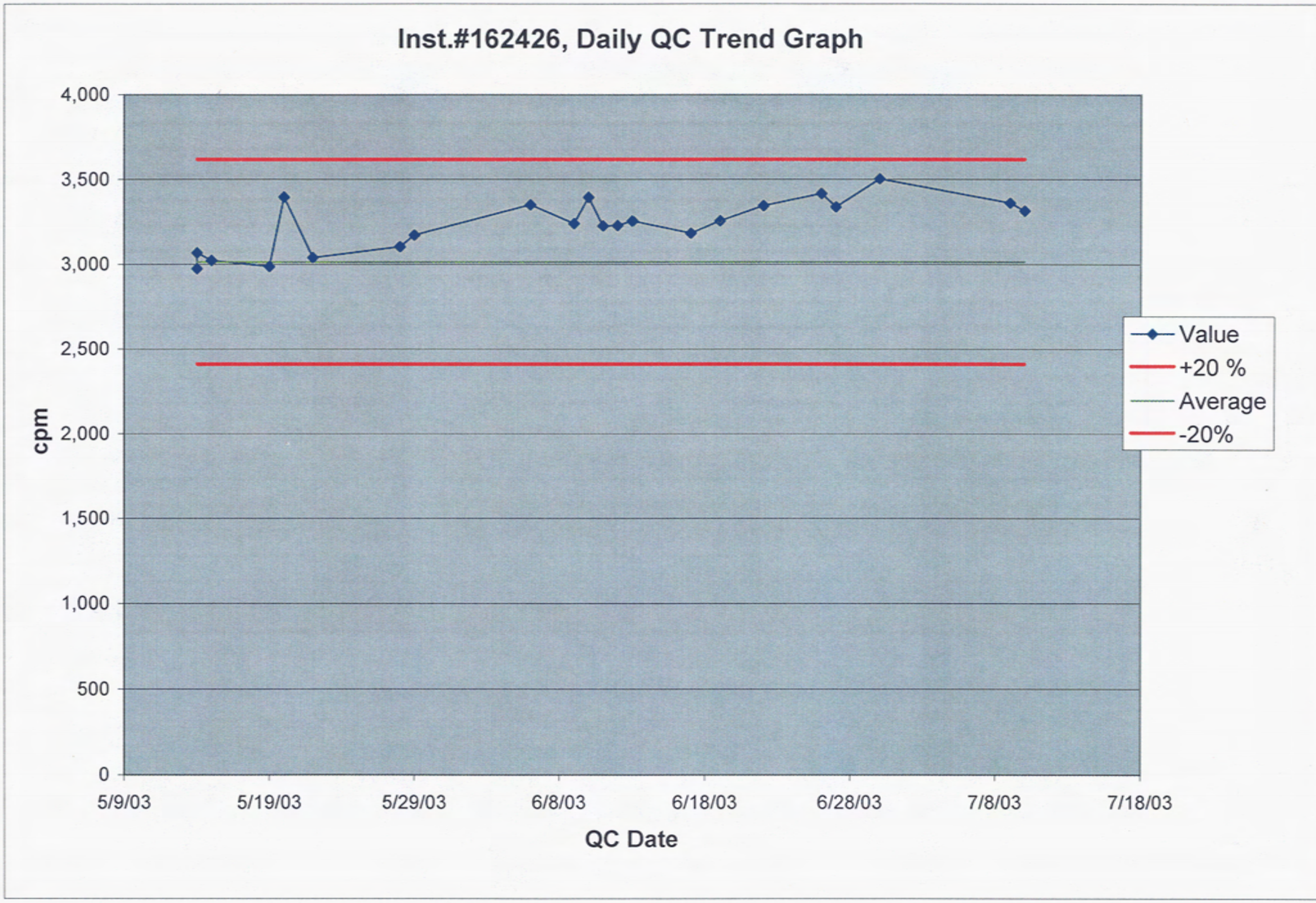
Inst.#162426		
QC Daily Source		
Date	Result (cpm)	P/F
3/31/2003	2666	Pass
4/2/2003	2689	Pass
4/7/2003	2558	Pass
4/8/2003	2568	Pass
4/9/2003	2479	Pass
4/10/2003	2574	Pass
4/11/2003	2449	Pass
4/14/2003	2650	Pass
4/15/2003	2543	Pass
4/16/2003	2583	Pass
4/17/2003	2536	Pass
4/18/2003	2636	Pass

Inst.#162426		Source Ser. #	3972-02
Initial Source Readings		Nuclide	Th-230
Date	Result (cpm)		
3/31/2003	2485		
3/31/2003	2529		
3/31/2003	2477		
3/31/2003	2513		
3/31/2003	2522		
3/31/2003	2512		
3/31/2003	2567		
3/31/2003	2448		
3/31/2003	2502		
3/31/2003	2520		
	Average		
	2508		


Inst.#162426, Daily QC Trend Graph
3500
3000
2500
2000
1500
1000
500
0
cpm
3/30/2003
4/1/2003
4/3/2003
4/5/2003
4/7/2003
4/9/2003
4/11/2003
4/13/2003
4/15/2003
4/17/2003
4/19/2003
QC Date
Value
+20 %
Average
-20%

Inst.#162426		
QC Daily Source		
Date	Result (cpm)	P/F
5/14/2003	2,974	Pass
5/14/2003	3,067	Pass
5/15/2003	3,021	Pass
5/19/2003	2,986	Pass
5/20/2003	3,396	Pass
5/22/2003	3,039	Pass
5/28/2003	3,103	Pass
5/29/2003	3,171	Pass
6/6/2003	3,351	Pass
6/9/2003	3,239	Pass
6/10/2003	3,394	Pass
6/11/2003	3,225	Pass
6/12/2003	3,228	Pass
6/13/2003	3,254	Pass
6/17/2003	3,183	Pass
6/19/2003	3,256	Pass
6/22/2003	3,345	Pass
6/26/2003	3,417	Pass
6/27/2003	3,337	Pass
6/30/2003	3,503	Pass
7/9/2003	3,360	Pass
7/10/2003	3,314	Pass

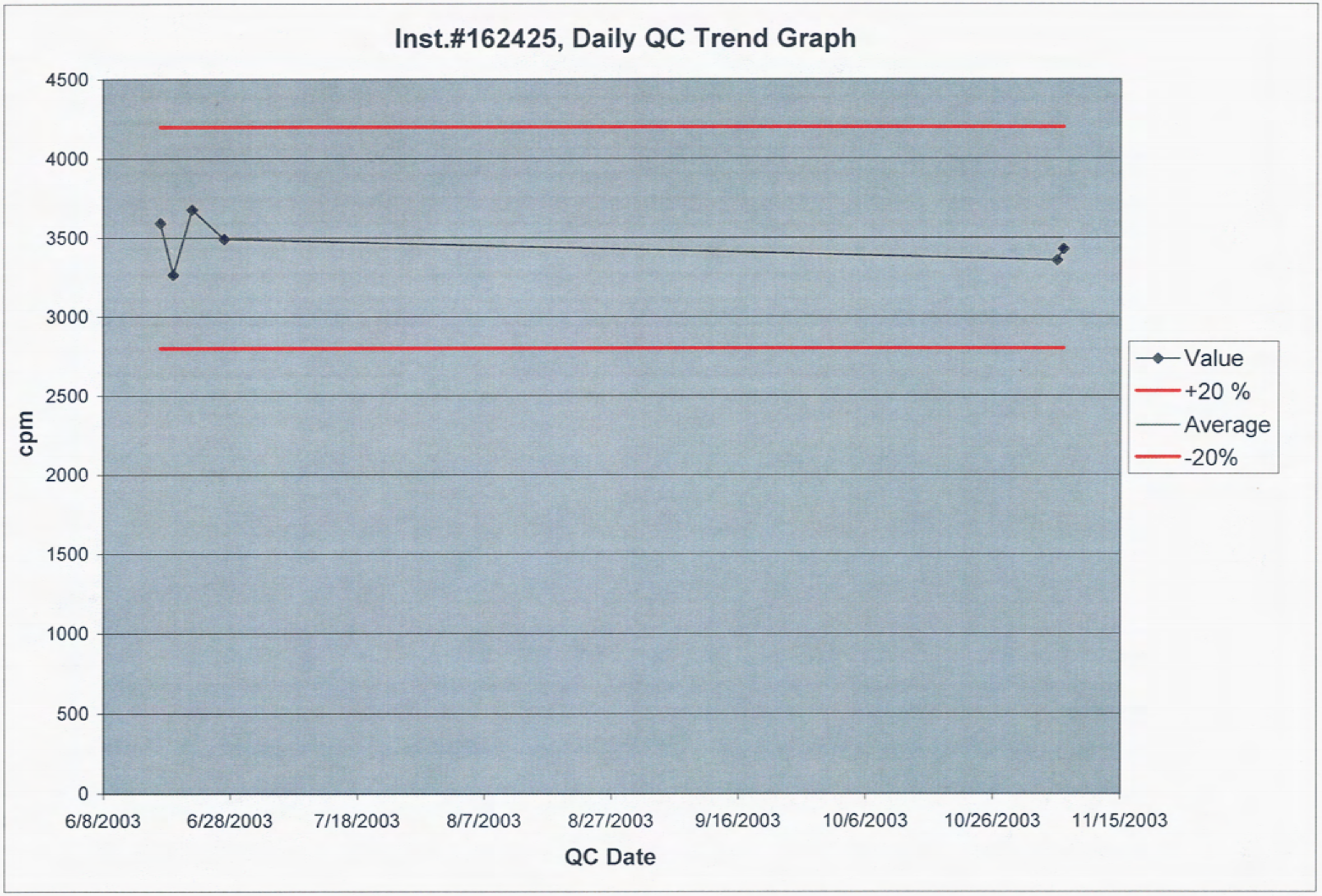
Inst.#162426		Source Ser. #	3972-02
Initial Source Readings		Nuclide	Th-230
Date	Result (cpm)		
5/13/2003	2,975		
5/13/2003	3,062		
5/13/2003	2,968		
5/13/2003	2,989		
5/13/2003	3,000		
5/13/2003	2,934		
5/13/2003	3,040		
5/13/2003	3,043		
5/13/2003	3,034		
5/13/2003	3,095		
	Average		
	3014		



Inst.#162426, Daily QC Trend Graph
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
cpm
5/9/03
5/19/03
5/29/03
6/8/03
6/18/03
6/28/03
7/8/03
7/18/03
QC Date
Value
+20 %
Average
-20%

Inst.#162425		
QC Daily Source		
Date	Result (cpm)	P/F
6/17/2003	3591	Pass
6/19/2003	3266	Pass
6/22/2003	3676	Pass
6/27/2003	3490	Pass
11/5/2003	3356	Pass
11/6/2003	3427	Pass

Inst.#162425		Source Ser. #	3972-02
Initial Source Readings		Nuclide	Th-230
Date	Result (cpm)		
5/28/2003	3443		
5/28/2003	3459		
5/28/2003	3557		
5/28/2003	3446		
5/28/2003	3570		
5/28/2003	3493		
5/28/2003	3531		
5/28/2003	3459		
5/28/2003	3532		
5/28/2003	3503		
	Average		
	3499		



Inst.#162425, Daily QC Trend Graph
4500
4000
3500
3000
2500
2000
1500
1000
500
0
cpm
6/8/2003
6/28/2003
7/18/2003
8/7/2003
8/27/2003
9/16/2003
10/6/2003
10/26/2003
11/15/2003
QC Date
Value
+20 %
Average
-20%

Instrument Efficiency Calculator Rev 0

PROJECT NAME
Transonic

ISOTOPE	SOURCE ID #:	DPM or µCi as of :
TH230	2897-01	6/11/2001

DPM	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	DPM on Date Efficiency Performed
22800	7.54E+04	11/12/2004	9.193E-06	3.42	**22799**

µCi	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	µCi on Date Efficiency Performed

Average background counts, cpm	Average Source plus background counts, cpm	DPM Based Calculated Efficiency, cpm/dpm	µCi Based Calculated Efficiency, cpm/dpm
0.0	7777.8	**0.341**	

	Background Counts, cpm	Source plus Background Counts, cpm
	0	7835
	0	7843
	0	7785
	0	7691
	0	7703
	0	7795
	0	7744
	0	7847
	0	7782
	0	7755
Average	0.0	7777.8

For:

Instrument/Probe Serial numbers		
	2929/43-10	
	129566/ PR132720	

By:

Name	Date Performed
Al Craig	11/12/2004

Instrument Efficiency Calculator Rev 0

PROJECT NAME
Transonic

ISOTOPE	SOURCE ID #:	DPM or µCi as of :
TH230	3972-02	4/29/2002

DPM	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	DPM on Date Efficiency Performed
15700	7.54E+04	11/12/2004	9.193E-06	2.54	15700

µCi	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	µCi on Date Efficiency Performed

Average background counts, cpm	Average Source plus background counts, cpm	DPM Based Calculated Efficiency, cpm/dpm	µCi Based Calculated Efficiency, cpm/dpm
0.4	5576.4	0.355	

	Background Counts, cpm	Source plus Background Counts, cpm
	0	5542
	0	5560
	0	5443
	0	5590
	0	5638
	0	5588
	0	5568
	0	5580
	1	5641
	0	5617
Average	0.4	5576.4

For:

Instrument/Probe Serial numbers		
	2929/43-10	
	163827/ PR171322	

By:

Name	Date Performed
Al Craig	11/12/2004

Instrument Efficiency Calculator Rev 0

PROJECT NAME
Transonic

ISOTOPE	SOURCE ID #:	DPM or µCi as of :
TH230	3972-02	4/29/2002

DPM	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	DPM on Date Efficiency Performed
15700	7.54E+04	11/12/2004	9.193E-06	2.54	15700

µCi	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	µCi on Date Efficiency Performed

Average background counts, cpm	Average Source plus background counts, cpm	DPM Based Calculated Efficiency, cpm/dpm	µCi Based Calculated Efficiency, cpm/dpm
1.1	3499.3	0.223	

	Background Counts, cpm	Source plus Background Counts, cpm
	2	3443
	0	3459
	2	3557
	1	3446
	0	3570
	2	3493
	1	3531
	0	3459
	2	3532
	1	3503
Average	1.1	3499.3

For:

Instrument/Probe Serial numbers		
	2224/4393	
	162425 / PR182403	

By:

Name	Date Performed
Al Craig	11/12/2004

Instrument Efficiency Calculator Rev 0

PROJECT NAME

Transonic

ISOTOPE	SOURCE ID #:	DPM or µCi as of :
TH230	3972-02	4/29/2002

DPM	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	DPM on Date Efficiency Performed
15700	7.54E+04	11/12/2004	9.193E-06	2.54	15700

µCi	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	µCi on Date Efficiency Performed

Average background counts, cpm	Average Source plus background counts, cpm	DPM Based Calculated Efficiency, cpm/dpm	µCi Based Calculated Efficiency, cpm/dpm
1.1	3014.0	**0.192**	

	Background Counts, cpm	Source plus Background Counts, cpm
	1	2975
	0	3062
	2	2968
	1	2989
	1	3000
	2	2934
	1	3040
	0	3043
	2	3034
	1	3095
Average	1.1	3014.0

For:

Instrument/Probe Serial numbers		
	2224/4393	
	162426 / PR193921	

By:

Name	Date Performed
Al Craig	11/12/2004

Instrument Efficiency Calculator Rev 0

PROJECT NAME

Transonic

DPM	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	DPM on Date Efficiency Performed
15700	7.54E+04	11/12/2004	9.193E-06	2.54	15700

ISOTOPE	SOURCE ID #:	DPM or µCi as of :
TH230	3972-02	4/29/2002

µCi	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	µCi on Date Efficiency Performed

Average background counts, cpm	Average Source plus background counts, cpm	DPM Based Calculated Efficiency, cpm/dpm	µCi Based Calculated Efficiency, cpm/dpm
0.2	5654.5	0.360	

	Background Counts, cpm	Source plus Background Counts, cpm
	0	5716
	0	5654
	0	5677
	0	5707
	0	5684
	0	5710
	0	5641
	0	5567
	0	5556
	0	5635
Average	0.2	5654.5

For: Instrument/Probe Serial numbers		
	2929/43-10	
	171590/ PR193921	

By:

Name	Date Performed
Al Craig	11/12/2004

Instrument Efficiency Calculator Rev 0

PROJECT NAME

Transonic

ISOTOPE	SOURCE ID #:	DPM or µCi as of :
TH230	2897-01	6/11/2001

DPM	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	DPM on Date Efficiency Performed
22800	7.54E+04	11/12/2004	9.193E-06	3.42	22799

µCi	half life, yrs	Decay-to Date	lamda, yr-1	decay, yrs	µCi on Date Efficiency Performed

Average background counts, cpm	Average Source plus background counts, cpm	DPM Based Calculated Efficiency, cpm/dpm	µCi Based Calculated Efficiency, cpm/dpm
0.3	8038.8	0.353	

	Background Counts, cpm	Source plus Background Counts, cpm
	0	8057
	0	8108
	0	7865
	0	8058
	0	8105
	0	8025
	0	8061
	0	8023
	0	8057
	0	8031
Average	0.3	8038.8

For:

Instrument/Probe Serial numbers		
	2929/43-10	
	171590/ PR193921	

By:

