

DEPARTMENT OF THE AIR FORCE WASHINGTON DC

20 September 2018

MEMORANDUM FOR NRC REGION IV
ATTN: Dr. Robert Evans

FROM: AFMSA/SG3PB

Subject: Review of the Final Status Survey Report (FSSR) of the Phase 1 of the Building 181 at

Robins AFB GA

We have attached the Final Status Survey Report (FSSR) of the Phase 1 of the Building 181 of the Robins AFB GA (Attachment 1). This project was performed under the regulatory authority of ARS Radioactive Materials License No. 17-29441-01 and a project-specific License Agreement between USAF and ARS Aleut Remediation (AAR) which specifies the responsibilities of Robins AFB under Master Materials License 42-23539-01AF and the activities of AAR under the ARS license. We reviewed the draft FSSR and provided comments which have been incorporated into this document. We have also attached the copy of the Verification Survey of the cell 5 and cell 6 of the Building 181 performed by the USAF School of Aerospace Medicine Occupational and Environmental Health Department/OECM Wright-Patterson AFB, OH (Attachment 2). After NRC approves the Attachment 1, USAF selected demolition contractor will demolish the Building 181 under the supervision of AAR/ARS.

We are reviewing at present, the Phase 2 Final Status Survey Plan for Building 181 dated August 2018. We request you to review the Attachment 1 and provide your approval/comments by 1 November 2018.

If you have any questions, please contact me at 703-681-6871 or email at ramachandra.k.bhat.civ@mail.mil

Ramachandra K. Bhat, Ph.D., CHP Senior Health Physicist USAF Radioisotope Committee Secretariat Air Force Medical Support Agency Office of the Surgeon General

2 Attachments:

- 1. FSSR of the Phase 1 of the Building 181
- 2. Verification Survey by USAFSAM

CC:

- 1.402 CMXG/MXDEC (Mr. Bethel)
- 2.78 MDG (Capt Baseley)
- 3. AFCEC (Ms. Cordell)
- 4. EPA Region IV (Mr. Richards)
- 5. The State of GA (Mr. Matos)
- 6. The State of GA (Mr. Simonton)
- 7. USAFSAM/OECM (Maj Shirah)

Final Status Survey Report for Building 181

August 2018

Prepared for:Robins Air Force Base

Prepared by:
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Attachment 1 – Decommissioning Plan for Robins AFB Building 181, June 2017

Attachment 2 – Photograph Log

Attachment 3 – Waste Disposal Certifications (Not Available As of Date of This Report)

Attachment 4 – Building 181 Final Status Survey Results (Survey Sheets)

Attachment 5 – Instrument Certifications and Daily Source Checks

Attachment 6 – Laboratory Analytical Report for Sediment Samples

Acronyms

AAR ARS Aleut Remediation, LLC

AFB Air Force Base

ALARA as low as reasonably achievable ANL Argonne National Laboratory

ANSI American National Standards Institute

ARS ARS International, LLC
C&D Construction and Demolition
CFR Code of Federal Regulations
CHP Certified Health Physicist

cm centimeter

cpm count per minute

DAC derived air concentration

DCGL Derived Concentration Guideline Level

DoD Department of Defense
DP Decommissioning Plan
dpm disintegration per minute
DQO Data Quality Objective
DU Depleted Uranium

ELAP Environmental Laboratory Accreditation Program

FSS Final Status Survey

FSSR Final Status Survey Report

g gram

HPT Health Physics Technician

HVAC heating, venting, and air conditioning

LAW Large Area Wipe LBP Lead-Based Paint

LBGR lower bound of the gray region LLRW low-level radioactive waste

lpm liter per minute

m meter

MARSSIM Multi-Agency Radiation Site Survey Implementation Manual

MDA Minimum Detectable Activity
MDC Minimum Detectable Concentration

NIST National Institute of Science and Technology

pCi picocurie QC Quality control

RCT Radiation Control Technician

RESRAD Residual Radioactivity Computer Codes RICS Radioisotope Committee Secretariat

RP Radiological Protection

sf square foot Th thorium

Acronyms (Continued)

U uranium

USAF United States Air Force

United States Environmental Protection Agency United States Nuclear Regulatory Commission Waste Acceptance Criteria US EPA US NRC

WAC

Executive Summary

The objective of the Robins Air Force Base (Robins AFB or the Base) Building 181 Final Status Survey (FSS) was to collect sufficient data to demonstrate that the residual radioactive contamination has been mitigated sufficiently to remove the site from federal and state radiological controls and permits. This document, referred to as an FSS Report (FSSR), describes: (i) the implementation of the Decommissioning Plan (DP); (ii) the results of the FSS activities; and (iii) develops conclusions based on the data.

Building 181, Cells 1 through 8, at Robins AFB is scheduled for demolition. Cells 5 and 6 in Building 181 are listed in Robins AFB Radioactive Material Permit (GA-00462-03/01AFP). The permit states that, "Building 181 remains on the permit until a Final Status Survey is conducted, a Final Status Survey Report is submitted for Building 181 (Cell numbers 5 and 6), and the United States Air Force (USAF) formally removes Building 181 from the permit."

Building 181 was characterized for radiological contamination resulting from depleted uranium (DU) operations within the facility. Preliminary radiation surveys performed by others, as well as surveys by ARS Aleut Remediation, LLC (AAR), a subsidiary of ARS International, LLC (ARS), detected radiological contamination in Cells 5 and 6 of Building 181.

AAR performed a Baseline Survey in November and December 2015 in the portions of Building 181 that will be demolished. The baseline survey delineated areas of depleted uranium (DU) contamination in Cells 5 and 6. The other cells and rooms of Building 181 were characterized to determine if they were impacted by migration of contamination from Cells 5 or 6. The baseline survey results indicated that only Cell 5, Cell 6, Room 3A (a room located between Cells 5 and 6), and contiguous areas and utilities were radiologically impacted.

This baseline survey provided sufficient information to develop a DP for Building 181. The DP established the scope and sequence for the decontamination and FSS activities. The DP specified the means and methods for collecting sufficient data to determine whether the radiological condition of the building satisfies the criteria for release of radiological regulatory controls. This release would allow demolition debris to be disposed in a construction and demolition (C&D) debris landfill.

The numerical criteria for release, which are called Derived Concentration Guideline Levels (DCGLs), were derived for the building surfaces of Building 181 Cells 5 and 6 and for the soils underlying Building 181. Details of the derivation of the DCGLs are provided in the DP, which was approved by the USAF and the United States Nuclear Regulatory Commission (US NRC). The State of Georgia and the United States Environmental Protection Agency (US EPA Region 4) were provided an opportunity to comment on the DCGLs. The radionuclide of concern may be described as DU. The DCGL for building surfaces contaminated with DU was calculated to be

2,570 disintegrations per minute per 100 square centimeters (dpm/100 cm²) of net gross beta contamination averaged over one square meter (m²). In this context, the measurement of gross beta contamination net of background is used as a surrogate for measurement of DU isotopes on building surfaces. The DCGL for soil under Building 181 was calculated to be 4.6 picocuries per gram (pCi/g) of uranium-238 (U-238), where U-238 is a surrogate for the radionuclides in the decay sequence of DU. The DP requires removal of radiological contamination that exceed the building surfaces and soil DCGLs.