Name	Date Performed
Al Craig	11/12/2004

Figure 5.10 Building A-7, Class 2 Survey Unit - Exterior

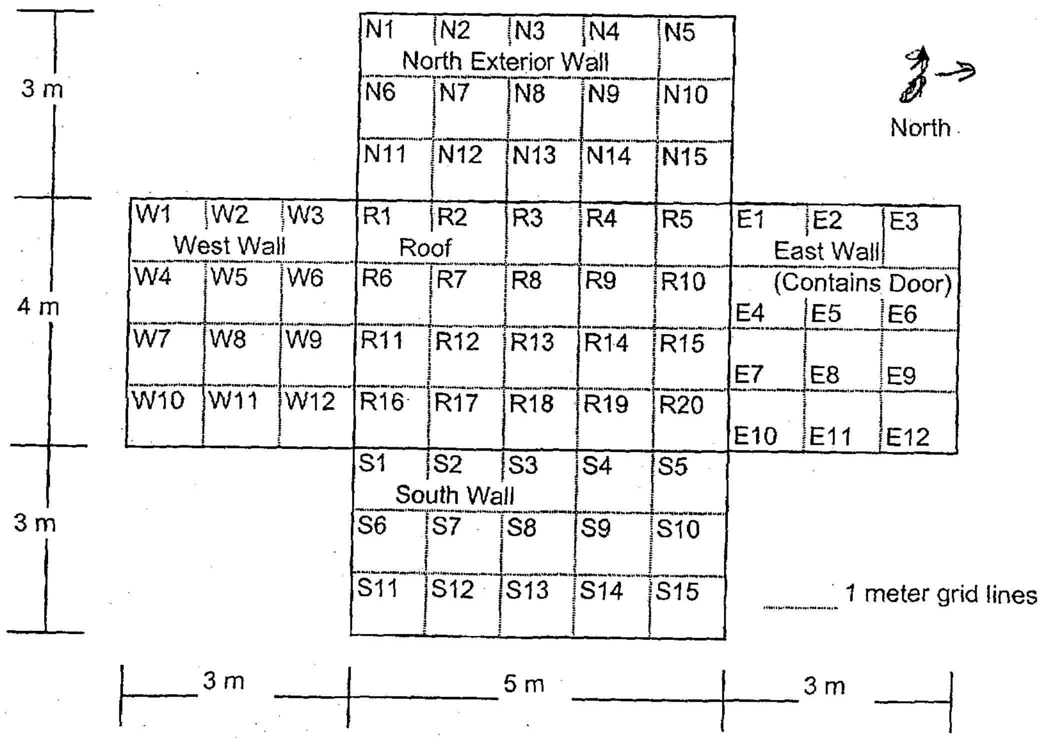
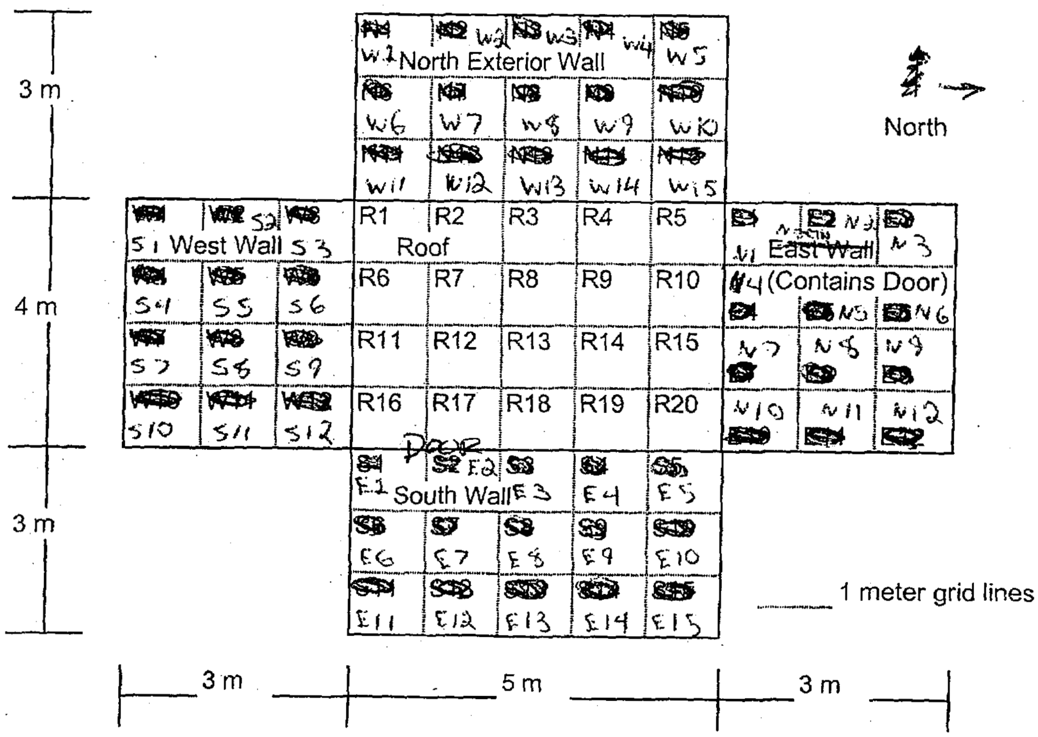


Figure 5.10 Building A-7, Class 2 Survey Unit - Exterior



RADIOLOGICAL SURVEY ~~REPORT~~

alpha 0.355 HWS

OK Beta Typ eff not 0.27 used for calcs HWS

ATGS#: 4/14/03 HWS

DATE: ~~4/14/03~~	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: K Pasquale	2224-1 / 43S3	162424 / PR193921	~~.199%~~	1/86	1/15/04 *	
LOCATION: A7 Exterior North Wall	2929	171590	.406 / .240	6/748	11/14/03 *	
REVIEWED BY: HW Seigert 11/18/04						

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

(Sample Total Counts)

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS (RESULTS - DPM/100CM² UNLESS NOTED) #	Bkg α	Bkg β
NWEA7	N1	5	800		4	775	N1	~~-0.7~~ -0.8 HWS	3
NWEA7	N2	1	250		2	168	N2	-0.7	0
NWEA7	N3	2	400		7	362	N3	0.5	3
NWEA7	N4	2	500		1	434	N4	0.5	9
NWEA7	N5	1	400		2	315	N5	-0.7	0
NWEA7	N6	0	200		3	182	N6	-0.7	17
NWEA7	N7	1	200		4	134	N7	0.5	28
NWEA7	N8	0	200		2	186	N8	1.7	34
NWEA7	N9	1	200		0	157	N9	1.7	30
NWEA7	N10	2	400		3	465	N10	-0.7	15
NWEA7	N11	2	200		5	161	N11	1.7	-4
NWEA7	N12	0	200		2	192	N12	-0.7	46
~~NWEA7~~	~~N13~~								not used HWS
~~NWEA7~~	~~N14~~								
~~NWEA7~~	~~N15~~							all values increase by ratio of efficiencies 0.406/0.355 = 1.14	

Remarks: Smears Counted on 7/2/03 K

See Counting Sheet. HWS

ALLIED TECHNOLOGY GROUP, INC. FORM ATGF-001

RADIOLOGICAL SURVEY REPORT

ATGS#:

eff for alpha = 0.36 HWS

OK Typ eff 0.27 not used for calcs HWS

DATE: 4/14/03	INSTRUMENTATION USED				
TIME: 0930	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: B GALATT	2224-1 / PR 4393	162426 / PR 193921	α 19%	1/86	1/15/04
LOCATION: A7 Exterior South Wall	2929	171590	.406 / .240	1/611	11/14/03
REVIEWED BY: HW Sigust 11/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	Smear Results #	βγ	α
SWEA7	S1	1	170		3	123	S1	4	2.3
SWEA7	S2	1	250		21	312	S2	-13	1.1
SWEA7	S3	4	920		57	801	S3	4	-0.1
SWEA7	S4	1	180		5	155	S4	23	1.1
SWEA7	S5	1	200		16	183	S5	35	2.3
SWEA7	S6	1	1000		23	1088	S6	16	1.1
SWEA7	S7	1	450		22	432	S7	-9	2.3
SWEA7	S8	1	380		35	397	S8	19	1.
SWEA7	S9	2	650		31	597	S9	-4	-0.1
SWEA7	S10	1	700		55	638	S10	2	1.1
SWEA7	S11	1	730		50	870	S11	2	-0.1
SWEA7	S12	1	640		35	678	S12	0	3.6
~~SWEA7~~	~~S13~~								
~~SWEA7~~	~~S14~~								
~~SWEA7~~	~~S15~~								

SMEAR RESULTS: RESULTS - DPM/100CM² UNLESS NOTED

βγ: not used HWS

α: all values increase by ratio of efficiencies 0.406/0.36 = 1.13 see counting sheet. HWS

Remarks: Smears counted on 4/22/03

ALLIED TECHNOLOGY GROUP, INC. FORM ATGF-001

RADIOLOGICAL SURVEY REPORT

alpha eff = 0.36 HWS

bK type eff 0.27 not used for calcs HWS

ATGS#:

DATE: 4/16/03	INSTRUMENTATION USED				
TIME: 0745	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: B. GALATI	2224-1 / PR-4383	162426 / PR-193921	α 18% / .406	1/70	1/15/04
LOCATION: A7 Exterior East Wall	2929	171590	.240	1/64	11/14/03
REVIEWED BY: [signature] 11/19/04					

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
EWEA7	E1	1	840		1	763	E1	25	1.1
EWEA7	E2	1	350		11	322	E2	0	-0.1
EWEA7	E3	1	450		17	470	E3	-19	-0.1
EWEA7	E4	1	250		8	274	E4	-15	-0.1
EWEA7	E5	1	140		4	118	E5	25	-0.1
EWEA7	E6	1	300		9	336	E6	14	1.1
EWEA7	E7	1	250		16	225	E7	-9	1.1
EWEA7	E8	1	200		12	129	E8	29	-0.1
EWEA7	E9	1	140		5	121	E9	14	-0.1
EWEA7	E10	1	100		5	105	E10	-9	-0.1
EWEA7	E11	1	300		4	274	E11	-15	-0.1
EWEA7	E12	1	250		12	272	E12	23	1.1
	E13	1	310		7	352	E13	8	-0.1
	E14	1	200		21	171	E14	0	-0.1
	E15	1	250		2	233	E15	-23	2.3
								Not used	all values increase by ratio of efficiency 0.406/0.36 = 1.13 see counting sheet HWS

SMEAR RESULTS RESULTS - DPM/100CM² UNLESS NOTED

Remarks: Smears Counted on 4/22/03

ALLIED TECHNOLOGY GROUP, INC. FORM ATGF-001

RADIOLOGICAL SURVEY REPORT HWS

OK Typical eff 0.27 not used for calc by HWS

alpha eff = 0.36 or 0.355

ATGS#:

DATE: 4/14/03	INSTRUMENTATION USED					
TIME: ~~0~~ 1100	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: B. GALATI	2224-1 / PR 4343	162436 / PR 193721	α 19%	1/84	/ /04	
LOCATION: A7 Exterior West Wall	2929	171590	.406 / ~~.240~~	4/10 / 2/596	11/14/03	
REVIEWED BY: HW Koppist 11/19/04						

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
WWEA7	W1	1	100		3	88	W1	20	1.0
WWEA7	W2	1	100		0	75	W2	-33	-0.2
WWEA7	W3	1	80		4	86	W3	15	1.0
WWEA7	~~W4~~ W6	1	80		1	76	W6	-0	-0.2
WWEA7	~~W5~~ W7	1	190		2	178	W7	24	-0.2
WWEA7	~~W6~~ W8	1	80		3	69	W8	20	2.2
WWEA7	~~W7~~								
WWEA7	~~W8~~								
~~WWEA7~~	~~W9~~								
~~WWEA7~~	W10								
WWEA7	W11	1	80		1	83	W11	5	1.0
WWEA7	W12	1	~~[illegible]~~ 180		1 2	161 ~~[illegible]~~	W12	13	2.2
	W13	1	450		2	474	W13	-10	-0.2
	W14	1	90		1	78	W14	30	1.0
	W15	1	80		2	74	W15	-10	-0.2
	W4	3	300		5	235	W4	-0.7	13
	W5	1	200		2	184	W5	3.0	-29
	W9	5	1500		18	1450	W9	6.5	41
	W10	4	450		9	414	W10	-0.7	0

not used

all values increase by ratio of efficiencies 0.406/0.36 = 1.13 or 0.406/0.355 = 1.14

Remarks: Smears counted on 7/18/03 ~~K~~
W4, W5, W9, and W10 counted on 7/18/03 ~~EBM~~ 02 HWS

alpha eff for W4, W5, W9, W10 = 0.355 HWS

ALLIED TECHNOLOGY GROUP, INC. FORM ATGF-001

RADIOLOGICAL SURVEY REPORT

alpha eff = 0.36 HWS

αc TYP eff =0.27 not used in calcs HWS

ATGS#:

DATE:	4/14/03
TIME:	1300
SURVEYOR:	B. GALATI
LOCATION:	A7 Exterior Roof Section
REVIEWED BY:	HW Siegrist 4/19/04

INSTRUMENTATION USED

MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
2224-1 / PR 264583	102426R / 193921	α 19%	1/86	1/15/04
2929	178590	.406 / .24	1/611 7/22	11/14/03

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	Smear Results #	βγ	α
REA7	R1	1	250		3	212	R1	2	1.1
REA7	R2	1	420		8	374	R2	21	-0.1
REA7	R3	1	450		7	423	R3	2	2.3
REA7	R4	1	400		6	339	R4	-6	1.1
REA7	R5	1	500		8	446	R5	-25	-0.1
REA7	R6	1	260		4	290	R6	-13	-0.1
REA7	R7	1	350		10	364	R7	6	-0.1
REA7	R8	1	340		0	391	R8	27	-0.1
REA7	R9	1	200		1	218	R9	29	2.3
REA7	R10	1	450		7	462	R10	4	1.1
REA7	R11	1	200		5	193	R11	10	3.6
REA7	R12	1	450		5	493	R12	52	2.3
REA7	R13	1	190		4	223	R13	4	1.1
REA7	R14	1	180		9	176	R14	-36	1.1
REA7	R15	1	200		10	167	R15	50	-0.1
REA7	R16	1	260		10	295	R16	33	-0.1
REA7	R17	1	250		9	281	R17	25	2.3
REA7	R18	1	350		9	244	R18	0	-0.1
REA7	R19	1	3200		7	3302	R19	4	-0.1
REA7	R20	1	600		1	654	R20	0	2.3

SMEAR RESULTS: RESULTS - DPM/100CM² UNLESS NOTED

Remarks: Smears counted on 4/22/03

not used

all values increase by ratio of efficiencies 0.406/0.36 = 1.13 see counting sheet

ALLIED TECHNOLOGY GROUP, INC. FORM ATGF-001

Figure 5.9 Building A-7, Class 2 Survey Unit - Interior

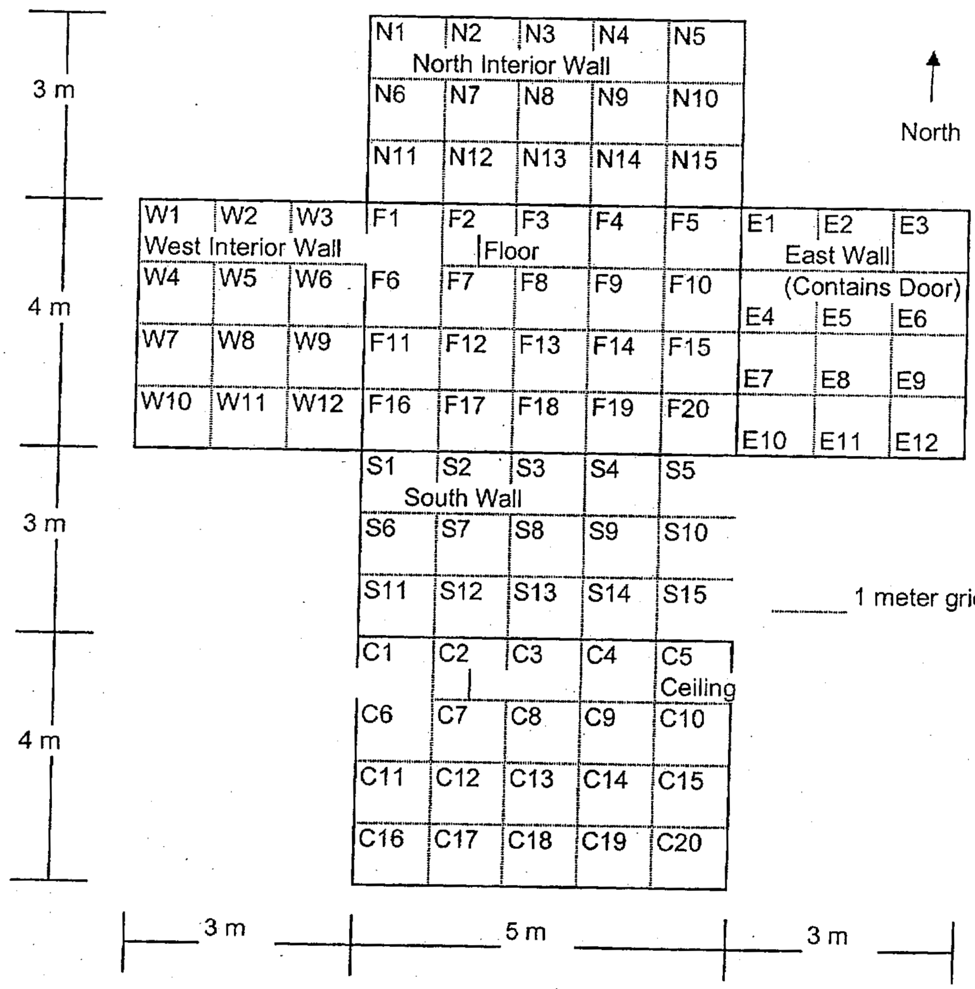
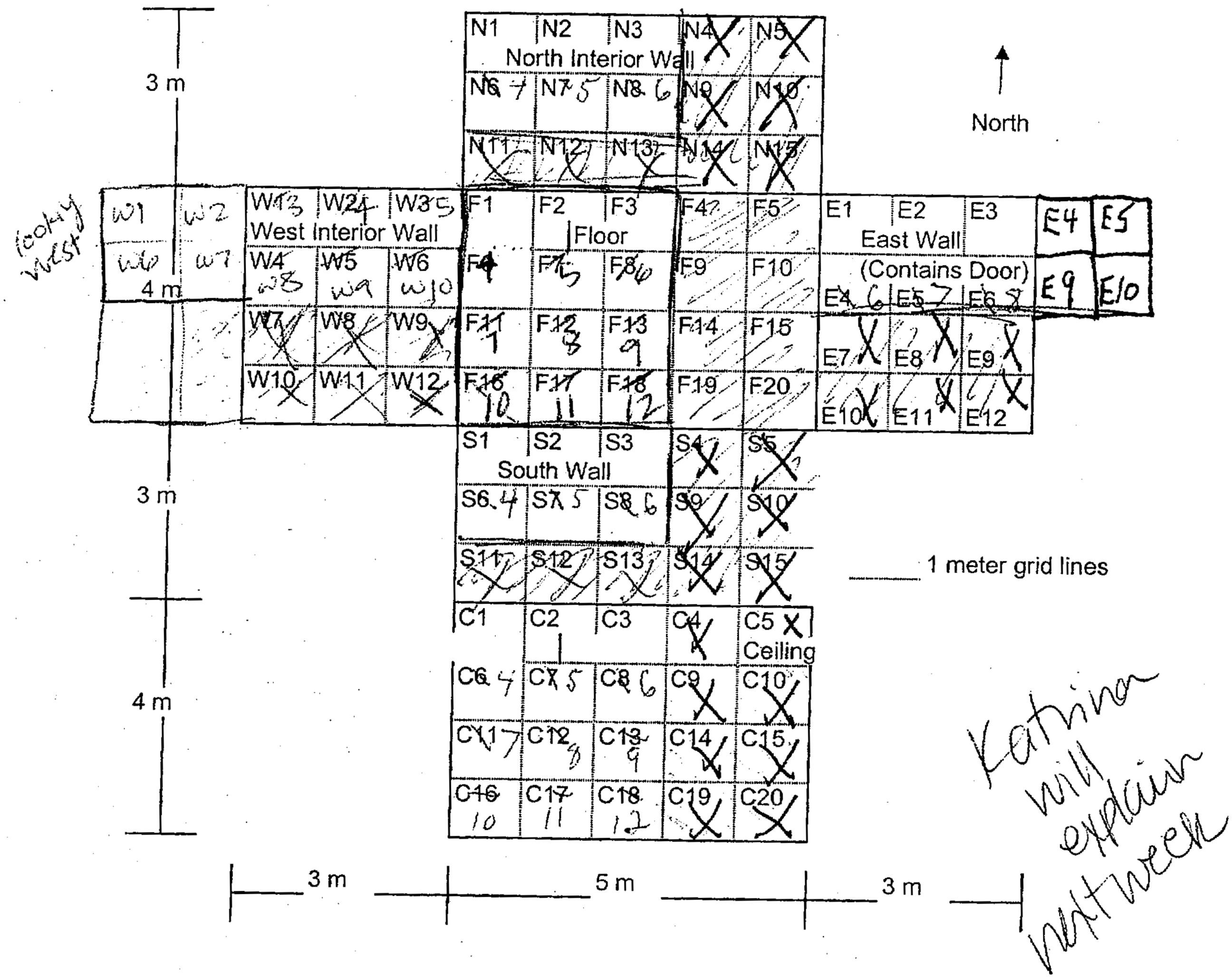


Figure 5.9 Building A-7, Class 2 Survey Unit - Interior



RADIOLOGICAL SURVEY REPORT

alpha eff = 0.355 HW/ not used for calcs HW/

ATGS#:

DATE: 2-10-03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: Kris Pagliaro	2224	162426	α 19%	0/150	1-15-04	
LOCATION: A7 North Wall Interior	2929	163827	~~400~~ 240	1/765	1/21/04	
REVIEWED BY: HW/ 11/19/04						
Smear Locations Circled; Dose Rates = mR/hr						

PURPOSE OF SURVEY: Release survey

SMEAR RESULTS
RESULTS - DPM/100CM²
UNLESS NOTED

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	#	β/α	α β
NWIA7	N1	0	160		2	78	N1	-0.8	3
NWIA7	N2	1	175		3	95	N2	-0.8	-14
NWIA7	N3	0	185		2	101	N3	-0.8	4
NWIA7	N4	0	150		0	115	N4	1.6	-14
NWIA7	N5	0	200		1	144	N5	2.8	9
NWIA7	N6	0	200		3	161	N6	-0.9	7.4
NWIA7	N7								
NWIA7	N8							Value	not used
NWIA7	N9							increase	
NWIA7	N10							by ratio	of
NWIA7	N11							efficiencies	
NWIA7	N12							0.406/0.355	
NWIA7	N13							= 1.14	
NWIA7	N14							HW/	
NWIA7	N15							see counting sheet.	

Remarks: Smears 7/1/03

RADIOLOGICAL SURVEY REPORT

ATGS#:

alpha eff = 0.34 HWS

beta not used in calcs HWS

DATE: 2-10-03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: Kris Pagliaro	2224	162426	α 19%	0/150	1-15-04	
LOCATION: A7 South Wall Interior	2929	129566	.370 ~~.240~~	4/1033	4/24/04	
REVIEWED BY: HW Szerquist 11/19/09						
Smear Locations Circled; Dose Rates = mR/hr						

PURPOSE OF SURVEY: Release survey

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
SWIA7	S1	2	200		2	105	S1	-45	0.5
SWIA7	S2	0	190		2	125	S2	1	0.5
SWIA7	S3	1	150		4	117	S3	-4	0.5
SWIA7	S4	2	150		2	72	S4	1	-0.8
SWIA7	S5	2	175		4	119	S5	9	-0.8
SWIA7	S6	2	260		1	145	S6	-4	0.5
SWIA7	S7								
SWIA7	S8							Not	Value
SWIA7	S9							Used HWS	increase by
SWIA7	S10								ratio of
SWIA7	S11								efficiencies
SWIA7	S12								0.37/0.34
SWIA7	S13								= 1.09
SWIA7	S14								See
SWIA7	S15								counting
									worksheet
									HWS

SMEAR RESULTS: RESULTS - DPM/100CM^2 UNLESS NOTED

Remarks: Smears 11/13/03

RADIOLOGICAL SURVEY REPORT

alpha eff = 0.134

beta Not used in calcs, hwd

ATGS#:

DATE: 2-10-03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: Kris Pugliaro	2224	162426	α 19%	0/150	1-15-04
LOCATION: A7 East Wall Interior	2929	129566	.370 / .270	6/1063	4/24/04
REVIEWED BY: HW Sujmt 11/19/09					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY: Release survey

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)
EWIA7	E1	1	190		3	108
EWIA7	E2	0	200		1	169
EWIA7	E3	3	150		3	92
EWIA7	E4	0	150		1	76
EWIA7	E5	1	125		4	82
EWIA7	E6	2	125		2	103
EWIA7	E7	3	150		6	130
EWIA7	E8	2	150		1	104
EWIA7	E9	1	125		4	109
EWIA7	E10	0	190		3	92
EWIA7	E11					
EWIA7	E12					

SMEAR RESULTS
RESULTS - DPM/100CM^2 UNLESS NOTED

#	βγ	α
E1	9	3.2
E2	-23	-0.8
E3	-19	0.5
E4	-34	0.5
E5	-39	-0.8
E6	35	0.5
E7	-4	1.9
E8	6	-0.8
E9	-15	-0.8
E10	22	0.5
	not used hwd	Values increase by ratio of efficiencies 0.37/0.134 = 1.088 see counting sheet HW

Remarks: Smears 11/13/03

RADIOLOGICAL SURVEY REPORT

alpha eff = 0.355

Beta not used in calcs HWS

ATGS#:

DATE: 6/28/03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: Kvon Hallen	2224-1	162426	~~α - 19%~~	0/150	1-15-04	
LOCATION: A7 West Wall Interior	2929	~~171990~~	.406	7/765	~~1/11/03~~	
REVIEWED BY: HW Siegrist 11/19/04		163827	.240		1/21/04	
Smear Locations Circled; Dose Rates = mR/hr NC HWS						

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)
WWIA7	W1	0	150		3	125
WWIA7	W2	0	100		2	106
WWIA7	W3	0	100		3	123
WWIA7	W4	0	100		2	105
WWIA7	W5	0	200		3	161
WWIA7	W6	0	150		1	142
WWIA7	W7	0	150		1	137
WWIA7	W8	0	150		1	139
WWIA7	W9	0	150		4	152
WWIA7	W10	0	150		3	103
~~WWIA7~~	~~W11~~					
~~WWIA7~~	~~W12~~					

SMEAR RESULTS
RESULTS - DPM/100CM² UNLESS NOTED

#	β-γ	α Bq
W1	-0.9	-22
W2	-0.9	14
W3	-0.9	26
W4	-0.9	-47
W5	0.4	-5
W6	0.5	-2
W7	0.5	19
W8	-0.7	-16
W9	-0.7	11
W10	-0.7	7
	all values increase by ratio 0.406/0.355 = 1.14 see counting sheet HWS	Not used

Remarks: Smears counted on 7/1/03

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RADIOLOGICAL SURVEY REPORT

alpha eff

beta not used for calcs HWS

ATGS#:

DATE: 2-10-03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: Kris Pagliaro	2224	162426	~~.1996~~	0/150	1-15-04
LOCATION: A7 Interior Ceiling	2929	129566	.370 ~~.340~~	4/1083	4/24/04
REVIEWED BY: HWSeagrist 11/19/04					

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY: Release survey

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS — RESULTS - DPM/100CM² UNLESS NOTED #	α	β
CIA7	C1	0	150		0	92	C1	-0.8	5
CIA7	C2	0	100		2	91	C2	-0.8	-8
CIA7	C3	2	180		0	98	C3	-0.8	
CIA7	C4	2	150		4	86	C4	0.5	-12
CIA7	C5	2	150		2	86	C5	-0.8	3
CIA7	C6	0	100		0	76	C6	-0.8	-25
CIA7	C7	0	125		1	83	C7	-0.8	-23
CIA7	C8	3	130		6	81	C8	-0.8	-32
CIA7	C9	2	125		1	76	C9	-0.8	-12
CIA7	C10	3	150		1	81	C10	-0.8	-32
CIA7	C11	2	120		2	91	C11	-0.8	40
CIA7	C12	3	150		7	83	C12	-0.8	-19
CIA7	C13								
CIA7	C14							all	not
CIA7	C15							values	used
CIA7	C16							increase	HWS
CIA7	C17							by ratio	
CIA7	C18							of efficiencies 0.37/0.34 = 1.088	
CIA7	C19							HWS	
CIA7	C20							see counting sheet	

Remarks: Smears Counted 11/13/03

RADIOLOGICAL SURVEY REPORT

beta not used HW in calcs.

ATGS#:

alpha eff = 0.355

DATE: 6/22/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K Pagliaro	2224	102426	α - 19%	0/150	1-15-04
LOCATION: A7 Floor Interior	2929	~~171910~~	40.6 / 26.6	6/748	~~11/14/03~~
REVIEWED BY: [illegible] 11/19/04		163827			4/21/04
Smear Locations Circled; Dose Rates = mR/hr					

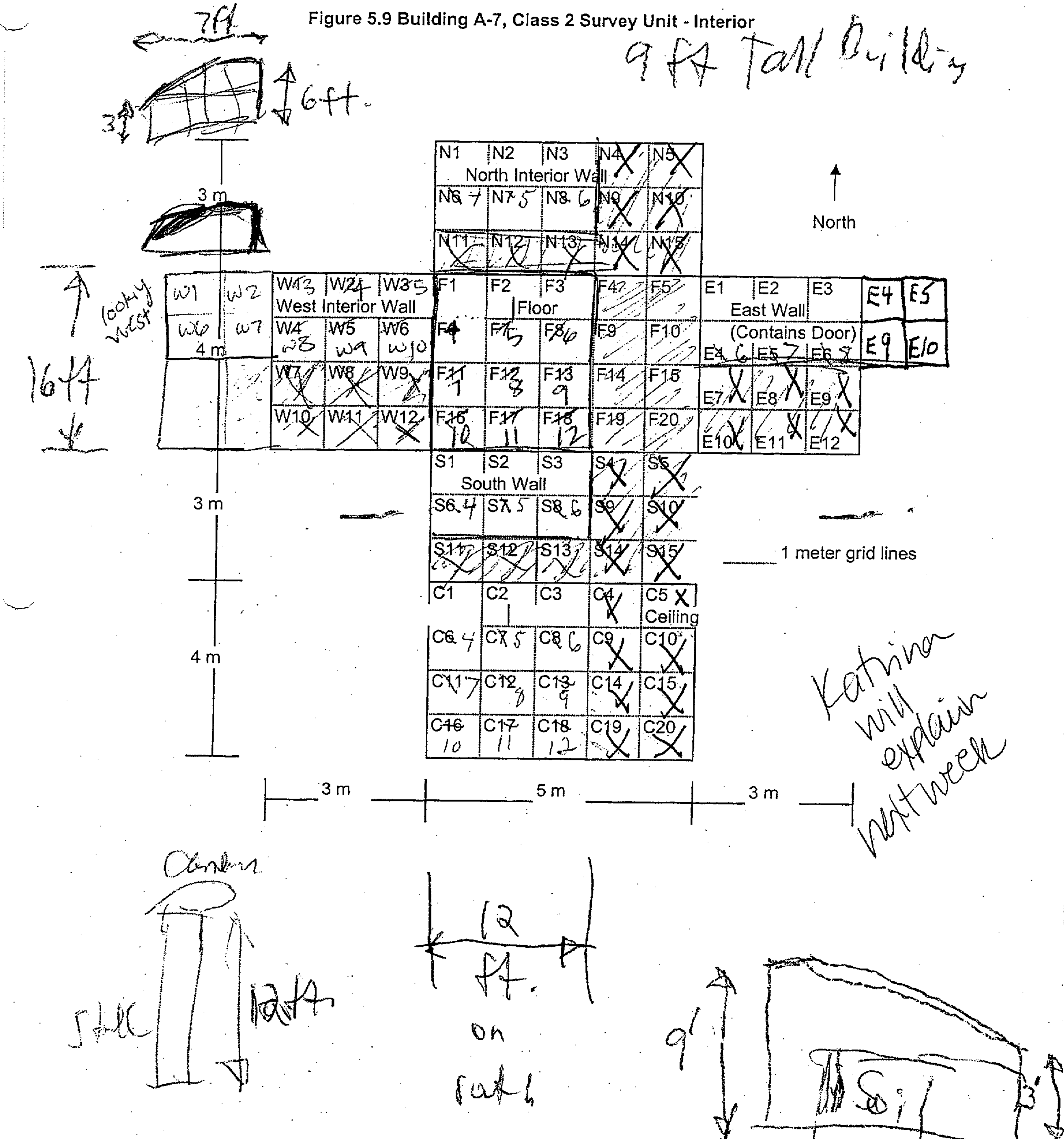
PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	#	βγ	αβγ
FIA7	F1	0	400		7	296	F1	1.7	28
FIA7	F2	20	350		15	279	F2	-0.7	13
FIA7	F3	1	300		6	314	F3	0.5	25
FIA7	F4	20	400		12	450	F4	0.5	-4
FIA7	F5	0	200		2	152	F5	-0.7	42
FIA7	F6	3	300		7	310	F6	-0.7	5
FIA7	F7	2	600		7	550	F7	1.7	11
FIA7	F8	4	250		3	171	F8	0.5	52
FIA7	F9	4	400		3	404	F9	-0.7	-2
FIA7	F10	0	250		1	213	F10	0.5	-4
FIA7	F11	0	300		5	242	F11	-0.7	7
FIA7	F12	1	300		4	262	F12	1.7	-4
FIA7	F13								
FIA7	F14							all	not
FIA7	F15							values increase	used HW
FIA7	F16							by ratio	
FIA7	F17							of efficiency 0.406/0.355 = 1.18	
FIA7	F18							see counting sheet	
FIA7	F19							HW	
FIA7	F20								

SMEAR RESULTS — RESULTS - DPM/100CM² UNLESS NOTED

Remarks: Smears counted on 7/2/03

Figure 5.9 Building A-7, Class 2 Survey Unit - Interior



Notes by H. Siegrist 10/8/04

RDAiken

RADIOLOGICAL SURVEY REPORT

Alpha Beta scintillation 2224-1 4387 & 4393 [illegible]

alpha eff=0.36 0.192 HWS

beta not used in calcs HWS

ATGS#:

DATE: ~~[illegible]~~ 4/10/03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: K Pushaw	2224-1	162420	α 19%	3/110	1/15/04	
LOCATION: X-Ray 2, Interior North Wall	2929	171590	.406 / 26	1/611	11/14/03	
REVIEWED BY: HW Seigert 11/19/04						
Smear Locations Circled; Dose Rates = mR/hr						

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
XR2NWE	NW1	Not Accessible							
XR2NWE	NW2								
XR2NWE	NW3	0	56		0	61	N3	8	-0.1
XR2NWE	NW4	0	79		0	85	N4	-21	-0.1
XR2NWE	NW5	2	80		1	67	N5	-4	-0.1
XR2NWE	NW6	0	65		1	82	N6	0	1.1
XR2NWE	NW7	0	69		0	58	N7	-9	-0.1
XR2NWE	NW8	Not Accessible							
XR2NWE	NW9	0	60		1	59	N9	—	—
XR2NWE	NW10	0	65		0	62	N10	-2	1.1
XR2NWE	NW11	0	67		1	75	N11	23	3.6
XR2NWE	NW12	1	72		1	71	N12	27	-0.1
XR2NWE	NW13	1	68		1	54	N13	-4	-0.1
XR2NWE	NW14	0	53		2	79	N14	-15	-0.1
XR2NWE	NW15	2	96		3	100	N15	12	-0.1
XR2NWE	NW16	1	107		16	393	N16	14	1.1
XR2NWE	NW17	0	78		2	69	N17	-19	2.3
XR2NWE	NW18	0	48		2	83	N18	14	1.1
XR2NWE	NW19	0	88		1	81	N19	6	1.1
XR2NWE	NW20	0	100		0	150	N20	7	1.1

not used HWS

Values increase by ratio of efficiencies 0.406/0.36 = 1. See mountain

Remarks: Smears 4/22/03 [illegible]

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beta not used in calcs HWS

RADIOLOGICAL SURVEY REPORT

ATGS#:

alpha eff = 0.136 HWS

0.192 HWS

DATE: ~~[illegible]~~ 9/18/03	INSTRUMENTATION USED				
TIME: /	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: [illegible]	2224-1 43-89	162424 PR143921	α 19%	3/110	1/15/04
LOCATION: X-Ray 2, Interior North Wall	2929	171590	.406 .290	1/611	11/14/03
REVIEWED BY: HW [illegible] 11/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)
XR2NWE	NW21	1	100		0	55
XR2NWE	NW22	0	108		0	179
XR2NWE	NW23	0	83		1	55
XR2NWE	NW24					
XR2NWE	NW25	0	74		0	72
XR2NWE	NW26	2	80		1	58
XR2NWE	NW27	1	100		1	80
XR2NWE	NW28	0	100		1	70

SMEAR RESULTS
RESULTS = DPM/100CM²
UNLESS NOTED

#	βγ	α
N21	-17	1.1
N22	-23	2.3
N23	-29	-0.1
N24	-13	-0.1
N25	27	2.3
N26	6	-0.1
N27	8	1.1
N28	-27	-0.1
	not used HWS	values increase by ratio of efficiencies 0.406/0.36 = 1.13 see counting sheet HWS

Remarks: Smears 9/22/03 [illegible]

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Figure 5.11 X-Ray 2, Class 1 Survey Unit, South Wall

Needs smears Class 1

South-West South

Exterior (looking North)

sw1	sw2	sw3	sw4	sw5	sw6	sw7	sw8
sw9	sw10	sw11	sw12	sw13	sw14	sw15	sw16
sw17	sw18	sw19	sw1 20	sw21	sw22	sw23	sw24
sw25	sw26	sw27	sw28	sw29	sw30	sw31	sw32

3.4 m

7.5 m

1 meter grid lines

South South-West

Interior Looking north

sw1	sw2	sw3	sw4	sw5	sw6	sw7	sw8
sw9	sw10	sw11	sw12	sw13	sw14	sw15	sw16
sw17	sw18	sw19	sw1 20	sw21	sw22	sw23	sw24
sw25	sw26	sw27	sw28	sw29	sw30	sw31	sw32

3.4 m

7.5 m

RADIOLOGICAL SURVEY REPORT

alpha eff = 0.353 HWS

beta not used HWS

ATGS#:

		INSTRUMENTATION USED				
DATE: 11/6/03						
TIME:		MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K Von Hollen / J Cope		2224-1	162425	0.223	0/131	4/15/04
LOCATION: X-Ray 2 Interior South ~~west~~ HWS wall		2929	171590	.350	.270	3/1129	11/19/04
REVIEWED BY: HWSiegrist 11/19/04						
Smear Locations Circled; Dose		Rates = mR/hr				