The DP also requires removal of DU contamination that exceeds the As Low As Reasonably Achievable (ALARA) criterion. The ALARA criterion was interpreted to mean that DU contamination that is below the DCGL should be removed if it is practicable. The DP does not provide a specific numerical ALARA limit for DU contamination. To implement the ALARA requirement, numerical guidance was applied during the FSS scanning activities. The numerical guidance was to remove localized contamination that exceeded a significant fraction of 2,570 dpm/100 cm². Removal of localized contamination below the DCGL is not required by the Multi-Agency Radiation Site Survey Implementation Manual (MARSSIM) (US NRC, 2000) and, therefore, not subject to MARSSIM criteria for elevated measurement comparisons.

The DP established two phases of activity. Phase 1 includes the decontamination and surveys needed to support the demolition of the structure (i.e., the roof, walls, floor slab, and outdoor pavement) and disposal of the demolition debris as non-radiological wastes. Phase 2 includes the surveys needed to demonstrate the release of the site, including the soil and any building material that is below the floor slab. This FSSR covers the Phase 1 activities of the DP. An addendum to this FSSR will be prepared to summarize the Phase 2 survey activities and results.

The Phase 1 radiological decontamination activities were performed using means and methods described in the DP. As of the date of this report, the resulting radioactive wastes are stored at Building 181 pending disposal at a licensed facility. This Phase 1 FSSR will be amended upon waste disposal, and the certifications of waste disposal will be attached.

Following the decontamination activities, the FSS was conducted. The MARSSIM [Nuclear Regulatory Commission Regulation (NUREG)-1575, Rev. 1] provides general guidance for performing appropriate FSS measurements. Specific FSS means and methods approved by the US NRC are stipulated in the DP. The final scanning, systematic, and biased measurements conducted following the decontamination of Building 181 did not detect contamination that exceeded the building surface DCGL of 2,570 dpm/100 cm². To demonstrate quality control, a minimum of 10 percent of the basic FSS measurements, involving more than 100 smear and static measurement locations, were replicated. The quality control measurements also indicate that no residual contamination exceeds the DCGL. The final condition of the facility is that all measurements of surface contamination are below 2,570 dpm/100 cm² of net gross beta activity. A US NRC

inspection team observed the FSS activities and collected confirmatory measurements in January 2018. A USAF verification survey was performed in March 2018, after the Phase 1 FSS was completed by AAR.

It is noted that during the Cell 6 FSS activities, AAR discovered that a portion of a utility chase under Room 6A1 was constructed as a subsurface vault. Access to this confined space is through an approximately 2-foot by 2-foot square manhole located in the southern half of Room 6A1. In this report, the term "subsurface vault" is used to describe the portion of the utility chase that lies under Room 6A1. The term "pipe chase" is used to describe the portion of the utility chase that is under Room 6B1.

The scope of Phase 1 did not include surveying materials below the floor slab; therefore, the Phase 1 activity to assess the subsurface vault was limited to collecting characterization data. The accessible (i.e., non-confined space) portions of the subsurface vault in Room 6A1 were evaluated for radiological contamination in January 2018 by collecting scans, direct frisk measurements, and smears at the entrance man-hole. A sample of sediment was also collected from the vault. A characterization survey team returned to the site in April 2018 and entered the vault. The subsurface vault apparently connects eastward to the pipe chase under Room 6B1, which then exits the east end of Cell 6. Further efforts are planned to survey the subsurface during demolition of the building. An addendum to Section 5.2 of the DP is being prepared to direct this Phase 2 effort.

During the Phase 1 FSS activities, AAR also discovered that the concrete apron at the west exit of Cell 6 was contaminated above the DCGL. The area was decontaminated and the Phase 1 FSS activity was expanded to include the apron and a buffer zone as FSS survey units.

The results presented in this FSSR demonstrate that the roof, walls, and floor slab in the radiological impacted areas of Building 181 (i.e., Cell 5, Cell 6, Room 3A, and contiguous areas) have been decontaminated to levels that support deregulation of these portions of the structure. Compliance with the DCGL was demonstrated because the highest measured total reading was 2,255 dpm/100cm² and the highest single smear reading was 130 dpm/100cm².

The subsurface structures, piping, and the soils under the impacted areas (e.g., Cells 5 and 6) will be surveyed during Phase 2. The Phase 2 activities include final status surveys of: (i) the subsurface vault under Room 6A1; (ii) the piping and the pipe chase located under Room 6B1; (iii) the soil underneath Cells 5 and 6; (iv) the underside of the pavement and the soil under the concrete apron and pavement on the west side of Cell 6; and (v) the sink and shower drain lines from the Room 6B1 restroom and any drain lines encountered under the pavement on the west side of Cell 6. A separate FSS report will be prepared for Phase 2.

1.0 Introduction

1.1 Background

Building 181, Cells 1 through 8, at Robins Air Force Base (Robins AFB or Base) is scheduled for demolition. The location of Building 181 at Robins AFB is shown on Figure 1. Cells 5 and 6 of Building 181 are listed in the Robins AFB Radioactive Material Permit (GA-00462-03/01AFP). The permit notes that, "Building 181 remains on the permit until a Final Status Survey is conducted, a Final Status Survey Report is submitted for Building 181 (Cell numbers 5 and 6), and the United States Air Force (USAF) formally removes Building 181 from the permit."

Building 181 at Robins AFB was constructed in the 1940s and originally used for testing aircraft engines. A plan view of Building 181 is shown on Figure 2. The facility was constructed to include 12 "cells" (to house the engines during testing) on the first floor, interconnecting rooms between the cells on the first floor, rooms on the second and third floors, and a limited number of subsurface rooms. After the testing of engines was curtailed, the individual cells of Building 181 were re-purposed for other uses. Cells 5 and 6 were converted to support removing depleted uranium (DU) oxidation products from DU shapes used as counterweights in various aircraft. Oxidation was removed from counterweights using manual and mechanical processes, including scraping and scrubbing the oxidation. This process resulted in loose DU contamination in the work area. The cleaned DU counterweights were wiped with isopropyl alcohol prior to being encased in aluminum screening. The process methods employed during these operations resulted in residual contamination of work areas in a portion of the building (e.g., Cells 5 and 6), including the rooms between Cells 5 and 6. The DU process is believed to be the sole source of radiological contamination within Building 181.

1.2 Layout of Cells 5 and 6

Building 181 has a total footprint of approximately 70,000 square feet (sf); Cells 1 through 8 encompass approximately 64,000 sf. As shown on Figure 2, Cell 5 consists of a single open space. Cell 6 has been separated into two rooms (Room 6A1 and 6B1). A breakroom, restroom, and shower are located on the east side of Room 6B1. A two-story structure abuts the north side of Cell 6. This structure contains Rooms 3A, 3D, and 3E, which were included in the survey program.

Historical engineering drawings of Building 181, including Cells 5 and 6, indicate that a utility chase runs under the east end of Cell 6, connecting to the underground utilities that run north-to-south on the exterior of the east side of Building 181. Drain pipes were observed exiting the utility chase under Room 6B1 at the east end of the building. Presumably the utility chase includes the utility pipes from Cell 6.