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS (RESULTS - DPM/100CM² UNLESS NOTED) #	βγ	α
XR2SWI	SW1	0	200		0	187	S1	11	-0.8
XR2SWI	SW2	0	150		0	164	S2	-45	-0.8
XR2SWI	SW3	0	180		0	182	S3	42	~~3.9~~ 3.8 HWS
XR2SWI	SW4	1	50		0	37	S4	-10	1.0
XR2SWI	SW5	0	100		0	92	S5	15	-0.4
XR2SWI	SW6	0	80		2	76	S6	17	~~-0.4~~ ~~8.7~~ 5.467 HWS
XR2SWI	SW7	0	150		0	142	S7	-6	2.4
XR2SWI	SW8	0	150		0	148	S8	-37	-0.4
XR2SWI	SW9	0	100		0	91	S9	48	-0.4
XR2SWI	SW10	0	200		1	212	S10	-64	-0.4
XR2SWI	SW11	0	250		0	247	S11	-18	2.4
XR2SWI	SW12	1	150		0	138	S12	-35	-0.4
XR2SWI	SW13	0	180		0	177	S13	-29	-0.4
XR2SWI	SW14	0	100		2	96	S14	19	-0.4
XR2SWI	SW15	0	120		1	116	S15	4	-0.4
XR2SWI	SW16	0	150		0	163	S16	-2	1.0
XR2SWI	SW17	0	150		0	141	S17	-16	-0.4
XR2SWI	SW18	1	100		0	87	S18	-25	-0.4
XR2SWI	SW19	0	100		2	92	S19	-16	1.0
XR2SWI	SW20	0	150		0	150	S20	21	-0.4

not used HWS

Remarks: Smears 11/21/03 k

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ATGS#:

RADIOLOGICAL SURVEY REPORT

DATE: 11/6/03

TIME:

SURVEYOR: Kim Hollen / Scott

LOCATION: X-Ray 2 Interior South ~~west~~ HWJ wall

REVIEWED BY: HW Liegrist 11/19/04

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

alpha eff = 0.1353 HWJ

beta not used in calcs HWJ

INSTRUMENTATION USED				
MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
2224-1	162425	0.223	0/131	9/15/04
2929	171590	.350 270	3/1129	11/19/04

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
XR2SWI	SW21	0	50		0	40	S21	-10	-0.4
XR2SWI	SW22	0	200		0	217	S22	-33	2.4
XR2SWI	SW23	0	180		0	191	S23	-47	-0.4
XR2SWI	SW24	0	200		0	186	S24	-2	2.4
XR2SWI	SW25	0	100		1	97	S25	23	2.4
XR2SWI	SW26	0	100		0	103	S26	17	-0.4
XR2SWI	SW27	0	150		2	147	S27	25	1.0
XR2SWI	SW28	0	250		0	237	S28	-12	-0.4
XR2SWI	SW29	0	100		0	97	S29	-16	1.0
XR2SWI	SW30	0	50		1	62	S30	29	2.4
XR2SWI	SW31	0	180		0	195	S31	-4	-0.4
XR2SWI	SW32	1	50		0	48	S32	21	-0.4

SMEAR RESULTS: RESULTS - DPM/100CM^2 UNLESS NOTED

not used HWJ

Remarks: smears 11/21/03

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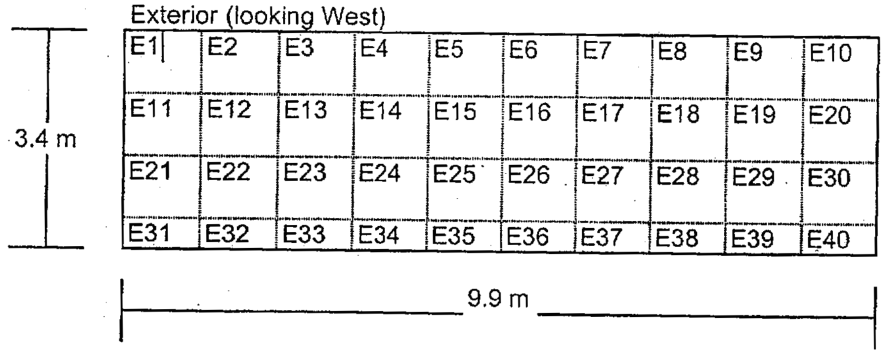
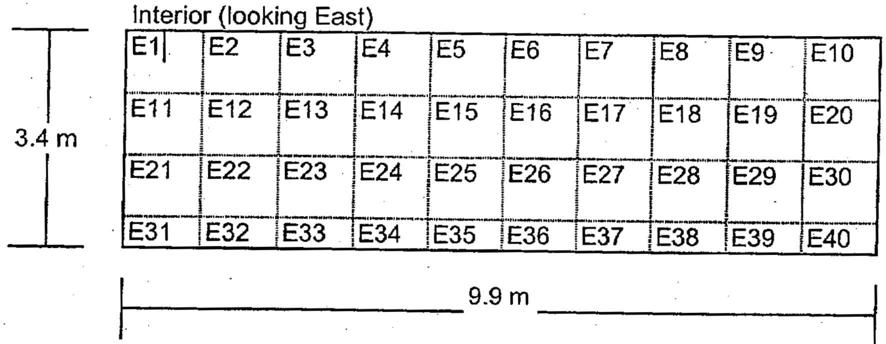
Figure 5.14 X-Ray 2, Class 2 Survey Unit, East Wall

Exterior (looking West)



1 meter grid lines

Interior (looking East)



RADIOLOGICAL SURVEY REPORT

ATGS#: 2/4/03 Hws

alpha eff 0.136 Hws

Data not used Hws

4/5/03 Hws

DATE: 2/4/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: Kris Pagliaro	2224-1	162415 / PR187440	0.223	0/146	4/15/04
LOCATION: X-Ray 2 Interior East wall	2929	171540	.406 / .240	5/627	11/14/03
REVIEWED BY: Hw [illegible] 11/19/04					

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
XR2EWI	E1	0	175		0	66	E1	-24	1.8
XR2EWI	E2	1	150		2	85	E2	3	1.8
XR2EWI	E3	2	150		1	65	E3	19	-0.6
XR2EWI	E4	1	150		0	[illegible]	E4	7	-0.6
XR2EWI	E5	4	150		0	77	E5	-33	-0.6
XR2EWI	E6	0	175		1	53	E6	-6	1.8
XR2EWI	E7	1	150		0	[illegible]	E7	5	-0.6
XR2EWI	E8	0	100		2	67	E8	1	1.8
XR2EWI	E9	2	100		1	[illegible]	E9	-10	-0.6
XR2EWI	E10	[illegible]	100		2	77	E10	-29	0.6
XR2EWI	E11	1	100		2	83	E11	9	0.6
XR2EWI	E12	1	150		1	82	E12	5	-0.6
XR2EWI	E13	1	150		0	73	E13	30	-0.6
XR2EWI	E14	1	100		1	97	E14	5	-0.6
XR2EWI	E15	0	100		1	85	E15	-10	-0.6
XR2EWI	E16	0	100		0	98	E16	-10	0.6
XR2EWI	E17	0	125		1	85	E17	-4	0.6
XR2EWI	E18	[illegible]	125		2	[illegible]	E18	-1	3.1
XR2EWI	E19	0	100		1	71	E19	-10	0.6
XR2EWI	E20	2	150		2	83	E20	-6	-0.6

Remarks: Smears 4/8/03

Not used Hws

Values change by ratio of efficiencies 0.406/0.136 = 1.13

See calc sheet

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RADIOLOGICAL SURVEY REPORT

beta not used HWS 4/5/03 HWS

ATGS#:

alpha eff = 0.36

DATE: 2/4/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. ~~DUE~~ DATE
SURVEYOR: Klastiano	2224-1	162825	0.223	0/146	4/15/04
LOCATION: X-Ray 2 Interior East wall	2929	171590	.406 ~~.340~~	5/627	11/14/03
REVIEWED BY: HWhitquist 11/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY: ______

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	#	βγ	α
XR2EWI	E21	1	100		2	76	E21	-18	0.6
XR2EWI	E22	2	125		2	73	E22	1	0.6
XR2EWI	E23	1	100		1	62	E23	1	0.6
XR2EWI	E24	0	100		2	86	E24	-8	0.6
XR2EWI	E25	0	100		0	76	E25	-16	-0.6
XR2EWI	E26	1	100		1	82	E26	3	-0.6
XR2EWI	E27	1	150		0	51	E27	-	-0.6
XR2EWI	E28	0	100		0	69	E28	-10	-0.6
XR2EWI	E29	0	100		2	86	E29	3	0.6
XR2EWI	E30	0	150		1	62	E30	7	-0.6
XR2EWI	E31	0	100		2	97	E31	24	-0.6
XR2EWI	E32	0	100		0	55	E32	7	-0.6
XR2EWI	E33	0	100		1	73	E33	-16	-0.6
XR2EWI	E34	0	150		0	68	E34	-22	-0.6
XR2EWI	E35	1	150		2	134	E35	-29	-0.6
XR2EWI	E36	0	150		1	94	E36	-1	0.6
XR2EWI	E37	2	125		1	88	E37	-1	-0.6
XR2EWI	E38	2	200		9	180	E38	-10	0.6
XR2EWI	E39	0	200		8	236	E39	-8	-0.6
XR2EWI	E40						E40	19	0.6

Remarks: Smears 4/8/03

not used HWS

all numbers change by ratio of efficiencies 0.406/0.36 = 1.13 See calc. sheet HWS

Figure 5.12 X-Ray 2, Class 1 Survey Unit, West Wall

Need Smears Class 2

Exterior (looking East)

1.8 m

W1	W2	W3	W4	W5	W6
W7	W8	W9	W10	W11	W12

6.1 m

______ 1 meter grid lines

Interior (looking West)

1.8 m

W1	W2	W3	W4	W5	W6
W7	W8	W9	W10	W11	W12

6.1 m

RADIOLOGICAL SURVEY REPORT

ATGS#:

Alpha eff. 0.341

both not used HWS

DATE: 11/5/03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: K von Hollen	2224-1	1102425	~~0.223~~	0/132	4/15/04	✓
LOCATION: X-Ray 2 Interior west wall	2929	~~171590~~	.350 ~~.270~~	6/1083	~~4/19/04~~	✓
REVIEWED BY: HW Siegrist 4/19/04		129566			4/24/~~03~~ 04 HWS	
Smear Locations Circled; Dose Rates = mR/hr						

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS - RESULTS - DPM/100CM² UNLESS NOTED #	βγ	α
XR2WWI	WW1	0	200		0	102	W1	-45	0.5
XR2WWI	WW2	0	100		0	74	W2	-12	-0.8
XR2WWI	WW3	0	100		1	154	W3	-21	0.5
XR2WWI	WW4	0	250		1	236	W4	-21	-0.8
XR2WWI	WW5	0	150		0	107	W5	9	-0.8
XR2WWI	WW6	0	150		1	109	W6	-26	-0.8
XR2WWI	WW7	0	180		2	104	W7	1	0.5
XR2WWI	WW8	0	100		1	108	W8	-8	-0.8
XR2WWI	WW9	0	200		1	135	W9	-32	-0.8
XR2WWI	WW10	0	150		0	130	W10	-25	-1.1
XR2WWI	WW11	0	150		0	111	W11	14	1.7
XR2WWI	WW12	0	150		6	122	W12	23	0.4
								Not used HWS	all values increase by ratio of efficiencies 0.350/0.341 = 1.03 See counting sheet HWS

Remarks: Smears ~~11/13/03~~ ~~11/24/03~~
Smears 11/13/03 HWS

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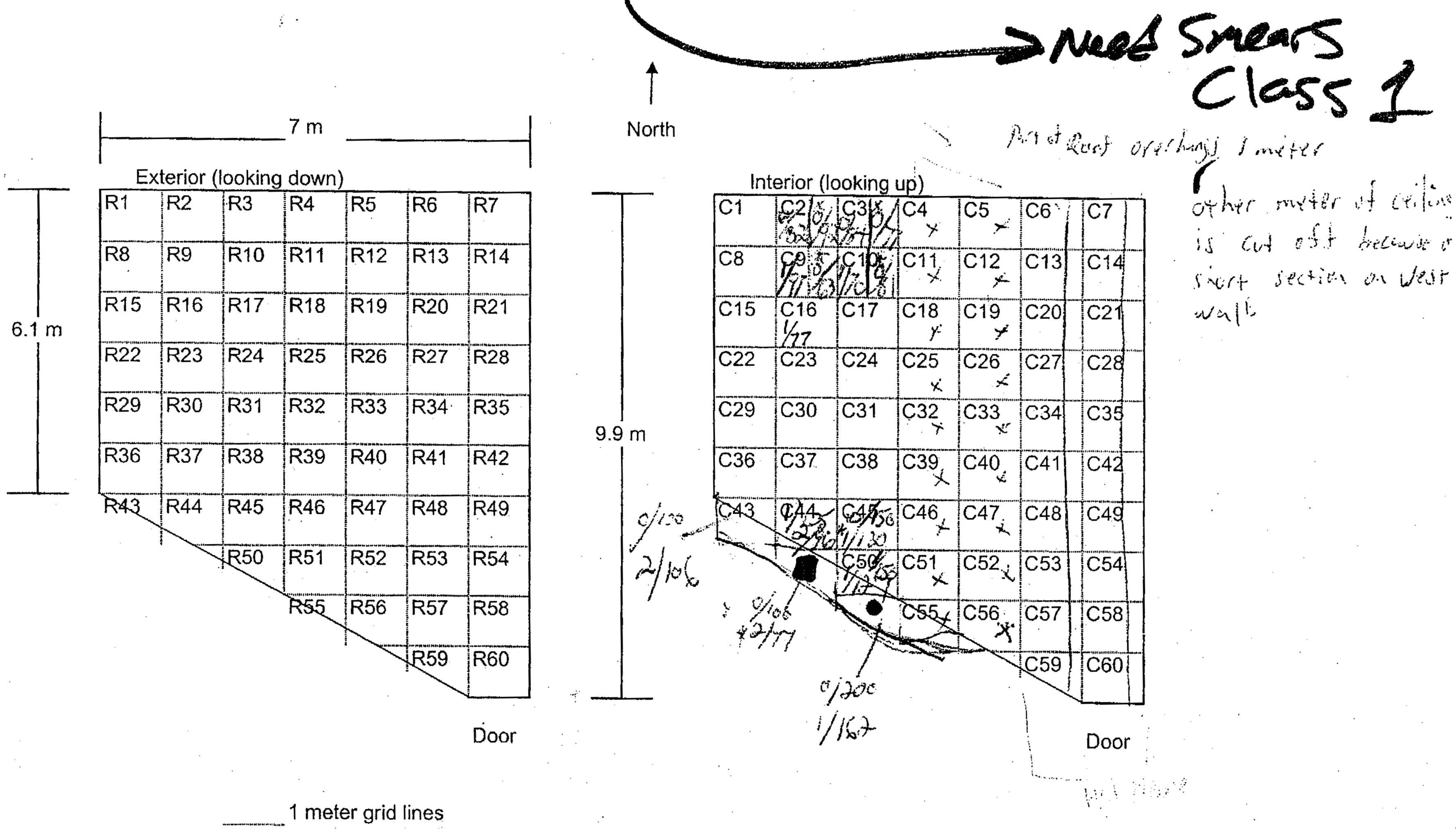
Figure 5.15 X-Ray 2, Class 1 Survey Unit, Roof and Ceiling



RADIOLOGICAL SURVEY REPORT

ATGS#:

alpha eff 0.355 HWS

beta not used HWS

DATE: 04-11-03	INSTRUMENTATION USED					
TIME: 1400	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: KBafus	Ludlum 2224 #43-83	162426 PR193921	α 19%	3/110	01/15/04 *	
LOCATION: X-Ray 2 Interior Ceiling section	2929	183827	.406 / .40	7/765	1/21/04 *	
REVIEWED BY: HWS 11/19/04						

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY: Release Survey

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
XR2CI	C1	1	91		0	75			
XR2CI	C2	0	82		0	92			
XR2CI	C3	0	84		0	77			
XR2CI	C4	1	150		0	111	C4	-3	-1.1
XR2CI	C5	2	200		2	182	C5	-17	0.1
XR2CI	C6			Not HWS					
XR2CI	C7			Accessible					
XR2CI	C8	1	64		0	68			
XR2CI	C9	1	97		0	63			
XR2CI	C10	1	70		0	81			
XR2CI	C11	2	175		2	129	C11	8	1.4
XR2CI	C12	1	200		5	111	C12	-3	-0.9
XR2CI	C13			Not HWS					
XR2CI	C14			Accessible					
XR2CI	C15	0	76		0	82			
XR2CI	C16	1	77		3	81			
XR2CI	C17	1	84	Not	accessible	HWS			
XR2CI	C18	2	200		4	131	C18	59	-.9
XR2CI	C19	1	150		3	124	C19	14	-.9
XR2CI	C20			Not	Accessible	HWS			

Remarks: Most of the interior surface is Covered with a Plastic 6/30/03 7/1/03 smear

not used HWS

all values increase by ratio of efficiency 0.406/0.355 = 1.14 see Counting Sheet HWS

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RADIOLOGICAL SURVEY REPORT

alpha eff = 0.355 HWS

beta Not Used in calcs HWS

ATGS#:

DATE: 04-11-03	INSTRUMENTATION USED				
TIME: 1430	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K Pappas	L2350M 2224 43-83	162426 PR133921	α 19%	3/110	01/15/04
LOCATION: X-Ray 2 Interior Ceiling section	2929	163877	.406 .210	7/765	1/21/04
REVIEWED BY: HW Seigrist 1/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY: Release survey

		Max Scan Result α (cpm)	Max Scan Result β (cpm)			1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS (DPM/100CM² UNLESS NOTED) #	βγ	α
XR2CI	C21					Not Accessible	HWS			
XR2CI	C22	1	86			1	71			
XR2CI	C23	0	76			0	69			
XR2CI	C24	0	78			1	77			
XR2CI	C25	0	150			2	125	C25	-11	2.8
XR2CI	C26	1	200			1	151	C26	-20	-0.9
XR2CI	C27					Not	Accessible			
XR2CI	C28						HWS			
XR2CI	C29	0	89			0	74			
XR2CI	C30	0	48			0	65			
XR2CI	C31	1	69			1	80			
XR2CI	C32	0	175			1	141	C32	28	-0.9
XR2CI	C33	0	175			3	143	C33	16	-0.9
XR2CI	C34					Not	HWS			
XR2CI	C35					Accessible				
XR2CI	C36	0	91			0	72			
XR2CI	C37	0	65			0	61			
XR2CI	C38	1	89			2	83			
XR2CI	C39	0	150			1	133	C39	-20	0.4
XR2CI	C40	2	121			2	175	C40	-1	-0.9

Remarks: Smears 6/30/03 7/1/03

Not Used HWS

all values increase by ratio of efficiencies 0.406/0.355 = 1.14 see counting sheet HWS

RADIOLOGICAL SURVEY REPORT

ATGS#:

alpha eff = 0.355

beta not used in calcs HWS

		INSTRUMENTATION USED				
DATE: 04/11/03						
TIME:		MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K Voppro		2224-1	162426	19.7%	3/110	1/15/04
LOCATION: X-Ray 2 Interior Ceiling section		2929	163827	.406 / 240	9/765	1/21/04
REVIEWED BY: HW Siegrist 11/19/04						
Smear Locations Circled; Dose		Rates = mR/hr				

PURPOSE OF SURVEY:

		Max Scan Result			1 Min Fixed Result		SMEAR RESULTS RESULTS - DPM/100CM² UNLESS NOTED		
		α (cpm)	β (cpm)		α (cpm)	β (cpm)	#	βγ	α
XR2CI	C41		Not Accessible HWS						
XR2CI	C42								
XR2CI	C43	0	100		2	106	C43	18	0.4
XR2CI	C44	1	125		2	96	C44	-1	-0.9
XR2CI	C45	0	150		1	130	C45	-20	0.4
XR2CI	C46	2	175		4	141	C46	24	0.4
XR2CI	C47	0	150		1	132	C47	9	-0.9
XR2CI	C48		Not accessible HWS						
XR2CI	C49								
XR2CI	C50	1	150		1	121	C50	-14	1.6
XR2CI	C51	1	150		0	141	C51	-39	-0.9
XR2CI	C52	1	150		2	138	C52	1	-0.9
XR2CI	C53		Not Accessible HWS						
XR2CI	C54								
XR2CI	C55	0	150		1	138	C55	-5	0.4
XR2CI	C56	3	175		1	130	C56	-7	0.4
XR2CI	C57								all values
XR2CI	C58							Not	increase by
XR2CI	C59							used	ratio of efficiencies
XR2CI	C60							HWS	0.406/0.355

Remarks: 0/100, 2/99, -1.1/29
6/30/03 7/1/03 Smears 0/100, 1/62, -1.1/8

= 1.14
See counting sheet
HWS

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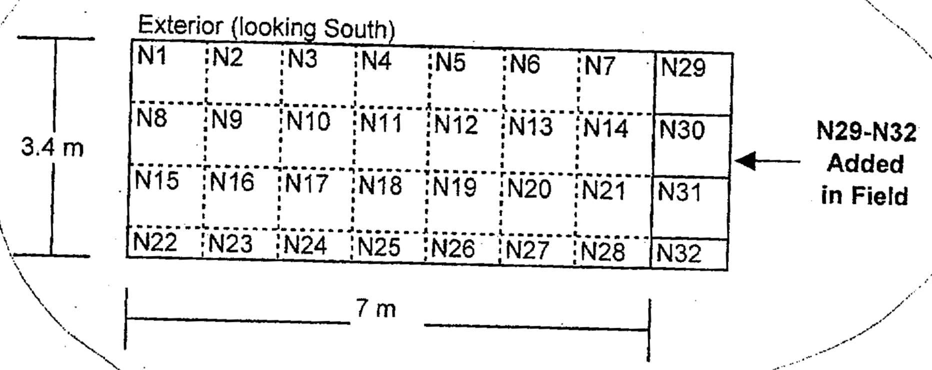
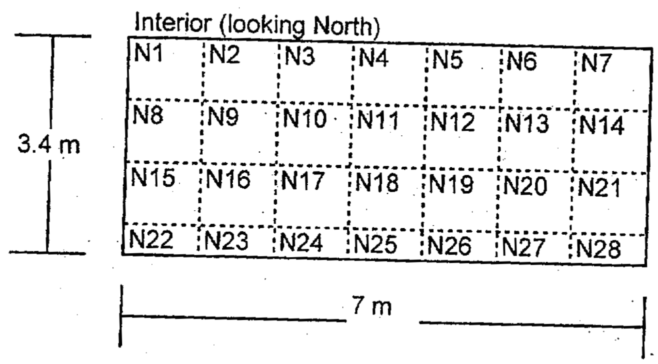
Figure 5.13 X-Ray 2, Class 2 Survey Unit, North Wall



.... 1 meter grid lines



RADIOLOGICAL SURVEY REPORT

Beta not used HWS

alpha eff 0.192 HWS

PAGE 2 OF 3

ATGS#:

DATE: 4-11-03

TIME:

SURVEYOR: K Pagler

LOCATION: X-Ray 2, Exterior North Wall

REVIEWED BY: HW Seignist 11/19/04

Smear Locations Circled; Dose Rates = mR/hr

INSTRUMENTATION USED

MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
Ludlum 2224	162426	α 19%	α 3	01-15-04 *
~~43-89~~	~~143921~~ HWS		~~β 110~~ HWS	
2929	171590	.350 .242	7/1139	11/19/04 *

PURPOSE OF SURVEY: Release Survey

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)
XR2NWE	NW1	2	200		6	110
XR2NWE	NW2	1	90		3	97
XR2NWE	NW3	3	150		2	64
XR2NWE	NW4	3	150		6	111
XR2NWE	NW5	0	150		7	112
XR2NWE	NW6	4	250		24	168
XR2NWE	NW7	0	200		5	126
XR2NWE	NW8	4	150		6	116
XR2NWE	NW9	4	200		2	126
XR2NWE	NW10	3	150		5	106
XR2NWE	NW11	3	150		7	116
XR2NWE	NW12	2	190		11	111
XR2NWE	NW13	4	175		7	104
XR2NWE	NW14	3	180		6	105
XR2NWE	NW15	1	175		9	126
XR2NWE	NW16	4	175		8	138
XR2NWE	NW17	4	200		6	114
XR2NWE	NW18	1	125		6	119
XR2NWE	NW19	1	125		1	98
XR2NWE	NW20	4	80		9	135

SMEAR RESULTS
RESULTS - DPM/100CM² UNLESS NOTED

#	βγ	α
N1	8	~~1.9~~ 1.8 HWS
N2	6	-1.0
N3	-18	~~1.9~~ 1.8 HWS
N4	-2	0.4
N5	-20	-1.0
N6	-8	~~1.9~~ 1.8 HWS
N7	-2	0.4
N8	23	0.4
N9	-39	0.4
N10	-18	0.4
N11	-39	-1.0
N12	-18	-1.0
N13	-27	0.4
N14	-18	0.4
N15	-27	0.4
N16	-4	~~1.9~~ 1.8 HWS
N17	13	0.4
N18	-33	-1.0
N19	0	~~1.9~~ 1.8 HWS
N20	11	0.4

not used HWS

Remarks: smears 11/25/03

RADIOLOGICAL SURVEY REPORT

Beta not used AWS

ATGS#:

PAGE 3 of 3

DATE: 4-11-03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE	
SURVEYOR: K Pagliaro	2224-1	162424	α 19%	α 3	1/15/04	
LOCATION: X-Ray 2, Exterior North Wall	2929	171590	.350 .270	β 1139	11/19/04	
REVIEWED BY: AW Siegrist 11/19/04						
Smear Locations Circled; Dose Rates = mR/hr						

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS (RESULTS - DPM/100CM² UNLESS NOTED) #	βγ	α
XR2NWE	NW21	3	150		3	106	N21	-37	0.4
XR2NWE	NW22	2	175		12	118	N22	-54	3.3
XR2NWE	NW23	0	200		10	131	N23	-8	-1.0
XR2NWE	NW24	1	150		8	132	N24	44	0.4
XR2NWE	NW25	1	150		7	109	N25	17	~~1.9~~ 1.18 AWS
XR2NWE	NW26	1	150		5	123	N26	-47	-1.0
XR2NWE	NW27	1	190		20	150	N27	-4	0.4
XR2NWE	NW28	3	175		6	119	N28	-4	~~1.9~~ 1.18 AWS
XR2NWE	NW29	0	100		6	112	N29	4	0.4
XR2NWE	NW30	0	150		2	115	N30	-2	-1.0
XR2NWE	NW31	0	150		4	74	N31	-10	0.4
XR2NWE	NW32	0	90		1	126	N32	-8	-1.0
								not used AWS	

Remarks: Smears 11/21/03 [illegible]

Figure 5.11 X-Ray 2, Class 1 Survey Unit, South Wall

Needs Smears Class 2

South-West South

3.4 m

sw1	sw2	sw3	sw4	sw5	sw6	sw7	sw8
sw9	sw10	Exterior (looking North) sw11	sw12	sw13	sw14	sw15	sw16
sw17	sw18	sw19	sw1 20	sw21	sw22	sw23	sw24
sw25	sw26	sw27	sw28	sw29	sw30	sw31	sw32

7.5 m

_____ 1 meter grid lines

South South-West

3.4 m

sw1	sw2	sw3	sw4	sw5	sw6	sw7	sw8
sw9	sw10	Interior Looking north sw11	sw12	sw13	sw14	sw15	sw16
sw17	sw18	sw19	sw1 20	sw21	sw22	sw23	sw24
sw25	sw26	sw27	sw28	sw29	sw30	sw31	sw32

looking south?
RP Allen
10/1/04

7.5 m

Exterior

RADIOLOGICAL SURVEY REPORT

ATGS#:

alpha eff = 0.353

beta not used in calcs. HW

		INSTRUMENTATION USED				
DATE: 11/6/03						
TIME:		MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K von Hollen / J Corte		2224-1	162425	0.223	0/131	4/15/04
LOCATION: X-Ray 2 ~~Exterior~~ South west wall		2929	171590	.350 .870	3/1129	11/19/04
REVIEWED BY: HW 11/19/04 South wall HW						
Smear Locations Circled; Dose		Rates = mR/hr			alpha bkg = 7	

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS #	βγ	α
XR2SWI	SW1	0	100		0	96	S1	~~6~~	-1.0
XR2SWI	SW2	0	100		0	111	S2	25	-1.0
XR2SWI	SW3	0	80		1	74	S3	29	-1.0
XR2SWI	SW4	0	50		0	42	S4	-23	~~1.9~~ 1.8 HW
XR2SWI	SW5	1	100		0	121	S5	29	~~1.9~~ 1.8 HW
XR2SWI	SW6	0	150		0	167	S6	25	-1.0
XR2SWI	SW7	0	120		0	113	S7	6	-1.0
XR2SWI	SW8	0	150		0	152	S8	-12	0.4
XR2SWI	SW9	0	150		0	157	S9	-14	-1.0
XR2SWI	SW10	0	150		0	165	S10	-16	~~1.9~~ 1.8 HW
XR2SWI	SW11	0	100		0	111	S11	13	0.4
XR2SWI	SW12	2	130		0	127	S12	4	-1.0
XR2SWI	SW13	0	180		0	178	S13	4	0.4
XR2SWI	SW14	0	250		0	262	S14	-12	0.4
XR2SWI	SW15	0	360		0	297	S15	-14	~~1.9~~ 1.8 HW
XR2SWI	SW16	0	100		0	104	S16	39	0.4
XR2SWI	SW17	0	350		1	365	S17	-18	-1.0
XR2SWI	SW18	0	100		0	107	S18	-20	-1.0
XR2SWI	SW19	0	100		0	92	S19	-8	0.4
XR2SWI	SW20	0	50		0	41	S20	13	~~1.9~~ 1.8 HW

Remarks: Smears 11/28/03

not used HW

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RADIOLOGICAL SURVEY REPORT

beta not used for calcs Hwf

alpha eff=0.353

ATGS#:

DATE: 11/6/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K. VonHollen/Sloth	2224-1	162425	0.223	0/131	4/15/04
LOCATION: X-Ray 2 Exterior South west wall	2929	171590	.350	5/1129	11/19/04
REVIEWED BY: [illegible] 11/19/04 South wall Hwf				alpha Bkg Hwf	
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	Smear #	βγ	α
XR2SWI	SW21	0	100		2	91	S21	-41	-1.0
XR2SWI	SW22	1	100		0	112	S22	-47	0.4
XR2SWI	SW23	0	150		1	146	S23	29	-1.0
XR2SWI	SW24	0	50		0	42	S24	15	0.4
XR2SWI	SW25	0	100		0	91	S25	8	-1.0
XR2SWI	SW26	0	100		0	98	S26	-54	0.4
XR2SWI	SW27	0	150		2	142	S27	-60	-1.0
XR2SWI	SW28	0	180		1	176	S28	5	-1.0
XR2SWI	SW29	0	100		0	89	S29	-12	-1.0
XR2SWI	SW30	0	200		1	213	S30	4	0.4
XR2SWI	SW31	0	100		0	83	S31	-14	-1.0
XR2SWI	SW32	0	150		0	148	S32	-23	-1.0

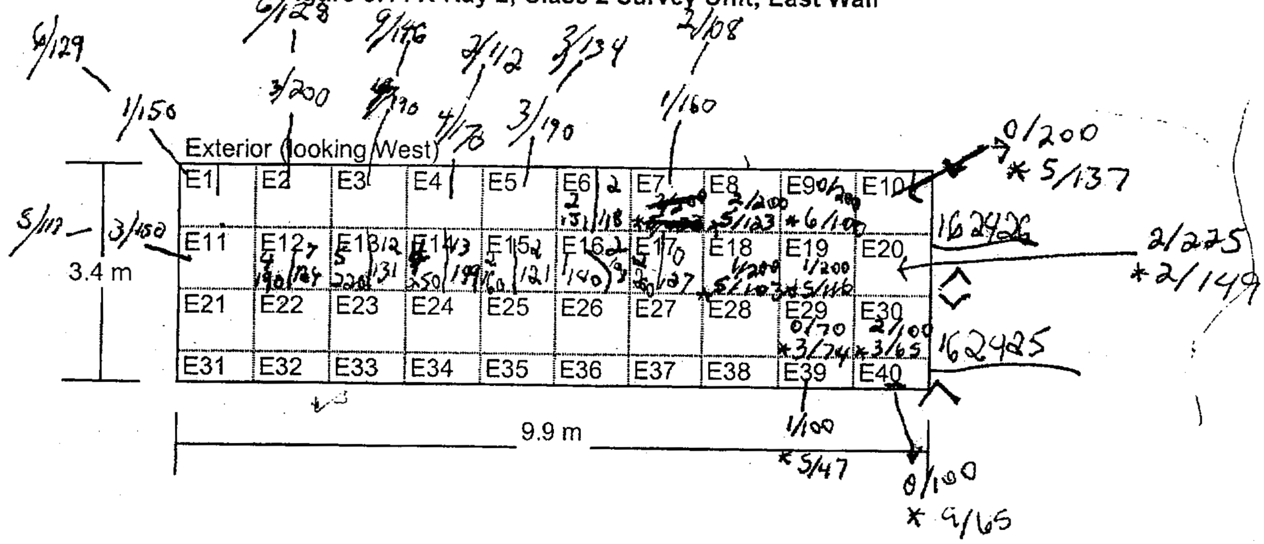
SMEAR RESULTS: RESULTS - DPM/100CM² UNLESS NOTED

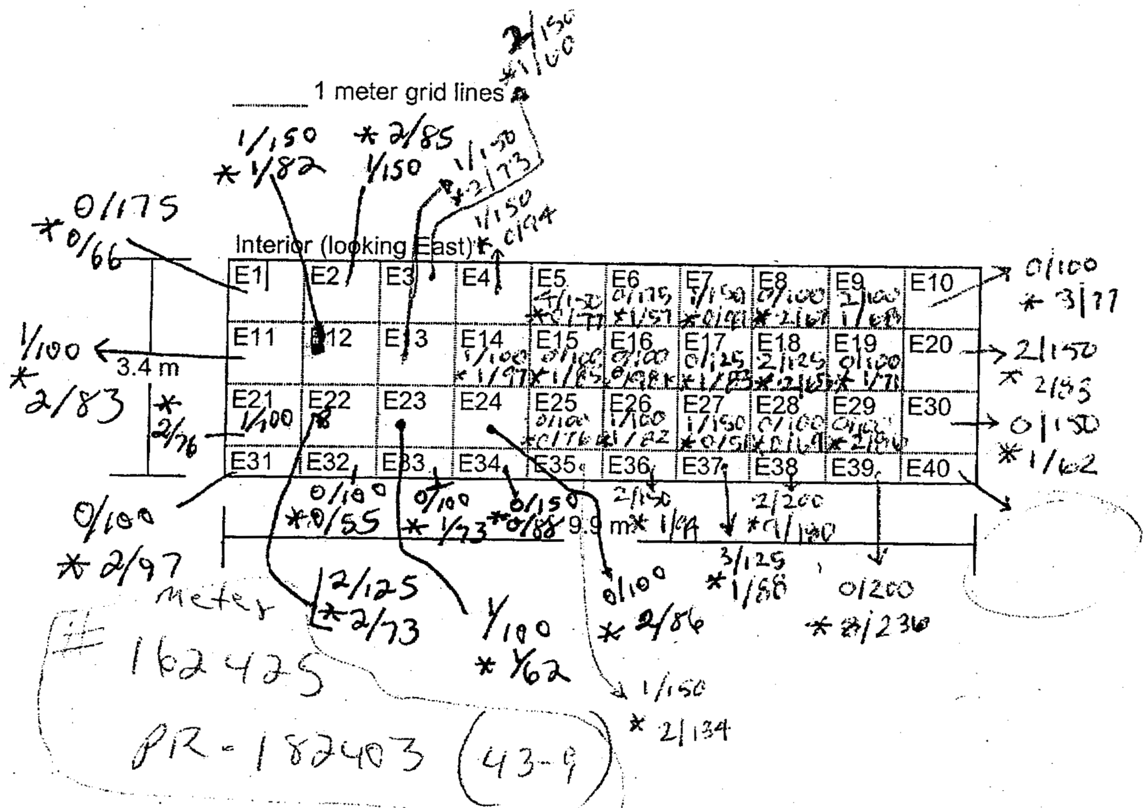
not used Hwf

Remarks: Smears 11/25/03

T54

Figure 5.14 X-Ray 2, Class 2 Survey Unit, East Wall





2/4/03

RADIOLOGICAL SURVEY REPORT

0.341 0.1223 Beta not used Hwo

ATGS#:

DATE: 02/04/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: Flagtaw	Ludlum 2224 43-93	162425 PR182483	0.333	1/150	04/05/03
LOCATION: X-Ray 2 Exterior East wall	2929	171590	.350 .290	0/1090	11/19/04
REVIEWED BY: Hw August 4/19/04					