There is also an electrical vault located adjacent to the overhead doors on the west end of Cell 6. There are historical drawings that indicate a 9-foot deep mechanical pit is located under Cell 6. However, ARS Aleut Remediation, LLC's (AAR) investigation of Cell 6 determined that the asbuilt location of the mechanical pit is under the east end of the Center Section (Room 4E) of Building 181, as shown on Figure 2.

1.3 Radionuclides of Concern

The radioactive contaminant of concern is DU because of the aircraft counterweight cleaning operations. The constituents of DU are U-238, U-235, U-234, and the associated decay products. DU is characterized by having the concentration of U-234 less than 50 percent of the concentration of U-238.

1.4 Historical Site Assessments

The portion of Building 181 that will be demolished was characterized for radiological contamination resulting from the DU operations conducted within the facility. A preliminary radiation survey performed by 78 AMDS/SGPB (Bioenvironmental Engineering) included 46 measurements for total radioactive contamination in Cells 5 and 6. Contamination was detected above 5,000 disintegrations per minute per 100 square centimeters (dpm/100 cm²). The date of this preliminary survey is not known. This survey established that portions of the building were impacted.

To corroborate this survey, AAR performed a follow-up scoping survey in August 2015 that also detected radiological contamination in Cells 5 and 6 of Building 181. The survey maps and affiliated results of the surveys performed in August 2015 are summarized in the Decommissioning Plan (DP) (AAR, 2017) (Attachment 1). There were no operations in the other portions of Building 181 that would have contaminated the structure; and therefore, these areas were not surveyed during the scoping survey.

AAR subsequently performed a Baseline Survey in November and December 2015 in the portions of Building 181 that will be demolished. The baseline survey delineated the areas of DU contamination in Cell 5, Cell 6, and Rooms 3A, 3D, and 3E. The other cells and rooms of Building 181 were also characterized to determine if they were impacted by migration of contamination from Cells 5 or 6. The baseline survey results indicated that only Cell 5, Cell 6, Room 3A (a first-floor room located between Cells 5 and 6), and contiguous areas and utilities were radiologically impacted.

The baseline survey data were used to prepare the DP. The DP documented: (i) the extent of radiological contamination requiring decontamination; (ii) an overview of how the decontamination would be performed and managed; and (iii) presented a design for the Multi-

Agency Radiation Survey and Site Investigation Manual (MARSSIM) Final Status Survey (FSS), including the calculation of site-specific Derived Concentration Guideline Levels (DCGLs). The scope of the FSS also included performing several measurements of the baseline survey that were incomplete. The DP was approved by the USAF, the United States Environmental Protection Agency Region 4 (US EPA Region 4), the Georgia Environmental Protection Division (GA EPD), the Radioisotope Committee Secretariat (RICS), and the United States Nuclear Regulatory Commission (US NRC) in September 2017.

1.5 Purpose

The purpose of the FSS is to determine if the radiological condition of the building satisfies the criteria for release from radiological regulatory controls. The approved DP established two phases of activity. Phase 1 included the decontamination and surveys needed to support the demolition of the structure (i.e., the roof, walls, floor slab, and outdoor pavement) and the disposal of any demolition debris as non-radiological wastes. Phase 2 included the surveys needed to demonstrate the release of the site, including the soil and any building material that is below the floor slab. This FSSR describes the Phase 1 activities of the Robins AFB DP.

The Phase 1 FSSR presents: (i) a summary of the decommissioning activities; (ii) the design of the FSS performed following decommissioning activities; (iii) the FSS field activities and procedures followed; (iv) the FSS results; (v) analysis of the FSS results; (vi) conclusions; and (vii) references.

2.0 Decontamination of Cells 5 and 6

In accordance with the DP, select areas of Building 181 required decontamination/decommissioning prior to performing the FSS. This section provides an overview of these activities.

The following areas of Building 181 required decontamination/decommissioning of lead-based paint (LBP) and/or radioactive material:

- Cell 5 Radiologically contaminated LBP on the walls up to two meters within the entire cell.
- Cell 5 LBP on the walls above two meters and ceiling (which may or may not be radiologically contaminated).
- Cell 6 Radiologically contaminated floors (includes LBP and tile), equipment, and walls (includes LBP) in Cells 5 and 6.
- Cell 6 The entrance to the subsurface vault under Room 6A1.
- Cell 6 The concrete apron and pavement (west side).
- Room 3A Radiologically contaminated floor (LBP) and threshold to Room 6A1.

The decontamination was implemented between December 2017 and February 2018 in general accordance with the DP. The decontamination was performed under the regulatory authority of ARS Radioactive Materials License No. 17-29441-01 and a project-specific License Agreement between USAF and AAR, which specifies the responsibilities of Robins AFB under Master Materials License 42-23539-01AF and the activities of AAR under the ARS license. In summary, this agreement states that AAR, a wholly-owned subsidiary of ARS, shall perform the decontamination/decommissioning work in accordance with its US NRC License No. 17-29441-01. Robins AFB shall continue to possess the radioactive material in Building 181 while it is on and within Building 181 and after it has been removed from the building surfaces and properly contained until such time the material is properly transported and disposed. Attachment 2 includes a photograph log with photographs of the decommissioning activities.

The numerical criteria for release, which are called DCGLs, were derived for both the building surfaces of Building 181 and for the underlying soil. Details of the derivation of the DCGLs are delineated in the DP. The radionuclide of concern may be described as DU. The DCGL for building surfaces contaminated with DU was calculated to be 2,570 dpm/100 cm² of net gross beta contamination averaged over one square meter (m²). In this context, the measurement of gross

beta contamination net of background is used as a surrogate for measurement of DU on building surfaces. The DCGL for soil under Building 181 is 4.6 picocuries per gram (pCi/g) of U-238, where U-238 is a surrogate radionuclide for all of the uranium isotopes in DU and their short-lived decay products.

2.1 Decontamination Summary

The decontamination included abatement of LBP greater than 1.0 milligram per square centimeter (mg/cm²), or 0.5 percent by weight, and with radioactive contamination greater than the DCGL from the interior surfaces of Cell 5 and Cell 6. The DP also required removal of DU contamination that exceeded the As Low As Reasonably Achievable (ALARA) criterion. The DCGL and the ALARA criteria are developed separately in the US NRC regulations (US NRC, 2018). The DCGL is a numerical value, while the US NRC defines ALARA as:

"making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest." (US NRC, 2018)

The DP also requires removal of DU contamination that exceeds the As Low As Reasonably Achievable (ALARA) criterion. The ALARA criterion was interpreted to mean that DU contamination that is below the DCGL should be removed if it is practicable. The DP does not provide a specific numerical ALARA limit for DU contamination. To implement the ALARA requirement, numerical guidance was applied during the FSS scanning activities. The numerical guidance was to remove localized contamination that exceeded a significant fraction of 2,570 dpm/100 cm². Removal of localized contamination below the DCGL is not required by the Multi-Agency Radiation Site Survey Implementation Manual (MARSSIM) (US NRC, 2000) and, therefore, not subject to MARSSIM criteria for elevated measurement comparisons.

The radiological decontamination included the use of strippable coatings, physical removal, and mechanical impaction/scarifying of building surfaces and equipment. Any localized spots of contamination that were found to exceed the approved DCGL after LBP removal were decontaminated by scarifying, scabbling, or chipping concrete to implement the ALARA criterion. These efforts succeeded in reducing contamination below the DCGL criteria for building surfaces.

During the decommissioning activities, surveys of the adjacent roof surfaces and the heating, venting, and air conditioning (HVAC) equipment and affiliated ductwork were performed. The adjacent roof surfaces and the powered ventilator on the roof were surveyed under MARSSIM

Class 1 criteria. The measurements were indistinguishable from background; therefore, no decontamination was performed on the roof or on the ventilation stack.

The HVAC equipment and affiliated ductwork were also surveyed under MARSSIM Class 1 specifications. The ductwork surveys consisted of both exposed exterior surface areas, as well as accessible interior surfaces. Coupon samples were cut from the ducts at bends and at locations where DU contamination might settle. The coupons, as well as the interior surfaces that were made accessible by the coupons, were surveyed. No DU contamination was found inside the Cell 6 HVAC system. Contaminated HVAC insulation in Room 6A1 was removed and will be disposed as low-level radioactive waste (LLRW). Some HVAC ductwork and other components in Room 6A1 were decontaminated. The space heaters in Cell 6 were found to be contaminated on exterior surfaces and will be disposed of as LLRW. Alternatively, the space heaters in Cell 5 were not contaminated above the DCGL and were left in place (there was not HVAC system in Cell 5).

The subsurface vault under the west end of Cell 6 Room 6A1, the soil below the concrete apron and pavement on the west side of Cell 6, and the soil under the building may be impacted; however, they cannot be accessed prior to demolition. The soil under the Building 181 Cells 5 and 6 will undergo a 100 percent gamma walk-over scan and systematic and biased soil samples will be collected following the demolition of Building 181. The post-demolition efforts (Phase 2 of the FSS) are further described in the DP.

2.2 Waste Management

The radiologically contaminated waste generated during the decontamination efforts is stored in Room 3A (double bagged asbestos materials) and in a shed located outside Cell 5 (LLRW). As of the date of this report, the radioactive wastes are pending disposal at a licensed facility. This Phase 1 FSS report will be amended upon waste disposal, and the certifications of waste disposal will be attached (Attachment 3). The waste was characterized in accordance with the proposed waste disposal facility's Waste Acceptance Criteria (WAC) and will be manifested for disposal as LLRW. Prior to shipment, the wastes will be size-reduced as necessary and packaged for transport and disposal as LLRW and/or mixed waste at a licensed treatment, storage, and disposal facility (TSDF).

Other miscellaneous debris or wastes with no radiological contamination detected by the survey instruments will be disposed as construction debris waste by the demolition contractor.

3.0 Final Status Survey Design

This section contains discussions of the: (i) MARSSIM classification; (ii) survey units; (iii) application of release criteria; (iv) data quality objectives (DQO); (v) deviations and field changes; (vi) reference area background; (vii) data verification and validation; and (viii) the number of measurements in each survey unit. The survey design was developed in the DP and implemented during the FSS.

3.1 MARSSIM Classification

Based on the results of the preliminary and baseline surveys, the decommissioning of Building 181 Cells 5 and 6 is classified as a Group 4 decommissioning project under US NRC criteria (NUREG-1757 Volume 1 Rev. 2 Figure 1.1) (US NRC, 2006), and the FSS is, therefore, subject to MARSSIM guidance. MARSSIM identifies two categories of radiological status: (i) impacted, which means having a possibility of containing radioactive contamination and a survey is required; and (ii) non-impacted, which means not considered as possibly containing significant residual regulated radioactivity. Cells 5 and 6 and the adjacent rooms, pavement, and underlying soil, are impacted; therefore, they are subject to a FSS.

MARSSIM further divides impacted areas by three classifications based on contamination potential:

- Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) greater than release criteria.
- Class 2 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination, or known contamination, but are not expected to exceed release criteria.
- Class 3 Areas: Any impacted areas that are not expected to contain any residual radioactivity or are expected to contain levels of residual radioactivity at a small fraction of the release criteria.

MARSSIM recommends the following survey unit areas for building surfaces:

- Class $1 \text{Up to } 100 \text{ m}^2$;
- Class $2 \text{Up to } 2,000 \text{ m}^2; \text{ and}$
- Class 3 Unlimited.

3.2 Survey Units

The MARSSIM classification system was applied to the designation of survey units (SUs) for this FSS. A SU is defined as a system, structure, or part of a structure that is likely to have similar potential contamination characteristics. Twenty SUs are listed in Table 1. There are 13 Class 1 SUs (65 percent of the total SUs); there is one Class 2 SU (5 percent of the total SUs); and six Class 3 SUs (30 percent of the total SUs).

The lower walls are defined for the survey as wall areas from the floor to a height of two meters. The upper walls are defined as wall areas that extend up to two meters above the lower walls. Ceilings are defined as wall and ceiling surfaces above the upper walls.

In three cases, the narrative of the DP included survey requirements that are not included in the listed FSS survey units. Therefore, these survey requirements were added to the scope of two adjacent survey units as follows:

- FSS-6 is a Class 1 survey of the upper walls of Room 6B1. The narrative of the DP also commits to a large area wipe (LAW) survey of the ceiling. Therefore, LAW measurements of the ceiling were added to the scope of FSS-6. The scope of FSS-6 does not include a Class 1 survey of the ceiling surfaces.
- FSS-9 is a Class 1 survey of the upper walls of Room 6A1. The narrative of the DP also commits to a LAW survey of the ceiling. Therefore, LAW measurements of the ceiling were added to the scope of FSS-9. The scope of FSS-9 does not include a Class 1 survey of the ceiling surfaces.
- The surveys of Room 3D and Room 3E that were completed after removal of asbestos tile are included as survey unit FC-2.

During the Phase 1 FSS, AAR further investigated a subsurface vault on the west end of Room 6A1 (FSS-10). Access to this confined space is through an approximately 2-foot by 2-foot square manhole located in the southern half of Room 6A1. The DP's discussion on survey unit classification (DP Section 2.3.4, MARSSIM Classification and Survey Units) states that:

"water could have carried contamination into this pipe chase/trench. The probability that such contamination could exceed the DCGL is low. This survey unit will be surveyed as part of the FSS following decontamination inside Cell 5 and 6 and conducted when the USAF demolition contractor initiates the removal of this portion of the Cell 5 and 6 floors."

In DP Section 5.1, the text reads

"the trench in Cells 5 and 6 had water in it and the trench was not surveyed during the Baseline Survey. The water will be removed during the decontamination of Cells 5 and 6. This trench will then be surveyed as a MARSSIM Class 2 area as originally planned."

The approved DP included dewatering of the pipe chase as a Phase 1 activity and placed the survey of the pipe chase in Phase 2. The DP assigned low probability to finding contamination in the pipe chase. The DP does not explicitly direct a characterization survey of the pipe chase, but such measurements are implicit, given that the chase was not characterized during the baseline survey.