Smear Locations Circled; Dose Rates = mR/hr

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS (RESULTS - DPM/100CM^2 UNLESS NOTED) #	βγ	α
XR2EWE	E1	1	150		6	129	E1	14	0.3
XR2EWE	E2	3	200		6	128	E2	2	0.3
XR2EWE	E3	4	190		9	146	E3	-14	-1.1
XR2EWE	E4	4	170		2	112	E4	31	0.3
XR2EWE	E5	3	190		3	134	E5	12	0.3
XR2EWE	E6	2	150		2	118	E6	14	0.3
XR2EWE	E7	1	160		2	108	E7	2	-1.1
XR2EWE	E8	2	200		5	123	E8	27	1.7
XR2EWE	E9	0	200		6	100	E9	12	-1.1
XR2EWE	E10	0	200		5	137	E10	17	0.3
XR2EWE	E11	3	150		5	113	E11	10	0.3
XR2EWE	E12	4	196		7	124	E12	14	-1.1
XR2EWE	E13	5	220		12	131	E13	17	0.3
XR2EWE	E14	4	250		13	149	E14	-4	0.3
XR2EWE	E15	2	160		2	121	E15	39	0.3
XR2EWE	E16	1	140		2	108	E16	12	-1.1
XR2EWE	E17	2	200		0	127	E17	6	-1.1
XR2EWE	E18	1	206		5	103	E18	7	-1.1
XR2EWE	E19	1	200		5	110	E19	33	1.7
XR2EWE	E20	2	225		2	149	E20	6	-1.1

Remarks: 11/24/03 Smore

Not used Hwg

RADIOLOGICAL SURVEY REPORT

Beta not used AW

ATGS#:

0.0223 | alpha eff = 0.341

DATE: 02/04/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K Ray Cox	Ludlum 2224 43-93	162423 PR182403	0.0223	1/150	04/05/03
LOCATION: X-Ray 2 Exterior East wall	2929	171590	.350 .340	8/1090	11/19/04
REVIEWED BY: AW Seagrist 11/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	SMEAR RESULTS (RESULTS - DPM/100CM² UNLESS NOTED) #	βγ	α
XR2EWE	E21	1	50		7	42	E21	-17	-1.1
XR2EWE	E22	2	50		4	46	E22	6	-1.1
XR2EWE	E23	2	50		1	61	E23	29	-1.1
XR2EWE	E24	1	75		3	82	E24	-2	-1.1
XR2EWE	E25	1	56		3	60	E25	39	0.3
XR2EWE	E26	1	50		1	53	E26	-17	-1.1
XR2EWE	E27	1	65		1	71	E27	25	0.3
XR2EWE	E28	1	55		2	62	E28	21	0.3
XR2EWE	E29	0	70		3	74	E29	-2	-1.1
XR2EWE	E30	2	100		3	65	E30	29	0.3
XR2EWE	E31	1	50		5	60	E31	-8	-1.1
XR2EWE	E32	~~4~~ 2	~~64~~ 50		4	64	E32	19	0.3
XR2EWE	E33	1	50		3	50	E33	23	-1.1
XR2EWE	E34	1	62		2	66	E34	-29	-1.1
XR2EWE	E35	1	50		2	57	E35	-25	-1.0
XR2EWE	E36	1	50		2	63	E36	25	0.4
XR2EWE	E37	8	100		13	105	E37	-35	-1.0
XR2EWE	E38	1	55		4	66	E38	-10	-1.0
XR2EWE	E39	1	100		5	47	E39	4	0.4
XR2EWE	E40	0	100		9	65	E40	-37	-1.0

Remarks: 11/28/03 Smears

Not used AW

Figure 5.12 X-Ray 2, Class 1 Survey Unit, West Wall

Need Smears Class 1

Exterior (looking East)

1.8 m

W1	W2	W3	W4	W5	W6
W7	W8	W9	W10	W11	W12

6.1 m

_____ 1 meter grid lines

Interior (looking West)

1.8 m

W1	W2	W3	W4	W5	W6
W7	W8	W9	W10	W11	W12

6.1 m

RADIOLOGICAL SURVEY REPORT

alpha eff=0.3341
beta not used Hw

ATGS#:

DATE: 11/6/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: KvonHollen	2224-1	162425	0.223	0/131	4/10/04
LOCATION: X-Ray 2 Exterior west wall	2929	171590	.350 ~~.270~~	8/1090	11/19/04
REVIEWED BY: [signature] 11/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

SMEAR RESULTS
RESULTS - DPM/100CM²
UNLESS NOTED

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	#	βγ	α
XR2WWE	WW1	0	100		1	123	W1	2	0.3
XR2WWE	WW2	0	350		2	600	W2	-19	1.7
XR2WWE	WW3	0	500		0	495	W3	-19	-1.1
XR2WWE	WW4	0	150		2	111	W4	10	-1.1
XR2WWE	WW5	0	200		1	112	W5	-17	-1.1
XR2WWE	WW6	0	900		1	836	W6	31	0.3
XR2WWE	WW7	0	100		0	90	W7	17	1.7
XR2WWE	WW8	0	750		0	579	W8	4	-1.1
XR2WWE	WW9	1	500		0	468	W9	33	-1.1
XR2WWE	WW10	0	150		0	123	W10	0	-1.1
XR2WWE	WW11	0	300		0	331	W11	-10	-1.1
XR2WWE	WW12	0	1500		0	1616	W12	-6	0.3

beta not used Hw

Remarks: Smears 11/24/03

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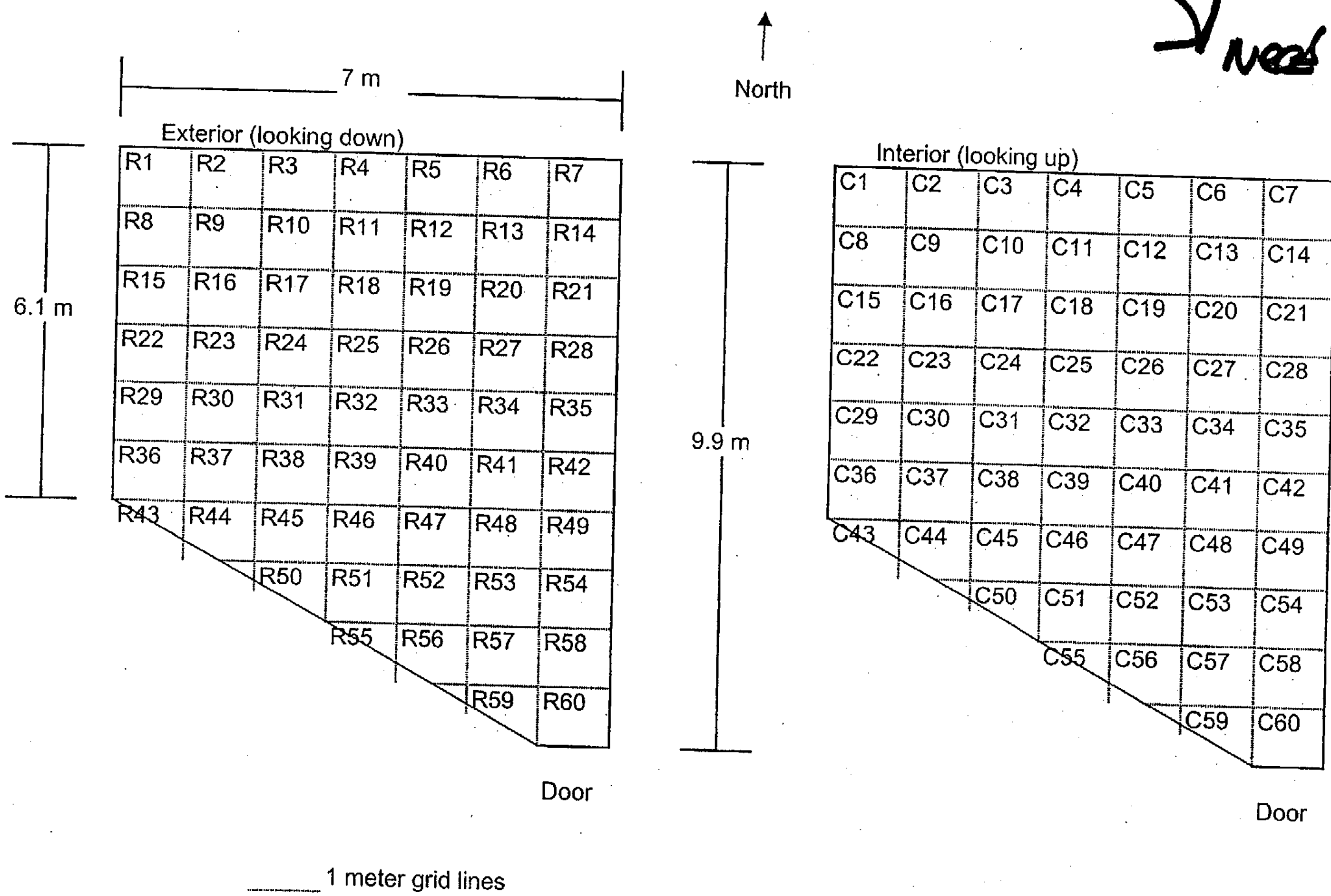
Figure 5.15 X-Ray 2, Class 1 Survey Unit, Roof and Ceiling

Need smears
Class 1



RADIOLOGICAL SURVEY REPORT

ATGS#:

alpha eff = 0.355

beta not used HWJ

DATE: 6/26/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: K von Hollen	2224-1	162426	α 19%	2/112	11/15/04
LOCATION: X-Ray 2 Exterior Roof section	2929	163827	0.406 α 0.240 β	12 α 847 β	1/21/04
REVIEWED BY: HW Fuguet 11/19/09					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	#	β/α	α By
XR2RE	R1	0	150		2	131	R1	-1.5	28
XR2RE	R2	10	500		28	431	R2	-1.5	11
XR2RE	R3	10	150		11	167	R3	-1.5	-16
XR2RE	R4	10	250		40	252	R4	-1.5	3
XR2RE	R5	50	400		51	437	R5	1.0	-26
XR2RE	R6	60	300		58	238	R6	-0.2	9
XR2RE	R7	60	400		44	385	R7	-0.2	-14
XR2RE	R8	0	600		7	631	R8	-1.5	-33
XR2RE	R9	50	1500		47	1339	R9	-1.5	-29
XR2RE	R10	50	400		37	357	R10	-1.5	19
XR2RE	R11	50	700		47	592	R11	-1.5	15
XR2RE	R12	50	600		46	649	R12	2.2	15
XR2RE	R13	50	300		27	236	R13	-0.2	67
XR2RE	R14	10	250		16	191	R14	2.2	25
XR2RE	R15	0	300		7	417	R15	2.2	79
XR2RE	R16	80	400		40	385	R16	1.0	19
XR2RE	R17	50	250		30	247	R17	2.2	36
XR2RE	R18	50	750		46	717	R18	2.2	9
XR2RE	R19	50	450		65	345	R19	-0.2	40
XR2RE	R20	50	400		52	328	R20	4.7	17

Remarks: 6/26/03 6/27/03 6/30/03 smears
alpha bkg 12 2 9 HWJ

cell values increase by ratio of efficiencies 0.406/0.355 = 1.0883 HWJ

not used HWJ

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RADIOLOGICAL SURVEY REPORT

ATGS#:

alphaeff = 0.355

bkrd not used in calcs HWF

DATE: 6/26/03	INSTRUMENTATION USED				
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: Kevin Hillian	22241	162426	19%	1/119	11/15/04
LOCATION: X-Ray 2 Exterior Roof section	2929	163827	40% 24%	16 847	1/21/04
REVIEWED BY: HWfugit 11/19/09					
Smear Locations Circled; Dose Rates = mR/hr				See bottom of page HWF	

PURPOSE OF SURVEY:

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)
XR2RE	R21	50	350		47	327
XR2RE	R22	0	400		6	417
XR2RE	R23	10	250		26	214
XR2RE	R24	10	250		36	257
XR2RE	R25	70	350		77	400
XR2RE	R26	100	400		71	454
XR2RE	R27	25	200		26	220
XR2RE	R28	60	300		94	300
XR2RE	R29	0	250		7	254
XR2RE	R30	100	600		82	518
XR2RE	R31	50	350		50	446
XR2RE	R32	50	1500		41	1361
XR2RE	R33	50	250		49	325
XR2RE	R34	50	350		40	291
XR2RE	R35	50	250		48	259
XR2RE	R36	0	1000		1	1032
XR2RE	R37	100	4,000		76	4193
XR2RE	R38	60	300		42	250
XR2RE	R39	50	250		28	235
XR2RE	R40	50	400		41	424

SMEAR RESULTS
RESULTS - DPM/100CM²
UNLESS NOTED

#	-Bkg α	β Bkg
R21	1.0	9
R22	-0.2	4
R23	1.0	-6
R24	-0.2	21
R25	0.1	18
R26	-1.1	20
R27	0.1	16
R28	0.1	-13
R29	0.1	4
R30	-1.1	-5
R31	-1.1	20
R32	0.1	25
R33	-1.1	10
R34	-1.1	8
R35	1.4	-5
R36	0.1	2
R37	2.6	62
R38	2.6	4
R39	0.1	6
R40	0.1	10
increase by ratio of efficiency 0.406/0.355 = 1.18 see counting worksheet HWF		not used HWF

Remarks: 6/26/03 6/27/03 6/26/03 Smears

α bkg ~~12~~ 12 HWF 2 9 HWF

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RADIOLOGICAL SURVEY REPORT

alpha eff =0.355 HWJ

Beta Not used in calcs HWJ

ATGS#:

DATE: 6/26/03	INSTRUMENTATION USED					
TIME:	MODEL	S/N	EFF. %	BKRD	CAL. DUE DATE
SURVEYOR: Kyle Hollen	2224-1	162426	α 19%	2/19	11/15/04
LOCATION: X-Ray 2 Exterior Roof section	2929	163827	40% .240	16 847	1/21/04
REVIEWED BY: Hw Keigert 11/19/04					
Smear Locations Circled; Dose Rates = mR/hr					

PURPOSE OF SURVEY:

SMEAR RESULTS
RESULTS - DPM/100CM²
UNLESS NOTED

		Max Scan Result α (cpm)	Max Scan Result β (cpm)		1 Min Fixed Result α (cpm)	1 Min Fixed Result β (cpm)	#	~~Bγ~~ α	~~α~~ β
XR2RE	R41	40	250		29	222	R41	0.1	-9
XR2RE	R42	0	200		16	216	R42	0.1	2
XR2RE	R43	0	2,000		6	2330	R43	0.1	14
XR2RE	R44	50	400		47	352	R44	-1.1	18
XR2RE	R45	50	250		46	268	R45	1.4	4
XR2RE	R46	100	300		49	277	R46	-1.1	0
XR2RE	R47	60	300		61	299	R47	-1.1	18
XR2RE	R48	50	250		39	204	R48	0.1	-19
XR2RE	R49	100	400		50	269	R49	-1.1	8
XR2RE	R50	50	1500		32	1440	R50	-1.1	2
XR2RE	R51	50	300		57	311	R51	-1.1	29
XR2RE	R52	20	550		25	595	R52	0.1	-3
XR2RE	R53	60	400		76	407	R53	0.1	-32
XR2RE	R54	50	500		52	532	R54	-1.1	-36
XR2RE	R55	50	550		41	526	R55	2.6	27
XR2RE	R56	50	1000		48	1056	R56	-1.1	16
XR2RE	R57	40	350		35	439	R57	-1.1	-3
XR2RE	R58	50	400		34	305	R58	0.1	27
XR2RE	R59	50	300		33	293	R59	-1.1	-38
XR2RE	R60	50	400		46	501	R60	-1.1	-13

Removable

Remarks: 6/26/03 6/27/03 6/30/03 smears

α Bkg 12 HWJ 2 9 HWJ

HWJ

all values increase by ratio of efficiencies 0.406/0.355 = 1.18 see counting worksheet. HWJ

not used HWJ

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CABRERA SMEAR COUNTING WORKSHEET (Rev 5)

α eff	β eff
0.3600	

Sample Count Time (min)	Daily Background Count Time (min)
2.0	20.0

dpm/100 cm²	
α Flag	β Flag
1,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm²) α	Sample (dpm/100 cm²) β	> α flag	> β flag	Tech. Initial
A7 Exterior, W1	4/18/2003	2		1		0.1		0.50		1.1				JAC
A7 Exterior, W2	4/18/2003	2		0		0.1		0.00		-0.3				JAC
A7 Exterior, W3	4/18/2003	2		1		0.1		0.50		1.1				JAC
														JAC
														JAC
A7 Exterior, W6	4/18/2003	2		0		0.1		0.00		-0.3				JAC
A7 Exterior, W7	4/18/2003	2		0		0.1		0.00		-0.3				JAC
A7 Exterior, W8	4/18/2003	2		2		0.1		1.00		2.5				JAC
														JAC
														JAC
A7 Exterior, W11	4/18/2003	2		1		0.1		0.50		1.1				JAC
A7 Exterior, W12	4/18/2003	2		2		0.1		1.00		2.5				JAC
A7 Exterior, W13	4/18/2003	2		0		0.1		0.00		-0.3				JAC
A7 Exterior, W14	4/18/2003	2		1		0.1		0.50		1.1				JAC
A7 Exterior, W15	4/18/2003	2		0		0.1		0.00		-0.3				JAC
A7 Exterior, S1	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, S2	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, S3	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, S4	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, S5	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, S6	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, S7	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, S8	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, S9	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, S10	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, S11	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, S12	4/22/2003	1		3		0.1		1.50		4.0				JAC
A7 Exterior, E1	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, E2	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E3	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E4	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E5	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E6	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, E7	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, E8	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E9	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E10	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E11	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E12	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, E13	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E14	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, E15	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, R1	4/22/2003	1		1		0.1		0.50		1.3				JAC

CABRERA SMEAR COUNTING WORKSHEET (Rev 5)

A7 Exterior, R2	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R3	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, R4	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, R5	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R6	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R7	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R8	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R9	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, R10	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, R11	4/22/2003	1		3		0.1		1.50		4.0				JAC
A7 Exterior, R12	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, R13	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, R14	4/22/2003	1		1		0.1		0.50		1.3				JAC
A7 Exterior, R15	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R16	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R17	4/22/2003	1		2		0.1		1.00		2.6				JAC
A7 Exterior, R18	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R19	4/22/2003	1		0		0.1		0.00		-0.1				JAC
A7 Exterior, R20	4/22/2003	1		2		0.1		1.00		2.6				JAC

CABRERA SMEAR COUNTING WORKSHEET (Rev 5)