An inspection of the subsurface vault during the Phase 1 activities indicated that there was no longer water in the vault and that the subsurface vault extended under the floor of Room 6A1. The vault is classified as a confined space. Because the Phase 1 scope of the DP did not include entering a confined space of this type, the characterization survey of the vault was limited to collecting scans, direct frisk measurements, and smears at the entrance manhole and the area directly below the man hole that could be accessed with remote tools. A sample of sediment was collected from the floor of the vault [sediment samples were also collected at other locations, see Section 4.7 (Sediment Samples)].

A characterization survey team returned to the site in April 2018 and entered the vault. The vault was found to be 20 feet wide, extending the length of Room 6A1 and narrowing at the west end. The vault is approximately four feet high. The subsurface vault apparently connects eastward to the pipe chase under Room 6B1, which then exits the east end of Cell 6, as previously described. The floor is damp and covered with sediment and debris. A sump containing water was discovered at the west end of the vault.

Characterization data were collected and are presently being analyzed. The results will be reported in a supplemental work plan that is being developed to address remediation and decontamination prior to demolition of the pipe chase. The results will be reported in an addendum to this FSSR.

The scope of this FSS survey activity also included completion of the baseline survey of the concrete apron and pavement on the west side of Cell 6. The completed baseline survey results exceeded the building surface DCGL. This result was an unexpected discovery. The pattern of the contamination was consistent with migration of contamination by historical operations involving DU being dispersed during loading or unloading operations on the apron or migrating out of Room 6A1 when the entrance door was opened. This contamination may have then spread as the result of wind, rain, or operational activities. The discovered contamination was removed, and the Phase 1 FSS activity was expanded to ensure that no other contamination was present above the DCGL in this area.

3.3 Application of Release Criteria

The release criteria include DCGLs and administrative actions for ALARA (i.e., actions that affect implementation of the release criteria). The DCGLs were applied as strict numerical criteria. The ALARA criterion was applied during the scan surveys by removing spots of significant contamination that were below the 2,570 dpm/100 cm² DCGL, but were in localized areas of contamination, relative to the average contamination in the survey unit.

The derivation of the surface contamination DCGL assumed that ten percent of the surface contamination was removable. This assumption does not constitute a DCGL per se. Rather, it is a data quality objective that must be evaluated during the validation process.

3.3.1 Derived Concentration Guideline Levels

DCGLs were derived for the building surfaces of Building 181 and for the soil beneath Cells 5 and 6. Details of the derivation of the DCGLs are contained in Appendix B of the DP: "Building 181 RESRAD Modeling Robins Air Force Base, Georgia" (Geosyntec 2016).

RESRAD-Build was used to derive the DU surface contamination value that would cause a total effective dose equivalent of 25 millirem per year (mrem/yr) to a worker. The derived value was 2,570 dpm/100 cm² using the assumption that ten percent of the total amount of radioactivity was removable contamination. This DCGL includes the radioactivity contributions from each of the three uranium isotopes (U-238, U-235, and U-234) present in DU. This combined DCGL was used because the hand-held radiation detectors used for the survey sum the contribution of the radiations emitted from all isotopes. The radiation dose equivalent contributed by each of the uranium isotopes is included in the DCGL calculation. No sum-of-fractions calculation for each of the isotopes is required because the DCGL for DU was computed considering the contribution of each uranium isotope and its decay products.

The assumption that removable contamination does not exceed ten percent of the DCGL will be tested and validated by measuring removable contamination during the FSS activity. The assumption that removable contamination does not exceed ten percent of the DCGL does not impose a distinct DCGL of 257 dpm/100 cm² for removable gross beta contamination. However, there is an obligation to ensure that the smear measurements are sufficiently sensitive to test and validate this assumption, and that the final results conform to the dose objective.

The soil DCGL was developed based on the US NRC's radiological criteria for unrestricted use of 25 mrem/yr (10 CFR 20.1402). A combined DCGL of 5.42 pCi/g for depleted uranium was calculated from the individual radionuclide DCGLs using the gross activity equation with the site-specific radionuclide fractions determined from the baseline survey. The combined DCGL was multiplied by the site-specific fraction of U-238 (85 percent) to obtain a surrogate DCGL of 4.60

pCi/g (i.e., achieving a U-238 concentration of 4.60 pCi/g will maintain a depleted uranium concentration of 5.42 pCi/g and satisfy the dose criterion). A surrogate DCGL for soil based on U-238 concentration is appropriate because depleted uranium is the sole radioactive contributor to risk, and the sum-of-fractions criterion is not applicable.

3.3.2 Application of Release Criteria

According to the DP, a survey unit may be released if the survey data satisfy the DCGL criteria and the ALARA criterion. The building surface DCGL and the soil DCGL are applied separately because exposure from soil will not occur until the building is being demolished and the limits are based on annual exposures. The surface activity DCGL (2,570 net dpm/100 cm²) is applied to building surfaces as a limit to the average concentration in a square meter for MARSSIM evaluations or as a limit to the individual results of static measurements for ALARA criteria.

There is no need to perform non-parametric statistical analyses if the individual scanning and statics measurement results do not exceed the surface contamination DCGL.

The expected soil concentration guides the classification of soil survey units after demolition. Phase 1 of the FSS did not include soil samples; however, the sediment samples are relevant to estimating potential soil concentrations. The ratio of U-234 to U-238 in DU is used to distinguish natural U-238 from U-238 associated with DU. Except for the subsurface vault under Room 6A1, volumetric characterization surveys of building sediments or debris that were conducted during this FSS do not present U-238 results that exceed the DCGL for soil. The soil under the impacted areas will be surveyed in Phase 2 after demolition of the building.

Application of the ALARA criterion is distinct from the MARSSIM FSS process. Surface radioactivity that is below the DCGL may be removed under ALARA without triggering elevated measurement criteria actions under MARSSIM and without causing reclassification or resurveying of a survey unit.

3.3.3 Investigation Levels

Investigation levels were established for scanning surfaces with floor monitor probes. The investigation level implements the MARSSIM requirement to investigate elevated scan results so that small areas of elevated radioactivity may be detected, if present. The FSS used the LM43-37 probe, which has 584 cm² of active area, for scanning large areas. For calculating the investigation level, the LM43-37 probe was assumed to have 100 cm² of active area, which is a significant conservatism. The investigation level was set at 50 percent of the DCGL for a 100 cm² active area probe, which is 1,285 net dpm. When the minimum detectable concentration (MDC) is based on equal false positive and false negative errors, and the MDC is equal to the DCGL, the investigation level is 2.33 sigma values above background, and the investigation level is 50 percent of the

DCGL. When the MDC is less than the DCGL, the investigation level is still 2.33 sigma values above background, but it is less than 50 percent of the DCGL. The DP used the terms MDC and minimum detectable activity (MDA) interchangeable. This report follows that convention.

Background levels were measured daily in Cell 4 using the same measurement methods that were implemented in the impacted areas. The investigation levels were calculated daily in terms of gross counts per minute. The survey spreadsheets were programmed with conditional formatting so that the scan results above the daily investigation level (or static results above the DCGL) were highlighted in red font on a pink fill. The LM43-37 probe has 584 cm² of open area. Any scan result of a one square meter area with an LM43-37 probe that exceeded the daily investigation level resulted in a follow-up 100 percent scan survey with an LM43-93 or LM43-89 probe. The LM43-93 probe has 100 cm² of open area. The LM43-89 probe has 125 cm² of active area. If all other factors are equal, the LM43-89 probe is more sensitive than the LM43-93 probe. The location showing the highest count rate was subjected to a one-minute static measurement and a smear sample.

When a 100 percent scan of a one square meter area was initially performed with an LM43-93 or LM43-89 probe, the location showing the highest count rate was subjected to a one-minute static measurement and a smear sample. In this case, the use of an investigation level was not applicable.

3.4 Data Quality Objectives

The DQO process and a graded approach are integrated within the MARSSIM process. The objective of the FSS is to demonstrate that the radioactive contamination has been sufficiently mitigated to support removal of Building 181 from the Robins AFB Radioactive Material Permit (GA-00462-03/01AFP). Removal of the building from the permit will allow disposal of building materials in a permitted construction and demolition (C&D) landfill. An initial survey, called the baseline survey, was performed to characterize the contamination, and provide a technical basis for the DP. The present survey, which follows the decontamination activity, is the MARSSIM FSS.

Instruments were calibrated according to American National Standards Institute (ANSI) N323A-1997. The survey methods specified in applicable AAR operating and technical procedures have been documented to provide a 95 percent confidence level in detection of surface contamination at values that satisfy the requirements of this FSS. The MDCs did not exceed 50 percent of the DCGL. The MDCs are recorded on each daily survey form.

Instruments were checked daily with traceable sources before use to assure they are operating within approximately 20 percent of their calibrated intrinsic efficiencies. Efficiencies are provided on each survey form.

Measurement accuracy and precision are approximately 20 percent. Completeness is assured by meeting the minimum surface area scan coverage requirements of MARSSIM (i.e., greater than 80 percent useable data).

The surveys were performed by trained Health Physics Technicians (HPTs) who followed standard procedures and who used properly calibrated instruments, as specified in the DP. HPTs were qualified in accordance with ARS' radiological protection (RP) procedure RP-29, *Radiological Control and Survey Technician Training*. Surveys were performed in accordance with ARS procedure RP-10, *Radioactive Contamination Control and Monitoring* and the ARS Operational Guide for Contamination Monitoring. Instrument background and performance was checked each day according to ARS procedures RP-52 and RP-53, *Setup and Operability Tests of Portable Field Instruments* and *Operability Tests – Field Instruments*.

Quality control (QC) verification measurements were performed on ten percent of the FSS static and smear measurements. The field QC verification measurements were generally performed by a dedicated QC HPT who did not perform the original measurements and who used a different instrument. QC instruments were tested daily to ensure that the instrument response was within 20 percent of the expected result. Smears were not counted by the same HPT that collected the smear samples.

During actual operations, a Certified Health Physicist (CHP) observed measurements and reviewed FSS field documentation. In addition, the CHP reviewed and evaluated the data collected during the FSS in support of this FSSR.

3.5 Deviations and Field Changes

Deviations between the FSS described in the DP and the FSS that was implemented in the field are presented below.

- The survey units were given sequential numerical designations. This is an administrative change, not a technical change, relative to the DP.
- The SU for the lower walls of Cell 5, which was a single Class 1 SU in the DP, was divided into two Class 1 SUs because the area of the lower walls was found to exceed 100 square meters. This is a technical change required to conform to MARSSIM. The actual surveyed area exceeds the minimum requirements of the approved DP, which is conservative.
- The floor of the foyer on the east side of Cell 6B1, which comprises approximately two square meters of concrete, was added to the scope of the Class 1 floor survey of Cell 6B1. The omission of this area from the scope of the floor survey was an administrative oversight.

- The ceiling of Room 6A1 was surveyed with scans, systematic statics, and smears. This
 exceeds the requirements of the DP, which specified only LAWs. The additional effort
 was performed due to the discovery of contamination above the DCGL on the heaters in
 the upper wall of the SU.
- The SU for the floor of Cell 6A1, which was a single Class 1 SU in the DP, was divided into two Class 1 SUs because the area of the floor was found to exceed 100 square meters. This is a technical change required to conform to MARSSIM.
- The HVAC system was added to the list of survey units because the DP narrative committed to a Class 1 survey of this equipment. The omission of these SUs from the table of SUs in the DP was an administrative oversight.
- Spots of contamination above the DCGL were found on the Cell 6 concrete apron and adjacent pavement. The designation of the concrete apron at the west exterior of Cell 6A1 was changed from Class 3 to Class 1. The survey area was also expanded to include the electrical utility vault that is contiguous with the Cell 6 concrete apron and a portion of the pavement in the yard that was contaminated.
- An additional SU was created as a buffer zone around the new Cell 6A1 apron SU in compliance with MARSSIM guidance. This is a technical change caused by discovery of contamination.
- An additional SU was added for investigation of soil under the Cell 6 apron and adjacent yard area after demolition.
- The utility chase described in the DP was found to be configured as a subsurface vault. Phase 1 survey plans were modified to include confined space entries. The scope of work in Phase 2 will be modified to address the subsurface vault under a separate work plan.
- AAR generally conducted its field QC measurements with different radiological instruments and on different days, which resulted in the QC measurements being similar but not identical to the primary MARSSIM measurements documented during the FSS. AAR's quality objective was to verify that no contamination above DCGLs existed in the survey units.
- All field QC measurements were performed by a qualified HPT who did not perform the
 initial MARSSIM measurements. Generally, the QC HPT used a different field instrument,
 but in some cases, excessive out-of-service instruments required use of the same
 instrument.

- The MDC for individual smears typically exceeded the sensitivity quality objective for removeable gross beta of 129 dpm/100cm². The highest individual smear MDC was 135 dpm/100cm². This exceedance is within the 20 percent DQO for conformance. The MDC for the average removeable gross beta contamination in a survey unit did not exceed 32 dpm/100cm² (Section 6.3)
- QC smears were collected by a dedicated QC HPT and counted on the same smear counter that was used for the primary MARSSIM smears. The back-up counter was reserved for counting air samples.

3.6 Reference Area Background

The reference radiation background was measured inside Cell 4 because: (i) the construction materials in Cell 4 are similar to materials in Cells 5 and 6; (ii) Cell 4 does not have a history of operations with DU; and (iii) contamination was not found in Cell 4. Therefore, Cell 4 is not an impacted area.

3.7 Data Verification and Validation

Data verification and validation ensured that the DQO process was implemented within the FSS process. Data verification involves comparing the type and quantity of data and documentation that were collected against the acquisition requirements of the DP. Data validation involves a review to ensure the data and documents satisfy the technical qualification requirements of the DP.

During the FSS activities, data verification was implemented by the CHP and the HP Supervisor, who independently reviewed the data packages for each survey unit to verify the type and quantity of data and documentations. Ten percent of the data points were repeated by a QC technician (who did not perform initial measurements).

Data validation was implemented by ensuring that each type of measurement was qualified prior to use. Instruments were calibrated according to ANSI N323A-1997. Survey instruments and methods, including smear sampling methods, were documented to provide a 95 percent confidence level in detection of surface contamination at levels not exceeding 50 percent of the DCGL. Instruments were checked daily before use to assure they are operating within approximately 20 percent of their calibrated intrinsic efficiencies. Qualification criteria are provided on each survey form (Attachment 4). Data were reviewed for completeness and compliance.