α eff	β eff
0.3550	

Sample Count Time (min)	Daily Background Count Time (min)
2.0	20.0

dpm/100 cm²	
α Flag	β Flag
1,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm²) α	Sample (dpm/100 cm²) β	> α flag	> β flag	Tech. Initial
A7 Interior N4	7/1/2003	7		2		0.4		1.00		1.8				JAC
A7 Interior N5	7/1/2003	7		3		0.4		1.50		3.2				JAC
A7 Interior N6	7/1/2003	7		0		0.4		0.00		-1.0				JAC
A7 Interior W1	7/1/2003	7		0		0.4		0.00		-1.0				JAC
A7 Interior W2	7/1/2003	7		0		0.4		0.00		-1.0				JAC
A7 Interior W3	7/1/2003	7		0		0.4		0.00		-1.0				JAC
A7 Interior W4	7/1/2003	7		0		0.4		0.00		-1.0				JAC
A7 Interior W5	7/1/2003	7		1		0.4		0.50		0.4				JAC
A7 Interior W6	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Interior W7	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Interior W8	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior W9	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior W10	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior F1	7/2/2003	6		2		0.3		1.00		2.0				JAC
A7 Interior F2	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior F3	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Interior F4	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Interior F5	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior F6	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior F7	7/2/2003	6		2		0.3		1.00		2.0				JAC
A7 Interior F8	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Interior F9	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior F10	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Interior F11	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Interior F12	7/2/2003	6		2		0.3		1.00		2.0				JAC
A7 Exterior W4	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior W5	7/2/2003	6		3		0.3		1.50		3.4				JAC
A7 Exterior W9	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Exterior W10	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior N1	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior N2	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior N3	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Exterior N4	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Exterior N5	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior N6	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior N7	7/2/2003	6		1		0.3		0.50		0.6				JAC
A7 Exterior N8	7/2/2003	6		2		0.3		1.00		2.0				JAC
A7 Exterior N9	7/2/2003	6		2		0.3		1.00		2.0				JAC
A7 Exterior N10	7/2/2003	6		0		0.3		0.00		-0.8				JAC
A7 Exterior N11	7/2/2003	6		2		0.3		1.00		2.0				JAC
A7 Exterior N12	7/2/2003	6		0		0.3		0.00		-0.8				JAC

CABRERA SMEAR COUNTING WORKSHEET (Rev 5)

α eff	β eff
0.3600	

Sample Count Time (min)	Daily Background Count Time (min)
2.0	20.0

dpm/100 cm² α Flag	β Flag
1,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm²) α	Sample (dpm/100 cm²) β	> α flag	> β flag
X-Ray 2 Interior, E1	4/8/2003	5		2		0.3		1.00		2.1			
X-Ray 2 Interior, E2	4/8/2003	5		2		0.3		1.00		2.1			
X-Ray 2 Interior, E3	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E4	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E5	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E6	4/8/2003	5		2		0.3		1.00		2.1			
X-Ray 2 Interior, E7	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E8	4/8/2003	5		2		0.3		1.00		2.1			
X-Ray 2 Interior, E9	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E10	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E11	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E12	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E13	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E14	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E15	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E16	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E17	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E18	4/8/2003	5		3		0.3		1.50		3.5			
X-Ray 2 Interior, E19	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E20	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E21	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E22	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E23	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E24	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E25	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E26	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E27	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E28	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E29	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E30	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E31	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E32	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E33	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E34	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E35	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E36	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E37	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E38	4/8/2003	5		1		0.3		0.50		0.7			
X-Ray 2 Interior, E39	4/8/2003	5		0		0.3		0.00		-0.7			
X-Ray 2 Interior, E40	4/8/2003	5		1		0.3		0.50		0.7			

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X-Ray 2 Interior, N1 Not Acc	4/22/2003	1				0.1				-0.1			
X-Ray 2 Interior, N2 Not Acc	4/22/2003	1				0.1				-0.1			
X-Ray 2 Interior, N3	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N4	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N5	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N6	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N7	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N8 Not Acc	4/22/2003	1				0.1				-0.1			
X-Ray 2 Interior, N9	4/22/2003	1				0.1				-0.1			
X-Ray 2 Interior, N10	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N11	4/22/2003	1		3		0.1		1.50		4.0			
X-Ray 2 Interior, N12	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N13	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N14	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N15	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N16	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N17	4/22/2003	1		2		0.1		1.00		2.6			
X-Ray 2 Interior, N18	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N19	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N20	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N21	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N22	4/22/2003	1		2		0.1		1.00		2.6			
X-Ray 2 Interior, N23	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N24	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N25	4/22/2003	1		2		0.1		1.00		2.6			
X-Ray 2 Interior, N26	4/22/2003	1		0		0.1		0.00		-0.1			
X-Ray 2 Interior, N27	4/22/2003	1		1		0.1		0.50		1.3			
X-Ray 2 Interior, N28	4/22/2003	1		0		0.1		0.00		-0.1			

CABRERA SMEAR COUNTING WORKSHEET (Rev 5)

α eff	β eff	Sample Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
0.3550		2.0	20.0	1,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
X-Ray 2 Roof 1	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 2	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 3	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 4	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 5	6/26/2003	12		2		0.6		1.00		1.1				JAC
X-Ray 2 Roof 6	6/26/2003	12		1		0.6		0.50		-0.3				JAC
X-Ray 2 Roof 7	6/26/2003	12		1		0.6		0.50		-0.3				JAC
X-Ray 2 Roof 8	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 9	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 10	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 11	6/26/2003	12		0		0.6		0.00		-1.7				JAC
X-Ray 2 Roof 12	6/27/2003	2		2		0.1		1.00		2.5				JAC
X-Ray 2 Roof 13	6/27/2003	2		0		0.1		0.00		-0.3				JAC
X-Ray 2 Roof 14	6/27/2003	2		2		0.1		1.00		2.5				JAC
X-Ray 2 Roof 15	6/27/2003	2		2		0.1		1.00		2.5				JAC
X-Ray 2 Roof 16	6/27/2003	2		1		0.1		0.50		1.1				JAC
X-Ray 2 Roof 17	6/27/2003	2		2		0.1		1.00		2.5				JAC
X-Ray 2 Roof 18	6/27/2003	2		2		0.1		1.00		2.5				JAC
X-Ray 2 Roof 19	6/27/2003	2		0		0.1		0.00		-0.3				JAC
X-Ray 2 Roof 20	6/27/2003	2		4		0.1		2.00		5.4				JAC
X-Ray 2 Roof 21	6/27/2003	2		1		0.1		0.50		1.1				JAC
X-Ray 2 Roof 22	6/27/2003	2		0		0.1		0.00		-0.3				JAC
X-Ray 2 Roof 23	6/27/2003	2		1		0.1		0.50		1.1				JAC
X-Ray 2 Roof 24	6/27/2003	2		0		0.1		0.00		-0.3				JAC
X-Ray 2 Roof 25	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 26	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 27	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 28	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 29	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 30	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 31	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 32	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 33	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 34	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 35	6/30/2003	9		2		0.5		1.00		1.5				JAC
X-Ray 2 Roof 36	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 37	6/30/2003	9		3		0.5		1.50		3.0				JAC
X-Ray 2 Roof 38	6/30/2003	9		3		0.5		1.50		3.0				JAC
X-Ray 2 Roof 39	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 40	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 41	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 42	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 43	6/30/2003	9		1		0.5		0.50		0.1				JAC

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X-Ray 2 Roof 44	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 45	6/30/2003	9		2		0.5		1.00		1.5				JAC
X-Ray 2 Roof 46	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 47	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 48	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 49	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 50	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 51	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 52	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 53	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 54	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 55	6/30/2003	9		3		0.5		1.50		3.0				JAC
X-Ray 2 Roof 56	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 57	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 58	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Roof 59	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Roof 60	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Ceiling 4	6/30/2003	9		0		0.5		0.00		-1.3				JAC
X-Ray 2 Ceiling 5	6/30/2003	9		1		0.5		0.50		0.1				JAC
X-Ray 2 Ceiling 11	6/30/2003	9		2		0.5		1.00		1.5				JAC
X-Ray 2 Ceiling 12	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 18	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 19	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 25	7/1/2003	7		3		0.4		1.50		3.2				JAC
X-Ray 2 Ceiling 26	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 32	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 33	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 39	7/1/2003	7		1		0.4		0.50		0.4				JAC
X-Ray 2 Ceiling 40	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 43	7/1/2003	7		1		0.4		0.50		0.4				JAC
X-Ray 2 Ceiling 44	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 45	7/1/2003	7		1		0.4		0.50		0.4				JAC
X-Ray 2 Ceiling 46	7/1/2003	7		1		0.4		0.50		0.4				JAC
X-Ray 2 Ceiling 47	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 50	7/1/2003	7		2		0.4		1.00		1.8				JAC
X-Ray 2 Ceiling 51	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 52	7/1/2003	7		0		0.4		0.00		-1.0				JAC
X-Ray 2 Ceiling 55	7/1/2003	7		1		0.4		0.50		0.4				JAC
X-Ray 2 Ceiling 56	7/1/2003	7		1		0.4		0.50		0.4				JAC

CABRERA SMEAR COUNTING WORKSHEET (Rev 5)

α eff	β eff
0.3550	

Sample Count Time (min)	Daily Background Count Time (min)
2.0	20.0

dpm/100 cm^2 α Flag	β Flag
1,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag
X-Ray 2 Interior, S03	11/21/2003	3		3		0.2		1.50		3.8			
X-Ray 2 Interior, S04	11/21/2003	3		1		0.2		0.50		1.0			
X-Ray 2 Interior, S05	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S06	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S07	11/21/2003	3		2		0.2		1.00		2.4			
X-Ray 2 Interior, S08	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S09	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S10	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S11	11/21/2003	3		2		0.2		1.00		2.4			
X-Ray 2 Interior, S12	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S13	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S14	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S15	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S16	11/21/2003	3		1		0.2		0.50		1.0			
X-Ray 2 Interior, S17	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S18	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S19	11/21/2003	3		1		0.2		0.50		1.0			
X-Ray 2 Interior, S20	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S21	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S22	11/21/2003	3		2		0.2		1.00		2.4			
X-Ray 2 Interior, S23	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S24	11/21/2003	3		2		0.2		1.00		2.4			
X-Ray 2 Interior, S25	11/21/2003	3		2		0.2		1.00		2.4			
X-Ray 2 Interior, S26	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S27	11/21/2003	3		1		0.2		0.50		1.0			
X-Ray 2 Interior, S28	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S29	11/21/2003	3		1		0.2		0.50		1.0			
X-Ray 2 Interior, S30	11/21/2003	3		2		0.2		1.00		2.4			
X-Ray 2 Interior, S31	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Interior, S32	11/21/2003	3		0		0.2		0.00		-0.4			
X-Ray 2 Exterior, W01	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, W02	11/24/2003	8		2		0.4		1.00		1.7			
X-Ray 2 Exterior, W03	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, W04	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, W05	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, W06	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, W07	11/24/2003	8		2		0.4		1.00		1.7			
X-Ray 2 Exterior, W08	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, W09	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, W10	11/24/2003	8		0		0.4		0.00		-1.1			

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X-Ray 2 Exterior, W11	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, W12	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E01	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E02	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E03	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E04	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E05	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E06	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E07	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E08	11/24/2003	8		2		0.4		1.00		1.7			
X-Ray 2 Exterior, E09	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E10	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E11	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E12	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E13	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E14	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E15	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E16	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E17	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E18	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E19	11/24/2003	8		2		0.4		1.00		1.7			
X-Ray 2 Exterior, E20	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E21	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E22	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E23	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E24	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E25	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E26	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E27	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E28	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E29	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E30	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E31	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E32	11/24/2003	8		1		0.4		0.50		0.3			
X-Ray 2 Exterior, E33	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E34	11/24/2003	8		0		0.4		0.00		-1.1			
X-Ray 2 Exterior, E35	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, E36	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, E37	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, E38	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, E39	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, E40	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S01	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S02	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S03	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S04	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, S05	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, S06	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S07	11/25/2003	7		0		0.4		0.00		-1.0			

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X-Ray 2 Exterior, S08	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S09	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S10	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, S11	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S12	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S13	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S14	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S15	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, S16	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S17	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S18	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S19	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S20	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, S21	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S22	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S23	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S24	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S25	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S26	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S27	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S28	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S29	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S30	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, S31	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, S32	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N01	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N02	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N03	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N04	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N05	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N06	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N07	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N08	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N09	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N10	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N11	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N12	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N13	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N14	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N15	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N16	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N17	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N18	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N19	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N20	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N21	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N22	11/25/2003	7		3		0.4		1.50		3.2			
X-Ray 2 Exterior, N23	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N24	11/25/2003	7		1		0.4		0.50		0.4			

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X-Ray 2 Exterior, N25	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N26	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N27	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N28	11/25/2003	7		2		0.4		1.00		1.8			
X-Ray 2 Exterior, N29	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N30	11/25/2003	7		0		0.4		0.00		-1.0			
X-Ray 2 Exterior, N31	11/25/2003	7		1		0.4		0.50		0.4			
X-Ray 2 Exterior, N32	11/25/2003	7		0		0.4		0.00		-1.0			

CABRERA STATIC COUNTING WORKSHEET (Rev 5)

Detector Active Area (cm^2)
100

α eff	β eff
0.1920	

Static Count Time (min)
1.0

Daily Background Count Time (min)
1.0

dpm/100 cm^2	
α Flag	β Flag
5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts*		Sample Total Counts		Background (cpm)		Sample Counts (cpm)		Sample (dpm/100 cm^2)		> α flag	> β flag	Tech. Initial
		α	β	α	β	α	β	α	β	α	β			
A7 Interior N1	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior N2	2/10/2003	0		3		0.0		3.00		15.6				
A7 Interior N3	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior N4	2/10/2003	0		0		0.0		0.00		0.0				
A7 Interior N5	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior N6	2/10/2003	0		3		0.0		3.00		15.6				
A7 Interior S1	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior S2	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior S3	2/10/2003	0		4		0.0		4.00		20.8				
A7 Interior S4	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior S5	2/10/2003	0		4		0.0		4.00		20.8				
A7 Interior S6	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior E1	2/10/2003	0		3		0.0		3.00		15.6				
A7 Interior E2	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior E3	2/10/2003	0		3		0.0		3.00		15.6				
A7 Interior E4	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior E5	2/10/2003	0		4		0.0		4.00		20.8				
A7 Interior E6	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior E7	2/10/2003	0		6		0.0		6.00		31.3				
A7 Interior E8	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior E9	2/10/2003	0		4		0.0		4.00		20.8				
A7 Interior E10	2/10/2003	0		3		0.0		3.00		15.6				
A7 Interior C1	2/10/2003	0		0		0.0		0.00		0.0				
A7 Interior C2	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior C3	2/10/2003	0		0		0.0		0.00		0.0				
A7 Interior C4	2/10/2003	0		4		0.0		4.00		20.8				
A7 Interior C5	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior C6	2/10/2003	0		0		0.0		0.00		0.0				
A7 Interior C7	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior C8	2/10/2003	0		6		0.0		6.00		31.3				
A7 Interior C9	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior C10	2/10/2003	0		1		0.0		1.00		5.2				
A7 Interior C11	2/10/2003	0		2		0.0		2.00		10.4				
A7 Interior C12	2/10/2003	0		7		0.0		7.00		36.5				

CABRERA STATIC COUNTING WORKSHEET (Rev 5)

Detector Active Area (cm^2)	α eff	β eff	Static Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
100	0.1920		1.0	1.0	5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
A7 Exterior N1	4/14/2003	1		4		1.0		4.00		15.6				
A7 Exterior N2	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior N3	4/14/2003	1		7		1.0		7.00		31.3				
A7 Exterior N4	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior N5	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior N6	4/14/2003	1		3		1.0		3.00		10.4				
A7 Exterior N7	4/14/2003	1		4		1.0		4.00		15.6				
A7 Exterior N8	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior N9	4/14/2003	1		0		1.0		0.00		-5.2				
A7 Exterior N10	4/14/2003	1		3		1.0		3.00		10.4				
A7 Exterior N11	4/14/2003	1		5		1.0		5.00		20.8				
A7 Exterior N12	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior S1	4/14/2003	1		3		1.0		3.00		10.4				
A7 Exterior S2	4/14/2003	1		21		1.0		21.00		104.2				
A7 Exterior S3	4/14/2003	1		57		1.0		57.00		291.7				
A7 Exterior S4	4/14/2003	1		5		1.0		5.00		20.8				
A7 Exterior S5	4/14/2003	1		16		1.0		16.00		78.1				
A7 Exterior S6	4/14/2003	1		23		1.0		23.00		114.6				
A7 Exterior S7	4/14/2003	1		22		1.0		22.00		109.4				
A7 Exterior S8	4/14/2003	1		35		1.0		35.00		177.1				
A7 Exterior S9	4/14/2003	1		31		1.0		31.00		156.3				
A7 Exterior S10	4/14/2003	1		55		1.0		55.00		281.3				
A7 Exterior S11	4/14/2003	1		50		1.0		50.00		255.2				
A7 Exterior S12	4/14/2003	1		35		1.0		35.00		177.1				
A7 Exterior W1	4/14/2003	1		3		1.0		3.00		10.4				
A7 Exterior W2	4/14/2003	1		0		1.0		0.00		-5.2				
A7 Exterior W3	4/14/2003	1		4		1.0		4.00		15.6				
A7 Exterior W4	4/14/2003	1		5		1.0		5.00		20.8				
A7 Exterior W5	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior W6	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior W7	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior W8	4/14/2003	1		3		1.0		3.00		10.4				
A7 Exterior W9	4/14/2003	1		18		1.0		18.00		88.5				
A7 Exterior W10	4/14/2003	1		9		1.0		9.00		41.7				
A7 Exterior W11	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior W12	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior W13	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior W14	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior W15	4/14/2003	1		2		1.0		2.00		5.2				
A7 Exterior R1	4/14/2003	1		3		1.0		3.00		10.4				
A7 Exterior R2	4/14/2003	1		8		1.0		8.00		36.5				
A7 Exterior R3	4/14/2003	1		7		1.0		7.00		31.3				
A7 Exterior R4	4/14/2003	1		6		1.0		6.00		26.0				