3.8 Number of Measurements

Scanning is the process of traversing a surface carefully with a probe to detect radioactivity. Scanning was performed with field survey instruments, with the exception of the LM2929, which

was used for static counts. Scanning was performed on 100 percent of the Class 1 SU surfaces and 10 percent of Class 3 SU surfaces; the one Class 2 SU is included under the scope for the Phase 2 FSS activities.

Static measurements are performed by holding the detector probe stationary approximately 0.25 inches above the surface of a material and recording the number of counts observed in a minute. A static measurement was collected in each scanned grid element (one square meter). Additional random systematic static measurements were collected in most of the SUs to be conservative. A minimum of 15 direct static measurements were required for each survey unit according to the DP. The locations of the static measurements were systematic in Class 1 survey units and judgmental in Class 3 survey units. The actual number of static measurements ranged from 24 to 125 depending on the SU.

In addition to the static measurements, removable contamination measurements using swipes were performed at each static measurement location. Swipe measurements are performed by rubbing a filter paper with moderate pressure over an area of 100 cm² to sample removable contamination. The radiations emitted from the filter paper are then counted on an LM2929. Since the swipe measurement results in this FSS did not exceed the DCGL, no further analysis was performed. Background levels for the field portable instruments were measured daily in Cell 4.

4.0 FSS Field Activities and Procedures

Following the decontamination of the radiologically contaminated areas of Building 181 as summarized in Section 2.0, a MARSSIM FSS was performed on the decontaminated surfaces. The photograph log in Attachment 2 includes photographs of the FSS activities.

4.1 Survey Staff

The FSS activity was organized and staffed as described in the DP (Attachment 1).

4.2 Survey Instruments

The selection and use of survey instruments conformed to the DP. Instrument calibration and certification data are provided in Attachment 5.

4.2.1 Selection and Types

The field survey instruments that are specified in the DP were used to perform the FSS. The 584 cm² (active area) LM 43-37 and LM 43-37-1 gas flow probes were generally used for scanning floor and walls. If the surface was not sufficiently level to provide a suitable geometry for measurement or if the handling of a large probe was inadvisable for ergonomic reasons, an LM43-93 or LM43-89 probe was used for initial scanning. The LM43-37s were paired to Ludlum Model 2221 scalers. The LM43-93s and LM43-89s were paired to LM4360 meters. Scanning results were recorded for each nominal one square meter grid element.

Ludlum gas flow proportional detectors were operated with LM2221 meters that were set to the 30 second integration mode. For each scan, the daily instrument background was added to the number of counts that would constitute 1,285 dpm of net beta activity per probe area. This quantity was programmed into the survey reports as conditional formatting that caused the result to appear in red font if the LM43-37 measurement exceeded the investigation level. In such cases, the affected grid element was resurveyed with the LM43-93 or LM43-89 probe.

When the LM43-93 or LM43-89 probe was used for scanning, the entire grid element was scanned at prescribed speed and distance. A one-minute static measurement and a smear were collected at the location of highest scan count rate.

The LM43-93 or LM43-89 probe was used to make total surface beta contamination measurements that were compared to the DCGL.

A Ludlum Model 2929 counter coupled with a Ludlum 43-10-1 dual phosphor detector was used to analyze swipes for removable alpha and beta/gamma contamination. The swipes were collected over 100 cm² areas and analyzed for removable alpha and beta/gamma contamination.

4.2.2 Calibration

Instruments were calibrated according to ANSI N323A-1997 as documented by the calibration certificates that are provided in Attachment 5.

4.2.3 Daily Checks

Daily performance tests were conducted with National Institute of Science and Technology (NIST) traceable sources prior to survey activities. No instruments exhibiting questionable performance were used in the FSS. Instruments were checked daily to assure operation within approximately 20 percent of calibrated efficiencies. The CHP reviewed all instrument source and background check results. Pertinent instrument data are provided on each FSS survey report form.

4.2.4 Probe Area Correction

The active area of the LM43-93 probe is 100 cm²; and therefore, no probe area correction is required for comparison to the DCGL. The active area of the LM43-89 probe is 125 cm². When individual surveys are conducted only with the LM43-89, the net counts were divided by the factor 1.25. If an individual survey involves both the LM43-93 and the LM43-89, the net counts were not corrected, which is conservative. The active area of the LM43-37 probe (584 cm²) was conservatively assumed to be 100 cm² when calculating investigation levels.

4.2.5 Efficiency

The calibrated 2 pi efficiencies were used for the FSS probes, as recommended in MARSSIM. The calibrated Sr-90/Y-90 source efficiency and a 0.50 surface efficiency factor were used for beta particles, according to NUREG 1507. The calibrated thorium-230 (Th-230) source efficiency and a 0.25 surface efficiency were used for alpha radiation, also per NUREG 1507. Note that the alpha radiation measurements were recorded for information only. The net gross beta measurement results were used to assess if a surface met the DCGL.

The beta source efficiency was measured using a S-90/Y-90 radiation source traceable to the NIST. The beta radiation energies from Sr-90/Y-90 closely match the beta radiation energies from thorium-234 and protactinium-234, which are decay products of U-238 in secular equilibrium with U-238. The alpha source efficiency was measured using a Th-230 source traceable to NIST, which matches the alpha energy of uranium-238. Alpha efficiencies were not used to calculate activity for comparison to the DCGL. Typical beta efficiencies and MDCs are shown in Table 2. The actual efficiencies are provided on Page 1 of the calibration report for each probe. These reports are provided in Attachment 5.

4.2.6 Sensitivity

With typical background counts and detector efficiencies, the MDCs of the radiation detection instruments used for this survey were adequate to meet the DCGLs. The MDC is used to express radiation detection instrument sensitivity. The MDC is the level of radioactivity that, if it were present, would be above the investigation level with 95 percent reliability. The MDC is a value that includes the statistical variation in the background count rate and the statistical variation in the sample count rate.

Equation 1 is used to calculate the scanning MDC, which is derived from equations 6-8 and 6-9 of MARSSIM. Equation 2 shows the equation for calculating the static MDC, which is derived from equation 6-7 and equation 6-15 of MARSSIM.

Equation 1. Scan MDC

$$MDC = (1.38 * (bcs * i)^{0.5} *60/i)/(0.75^{0.5} *A * es * ei)$$

where:

- 1.38 is the index of sensitivity for a true positive proportion of 0.95 and a false positive proportion of 0.60;
- bcs is the background count rate in counts per second;
- *i* is the measurement interval for this survey (1 second for both the Ludlum 43-93 and the Ludlum 43-89 detector);
- 0.75 is the observer efficiency (for experienced surveyors);
- A is the area of the detector in units of 100 cm², which is 1 for the LM43-93 or LM43-37 series probes and 1.25 for the larger LM43-89 probe;
- es is the surface efficiency; and
- ei is the source efficiency.