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A7 Exterior R5	4/14/2003	1		8		1.0		8.00		36.5				
A7 Exterior R6	4/14/2003	1		4		1.0		4.00		15.6				
A7 Exterior R7	4/14/2003	1		10		1.0		10.00		46.9				
A7 Exterior R8	4/14/2003	1		0		1.0		0.00		-5.2				
A7 Exterior R9	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior R10	4/14/2003	1		7		1.0		7.00		31.3				
A7 Exterior R11	4/14/2003	1		5		1.0		5.00		20.8				
A7 Exterior R12	4/14/2003	1		5		1.0		5.00		20.8				
A7 Exterior R13	4/14/2003	1		4		1.0		4.00		15.6				
A7 Exterior R14	4/14/2003	1		9		1.0		9.00		41.7				
A7 Exterior R15	4/14/2003	1		10		1.0		10.00		46.9				
A7 Exterior R16	4/14/2003	1		10		1.0		10.00		46.9				
A7 Exterior R17	4/14/2003	1		9		1.0		9.00		41.7				
A7 Exterior R18	4/14/2003	1		9		1.0		9.00		41.7				
A7 Exterior R19	4/14/2003	1		7		1.0		7.00		31.3				
A7 Exterior R20	4/14/2003	1		1		1.0		1.00		0.0				
A7 Exterior E1	4/16/2003	1		1		1.0		1.00		0.0				
A7 Exterior E2	4/16/2003	1		11		1.0		11.00		52.1				
A7 Exterior E3	4/16/2003	1		17		1.0		17.00		83.3				
A7 Exterior E4	4/16/2003	1		8		1.0		8.00		36.5				
A7 Exterior E5	4/16/2003	1		4		1.0		4.00		15.6				
A7 Exterior E6	4/16/2003	1		9		1.0		9.00		41.7				
A7 Exterior E7	4/16/2003	1		16		1.0		16.00		78.1				
A7 Exterior E8	4/16/2003	1		12		1.0		12.00		57.3				
A7 Exterior E9	4/16/2003	1		5		1.0		5.00		20.8				
A7 Exterior E10	4/16/2003	1		5		1.0		5.00		20.8				
A7 Exterior E11	4/16/2003	1		4		1.0		4.00		15.6				
A7 Exterior E12	4/16/2003	1		12		1.0		12.00		57.3				
A7 Exterior E13	4/16/2003	1		7		1.0		7.00		31.3				
A7 Exterior E14	4/16/2003	1		21		1.0		21.00		104.2				
A7 Exterior E15	4/16/2003	1		2		1.0		2.00		5.2				

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Detector Active Area (cm^2)	α eff	β eff	Static Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
100	0.1920		1.0	1.0	5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
A7 Interior W1	6/22/2003	0		3		0.0		3.00		15.6				
A7 Interior W2	6/22/2003	0		2		0.0		2.00		10.4				
A7 Interior W3	6/22/2003	0		3		0.0		3.00		15.6				
A7 Interior W4	6/22/2003	0		2		0.0		2.00		10.4				
A7 Interior W5	6/22/2003	0		3		0.0		3.00		15.6				
A7 Interior W6	6/22/2003	0		1		0.0		1.00		5.2				
A7 Interior W7	6/22/2003	0		1		0.0		1.00		5.2				
A7 Interior W8	6/22/2003	0		1		0.0		1.00		5.2				
A7 Interior W9	6/22/2003	0		4		0.0		4.00		20.8				
A7 Interior W10	6/22/2003	0		3		0.0		3.00		15.6				
A7 Interior F1	6/22/2003	0		7		0.0		7.00		36.5				
A7 Interior F2	6/22/2003	0		15		0.0		15.00		78.1				
A7 Interior F3	6/22/2003	0		6		0.0		6.00		31.3				
A7 Interior F4	6/22/2003	0		12		0.0		12.00		62.5				
A7 Interior F5	6/22/2003	0		2		0.0		2.00		10.4				
A7 Interior F6	6/22/2003	0		7		0.0		7.00		36.5				
A7 Interior F7	6/22/2003	0		7		0.0		7.00		36.5				
A7 Interior F8	6/22/2003	0		3		0.0		3.00		15.6				
A7 Interior F9	6/22/2003	0		3		0.0		3.00		15.6				
A7 Interior F10	6/22/2003	0		1		0.0		1.00		5.2				
A7 Interior F11	6/22/2003	0		5		0.0		5.00		26.0				
A7 Interior F12	6/22/2003	0		4		0.0		4.00		20.8				

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Detector Active Area (cm^2)	α eff	β eff	Static Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
100	0.2230		1.0	1.0	5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
X-Ray 2 Exterior E1	2/4/2003	1		6		1.0		6.00		22.4				
X-Ray 2 Exterior E2	2/4/2003	1		6		1.0		6.00		22.4				
X-Ray 2 Exterior E3	2/4/2003	1		9		1.0		9.00		35.9				
X-Ray 2 Exterior E4	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E5	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Exterior E6	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E7	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E8	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E9	2/4/2003	1		6		1.0		6.00		22.4				
X-Ray 2 Exterior E10	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E11	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E12	2/4/2003	1		7		1.0		7.00		26.9				
X-Ray 2 Exterior E13	2/4/2003	1		12		1.0		12.00		49.3				
X-Ray 2 Exterior E14	2/4/2003	1		13		1.0		13.00		53.8				
X-Ray 2 Exterior E15	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E16	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E17	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Exterior E18	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E19	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E20	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E21	2/4/2003	1		7		1.0		7.00		26.9				
X-Ray 2 Exterior E22	2/4/2003	1		4		1.0		4.00		13.5				
X-Ray 2 Exterior E23	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Exterior E24	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Exterior E25	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Exterior E26	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Exterior E27	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Exterior E28	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E29	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Exterior E30	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Exterior E31	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E32	2/4/2003	1		4		1.0		4.00		13.5				
X-Ray 2 Exterior E33	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Exterior E34	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E35	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E36	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Exterior E37	2/4/2003	1		13		1.0		13.00		53.8				
X-Ray 2 Exterior E38	2/4/2003	1		4		1.0		4.00		13.5				
X-Ray 2 Exterior E39	2/4/2003	1		5		1.0		5.00		17.9				
X-Ray 2 Exterior E40	2/4/2003	1		9		1.0		9.00		35.9				
X-Ray 2 Interior E1	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E2	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E3	2/4/2003	1		1		1.0		1.00		0.0				

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X-Ray 2 Interior E4	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E5	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E6	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E7	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E8	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E9	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E10	2/4/2003	1		3		1.0		3.00		9.0				
X-Ray 2 Interior E11	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E12	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E13	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E14	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E15	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E16	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E17	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E18	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E19	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E20	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E21	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E22	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E23	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E24	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E25	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E26	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E27	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E28	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E29	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E30	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E31	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E32	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E33	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E34	2/4/2003	1		0		1.0		0.00		-4.5				
X-Ray 2 Interior E35	2/4/2003	1		2		1.0		2.00		4.5				
X-Ray 2 Interior E36	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E37	2/4/2003	1		1		1.0		1.00		0.0				
X-Ray 2 Interior E38	2/4/2003	1		9		1.0		9.00		35.9				
X-Ray 2 Interior E39	2/4/2003	1		8		1.0		8.00		31.4				
X-Ray 2 Interior E40 Not Acc	2/4/2003	1				1.0				-4.5				

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Detector Active Area (cm^2)	α eff	β eff	Static Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
100	0.1920		1.0	1.0	5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
X-Ray 2 Exterior N1	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N2	4/11/2003	3		3		3.0		3.00		0.0				
X-Ray 2 Exterior N3	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Exterior N4	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N5	4/11/2003	3		7		3.0		7.00		20.8				
X-Ray 2 Exterior N6	4/11/2003	3		24		3.0		24.00		109.4				
X-Ray 2 Exterior N7	4/11/2003	3		5		3.0		5.00		10.4				
X-Ray 2 Exterior N8	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N9	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Exterior N10	4/11/2003	3		5		3.0		5.00		10.4				
X-Ray 2 Exterior N11	4/11/2003	3		7		3.0		7.00		20.8				
X-Ray 2 Exterior N12	4/11/2003	3		11		3.0		11.00		41.7				
X-Ray 2 Exterior N13	4/11/2003	3		7		3.0		7.00		20.8				
X-Ray 2 Exterior N14	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N15	4/11/2003	3		9		3.0		9.00		31.3				
X-Ray 2 Exterior N16	4/11/2003	3		8		3.0		8.00		26.0				
X-Ray 2 Exterior N17	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N18	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N19	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Exterior N20	4/11/2003	3		9		3.0		9.00		31.3				
X-Ray 2 Exterior N21	4/11/2003	3		3		3.0		3.00		0.0				
X-Ray 2 Exterior N22	4/11/2003	3		10		3.0		10.00		36.5				
X-Ray 2 Exterior N23	4/11/2003	3		12		3.0		12.00		46.9				
X-Ray 2 Exterior N24	4/11/2003	3		8		3.0		8.00		26.0				
X-Ray 2 Exterior N25	4/11/2003	3		7		3.0		7.00		20.8				
X-Ray 2 Exterior N26	4/11/2003	3		5		3.0		5.00		10.4				
X-Ray 2 Exterior N27	4/11/2003	3		20		3.0		20.00		88.5				
X-Ray 2 Exterior N28	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N29	4/11/2003	3		6		3.0		6.00		15.6				
X-Ray 2 Exterior N30	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Exterior N31	4/11/2003	3		4		3.0		4.00		5.2				
X-Ray 2 Exterior N32	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N1 Not Acc	4/18/2003	3				3.0				-15.6				
X-Ray 2 Interior N2 Not Acc	4/18/2003	3				3.0				-15.6				
X-Ray 2 Interior N3	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N4	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N5	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N6	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N7	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N8 Not Acc	4/18/2003	3				3.0				-15.6				
X-Ray 2 Interior N9	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N10	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N11	4/18/2003	3		1		3.0		1.00		-10.4				

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X-Ray 2 Interior N12	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N13	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N14	4/18/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior N15	4/18/2003	3		3		3.0		3.00		0.0				
X-Ray 2 Interior N16	4/18/2003	3		16		3.0		16.00		67.7				
X-Ray 2 Interior N17	4/18/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior N18	4/18/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior N19	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N20	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N21	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N22	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N23	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N24 Not Acc	4/18/2003	3				3.0				-15.6				
X-Ray 2 Interior N25	4/18/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior N26	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N27	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior N28	4/18/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C1	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C2	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C3	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C4	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C5	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C6 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C7 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C8	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C9	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C10	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C11	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C12	4/11/2003	3		5		3.0		5.00		10.4				
X-Ray 2 Interior C13 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C14 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C15	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C16	4/11/2003	3		3		3.0		3.00		0.0				
X-Ray 2 Interior C17 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C18	4/11/2003	3		4		3.0		4.00		5.2				
X-Ray 2 Interior C19	4/11/2003	3		3		3.0		3.00		0.0				
X-Ray 2 Interior C20 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C21 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C22	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C23	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C24	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C25	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C26	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C27 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C28 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C29	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C30	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C31	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C32	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C33	4/11/2003	3		3		3.0		3.00		0.0				
X-Ray 2 Interior C34 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C35 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C36	4/11/2003	3		0		3.0		0.00		-15.6				

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X-Ray 2 Interior C37	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C38	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C39	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C40	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C41 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C42 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C43	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C44	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C45	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C46	4/11/2003	3		4		3.0		4.00		5.2				
X-Ray 2 Interior C47	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C48 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C49 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C50	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C51	4/11/2003	3		0		3.0		0.00		-15.6				
X-Ray 2 Interior C52	4/11/2003	3		2		3.0		2.00		-5.2				
X-Ray 2 Interior C53 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C54 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C55	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C56	4/11/2003	3		1		3.0		1.00		-10.4				
X-Ray 2 Interior C57 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C58 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C59 Not Acc	4/11/2003	3				3.0				-15.6				
X-Ray 2 Interior C60 Not Acc	4/11/2003	3				3.0				-15.6				

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Detector Active Area (cm^2)	α eff	β eff	Static Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
100	0.1920		1.0	1.0	5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
X-Ray 2 Exterior R1	6/26/2003	2		2		2.0		2.00		0.0				
X-Ray 2 Exterior R2	6/26/2003	2		28		2.0		28.00		135.4				
X-Ray 2 Exterior R3	6/26/2003	2		11		2.0		11.00		46.9				
X-Ray 2 Exterior R4	6/26/2003	2		40		2.0		40.00		197.9				
X-Ray 2 Exterior R5	6/26/2003	2		51		2.0		51.00		255.2				
X-Ray 2 Exterior R6	6/26/2003	2		58		2.0		58.00		291.7				
X-Ray 2 Exterior R7	6/26/2003	2		44		2.0		44.00		218.8				
X-Ray 2 Exterior R8	6/26/2003	2		7		2.0		7.00		26.0				
X-Ray 2 Exterior R9	6/26/2003	2		47		2.0		47.00		234.4				
X-Ray 2 Exterior R10	6/26/2003	2		37		2.0		37.00		182.3				
X-Ray 2 Exterior R11	6/26/2003	2		47		2.0		47.00		234.4				
X-Ray 2 Exterior R12	6/26/2003	2		46		2.0		46.00		229.2				
X-Ray 2 Exterior R13	6/26/2003	2		27		2.0		27.00		130.2				
X-Ray 2 Exterior R14	6/26/2003	2		16		2.0		16.00		72.9				
X-Ray 2 Exterior R15	6/26/2003	2		7		2.0		7.00		26.0				
X-Ray 2 Exterior R16	6/26/2003	2		40		2.0		40.00		197.9				
X-Ray 2 Exterior R17	6/26/2003	2		30		2.0		30.00		145.8				
X-Ray 2 Exterior R18	6/26/2003	2		46		2.0		46.00		229.2				
X-Ray 2 Exterior R19	6/26/2003	2		65		2.0		65.00		328.1				
X-Ray 2 Exterior R20	6/26/2003	2		52		2.0		52.00		260.4				
X-Ray 2 Exterior R21	6/26/2003	2		47		2.0		47.00		234.4				
X-Ray 2 Exterior R22	6/26/2003	2		6		2.0		6.00		20.8				
X-Ray 2 Exterior R23	6/26/2003	2		26		2.0		26.00		125.0				
X-Ray 2 Exterior R24	6/26/2003	2		36		2.0		36.00		177.1				
X-Ray 2 Exterior R25	6/26/2003	2		77		2.0		77.00		390.6				
X-Ray 2 Exterior R26	6/26/2003	2		71		2.0		71.00		359.4				
X-Ray 2 Exterior R27	6/26/2003	2		26		2.0		26.00		125.0				
X-Ray 2 Exterior R28	6/26/2003	2		94		2.0		94.00		479.2				
X-Ray 2 Exterior R29	6/26/2003	2		7		2.0		7.00		26.0				
X-Ray 2 Exterior R30	6/26/2003	2		82		2.0		82.00		416.7				
X-Ray 2 Exterior R31	6/26/2003	2		50		2.0		50.00		250.0				
X-Ray 2 Exterior R32	6/26/2003	2		41		2.0		41.00		203.1				
X-Ray 2 Exterior R33	6/26/2003	2		49		2.0		49.00		244.8				
X-Ray 2 Exterior R34	6/26/2003	2		40		2.0		40.00		197.9				
X-Ray 2 Exterior R35	6/26/2003	2		48		2.0		48.00		239.6				
X-Ray 2 Exterior R36	6/26/2003	2		1		2.0		1.00		-5.2				
X-Ray 2 Exterior R37	6/26/2003	2		76		2.0		76.00		385.4				
X-Ray 2 Exterior R38	6/26/2003	2		42		2.0		42.00		208.3				
X-Ray 2 Exterior R39	6/26/2003	2		28		2.0		28.00		135.4				
X-Ray 2 Exterior R40	6/26/2003	2		41		2.0		41.00		203.1				
X-Ray 2 Exterior R41	6/26/2003	2		29		2.0		29.00		140.6				
X-Ray 2 Exterior R42	6/26/2003	2		16		2.0		16.00		72.9				
X-Ray 2 Exterior R43	6/26/2003	2		6		2.0		6.00		20.8				

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X-Ray 2 Exterior R44	6/26/2003	2		47		2.0		47.00		234.4				
X-Ray 2 Exterior R45	6/26/2003	2		46		2.0		46.00		229.2				
X-Ray 2 Exterior R46	6/26/2003	2		49		2.0		49.00		244.8				
X-Ray 2 Exterior R47	6/26/2003	2		61		2.0		61.00		307.3				
X-Ray 2 Exterior R48	6/26/2003	2		39		2.0		39.00		192.7				
X-Ray 2 Exterior R49	6/26/2003	2		50		2.0		50.00		250.0				
X-Ray 2 Exterior R50	6/26/2003	2		32		2.0		32.00		156.3				
X-Ray 2 Exterior R51	6/26/2003	2		57		2.0		57.00		286.5				
X-Ray 2 Exterior R52	6/26/2003	2		25		2.0		25.00		119.8				
X-Ray 2 Exterior R53	6/26/2003	2		76		2.0		76.00		385.4				
X-Ray 2 Exterior R54	6/26/2003	2		52		2.0		52.00		260.4				
X-Ray 2 Exterior R55	6/26/2003	2		41		2.0		41.00		203.1				
X-Ray 2 Exterior R56	6/26/2003	2		48		2.0		48.00		239.6				
X-Ray 2 Exterior R57	6/26/2003	2		35		2.0		35.00		171.9				
X-Ray 2 Exterior R58	6/26/2003	2		34		2.0		34.00		166.7				
X-Ray 2 Exterior R59	6/26/2003	2		33		2.0		33.00		161.5				
X-Ray 2 Exterior R60	6/26/2003	2		46		2.0		46.00		229.2				

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Detector Active Area (cm^2)	α eff	β eff	Static Count Time (min)	Daily Background Count Time (min)	dpm/100 cm^2 α Flag	dpm/100 cm^2 β Flag
100	0.2230		1.0	1.0	5,000	

* Morning Daily Count

Sample ID# and Description	Date	Background Total Counts* α	Background Total Counts* β	Sample Total Counts α	Sample Total Counts β	Background (cpm) α	Background (cpm) β	Sample Counts (cpm) α	Sample Counts (cpm) β	Sample (dpm/100 cm^2) α	Sample (dpm/100 cm^2) β	> α flag	> β flag	Tech. Initial
X-Ray 2 Exterior SW1	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW2	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW3	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Exterior SW4	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW5	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW6	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW7	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW8	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW9	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW10	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW11	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW12	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW13	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW14	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW15	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW16	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW17	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Exterior SW18	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW19	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW20	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW21	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Exterior SW22	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW23	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Exterior SW24	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW25	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW26	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW27	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Exterior SW28	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Exterior SW29	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW30	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Exterior SW31	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Exterior SW32	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W1	11/5/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W2	11/5/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W3	11/5/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W4	11/5/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W5	11/5/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W6	11/5/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W7	11/5/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior W8	11/5/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W9	11/5/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W10	11/5/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W11	11/5/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W12	11/5/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW1	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW2	11/6/2003	0		0		0.0		0.00		0.0				

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X-Ray 2 Interior SW3	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW4	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW5	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW6	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior SW7	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW8	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW9	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW10	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior SW11	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW12	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW13	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW14	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior SW15	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior SW16	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW17	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW18	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW19	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior SW20	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW21	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW22	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW23	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW24	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW25	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior SW26	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW27	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior SW28	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW29	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW30	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior SW31	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior SW32	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W1	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W2	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior W3	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W4	11/6/2003	0		2		0.0		2.00		9.0				
X-Ray 2 Interior W5	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W6	11/6/2003	0		1		0.0		1.00		4.5				
X-Ray 2 Interior W7	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W8	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W9	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W10	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W11	11/6/2003	0		0		0.0		0.00		0.0				
X-Ray 2 Interior W12	11/6/2003	0		0		0.0		0.00		0.0				