For example, using the values in Table 2, the scan MDC of the LM 43-89 probe in Table 2 is calculated as:

$$MDC = (1.38 * ((500/60) * 1)^{0.5} *60/1)/ (0.75^{0.5} * 1.25 * 0.22) = 1,000 dpm/100 cm^{2}.$$

Note that the MDC was rounded down. The values in Table 2 are calculated using a one second measurement interval for the LM43-93 and LM43-89 probes. The measurement interval for the LM43-37 probe is two seconds. Using the LM43-37 probe as an example, the scan MDC is:

$$MDC = (1.38 * ((1000/60) * 2)^{0.5} *60/2)/ (0.75^{0.5} *1* 0.22) = 1,250 dpm/100 cm^{2}.$$

Equation 2. Static MDC

MDC =
$$(3/ts + 3.29 * sn)/(A * es * ei);$$

 $sn = (60*bcs/ts + 60*bcs/tb)^{0.5}$

where:

- 3 is a statistical parameter related to reliability;
- 3.29 is a statistical parameter that represents 95 percent confidence with equal background and static count times;
- sn is the propagated uncertainty of the net count rate (e.g., MARSSIM equation 6-15);
- ts is the gross sample count time (min); and
- tb is the background sample count time (min).

The count time used for the LM43-93 and LM43-89 probes was one minute; the count time for the LM43-37 series probes was 30 seconds. The background time for all probes was one minute for calculating sensitivity; longer background count times were used in the field to be conservative. Using the values in Table 2, the static MDC of the LM 43-89 probe in Table 2 is calculated as:

$$sn = (60*(500/60)/1 + 60*(500/60)/1)^{0.5} = 1000^{0.5} = 31.62$$

$$MDC = (3/1 + 3.29*31.62)/(1.25*0.22) = 390 \text{ dpm}/100 \text{ cm}^2.$$

Using the LM43-37 probe as an example, the static MDC is:

$$sn = (60*(1000/60)/0.5 + 60*(1000/60)/1)^{0.5} = 3000^{0.5} = 54.77$$

$$MDC = (3/0.5 + 3.29*54.77)/(1*0.22) = 850 \text{ dpm}/100 \text{ cm}^2.$$

4.3 Survey Methods

A one-meter square grid was established on all MARSSIM Class 1 SUs and on the Class 3 floor SUs. Grid boundaries were marked with indelible marker or paint. The numbering convention for the square meter grid was generally "SRC" under the convention that:

- S denotes the type of surface, where F denotes floor, W denotes wall, and C denotes ceiling;
- R denotes rows, which are letters; and
- C denoted columns, which are numbers.

For example, FA1 will denote a floor location at Row A, Column 1.

Because floors are noted on the survey forms and distinguishable by inspection in the field, the "F" designation was not always applied. The rows were typically incremented from west to east. The columns were typically incremented from north to south. Survey data were documented in accordance with DP requirements. The final measurement locations were marked in the field and numbered on survey reports. The survey reports are included in Attachment 4.

Note that the instrument results were not corrected for the open detector area of the 821 cm² Ludlum 43-37-1 or the 584 cm² Ludlum 43-37. No correction was made because the contamination under the detector was not known to be uniform. If the contaminated area was less than the detector's active area, using the full area would underestimate the sensitivity. To be conservative, the assigned area of the LM43-37 probe did not exceed 125 cm², which is the area of the LM43-89 probe, for the purpose of calculating the value of the scan MDC. Therefore, the approach taken in this survey is to apply a conservative investigation level and use LM43-93 or LM43-89 probes for calculating surface contamination area concentrations.

The LM43-93 has an active area of 100 cm². The LM43-89 has an active area of 125 cm². If the LM43-89 was used exclusively for a series of measurements, the count rate results were corrected to normalize the reported contamination to a 100 cm² area.

The HPT performed a one-minute static measure and collected a smear at the location of the highest scanning count rate. The survey spreadsheet was programmed to identify LM43-37 scan results that exceeded 50 percent of the DCGL (1,275 dpm), which corresponds to approximately 2.33 sigma values above background. The HPT investigated any areas presenting above 1,285 dpm on an LM43-37 by scanning affected grid elements with the smaller probes.

4.4 Gridding

Class 1 SUs were divided into grid elements for scanning by marking lines at one-meter intervals in vertical and horizontal planes. Class 3 SUs were generally not gridded for scanning; instead, the locations for scanning, statics, and smears in Class 3 SUs were selected according to process knowledge. Process knowledge was applied so that locations that were most likely to be contaminated were selected for scanning in Class 3 SUs. However, floors and pavement were always gridded because it was practicable and because floors were most likely to require upgrading. In this FSS, for example, the SU for the Cell 6 concrete apron was upgraded to Class 1 during the FSS survey, and an additional Class 3 SU was added as a buffer zone.

Systematic sampling locations were typically laid out on a random-start triangular grid, as specified in MARSSIM, for the Class 1 SUs. Typically, a pattern based on a two-meter-sided isosceles triangle was marked on the SU. This resulted in significantly more than 15 systematic sample locations in most SUs, which was conservative. Drawings of the basic grid locations in Cells 5, Room 6B1, Room 6A1, and Room 3A are provided on Figures 3, 4, 5 and 6, respectively.

4.5 Static Measurements

At a minimum, static measurements were collected at systematic sampling locations and at the highest location in grid elements that exceeded the LM43-37 investigation level. The LM43-93 or LM43-89 probe was used to measure surface contamination for comparison to the DCGL. Measurements were made with the detector held approximately 0.25 inches above the surface being measured. A one-minute count was performed, which achieved a MDC less than 50 percent of the DCGL. The terms MDA and MDC are generally interchangeable in this FSSR.

Biased direct measurements were made at locations where the HPT noted an LM43-37 scan measurement result greater than the investigation level. The purpose was to search for potential discrete areas of contamination that exceeded the DCGL.

Figures 7 and 8 show the location of the basic static sample locations in Cell 5, Cell 6, and Room 3A, respectively.

The gross detector response in the alpha channel was reduced by the area background (net count) and corrected for detector efficiency (both source and intrinsic) to yield dpm/100 cm² readings. Note that the decision to decontaminate an area and the success of the decontamination in meeting the DCGL were always based on the direct (static) beta measurements.

4.6 Smear Samples

Smear samples were collected wherever static measurements were collected for FSS purposes. Smears were wiped over an area of 100 cm²; the alpha and beta activity on the sample was counted in the Ludlum Model 2929 low-background counter.

4.7 Sediment Samples

In addition to the surface contamination surveys that are required by the DP, sediment samples were collected in the electrical vault on the west side of Cell 6 (Attachment 2, Photograph 26), in the pipe chase on the east side of Cell 6 (Attachment 2, Photographs 24 and 25), and from the subsurface vault under Room 6A1 (Attachment 2, Photographs 4 and 18). These samples were collected for characterization purposes to inform planning for Phase 2 of the FSS. Note that the soil under the impacted portions of Building 181 was not sampled. The soil under the impacted portions of Building 181 structure will be surveyed after the building has been demolished.

The sediment samples were collected using hand trowels. The samples were placed in zip-lock bags, double bagged in the field, and then triple-bagged prior to shipping to mitigate potential cross-contamination.

The samples were sent to the ARS' Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) accredited laboratory in Port Allen, Louisiana under chain-of-custody. The sediment samples were analyzed by gamma spectroscopy and by alpha spectroscopy for U-238, U-235, and U-234.

4.8 Air Monitoring

Air sampling was performed with stationary pumps that operated for an entire work shift at approximately 40 to 60 liters per minute (lpm) or with portable breathing zone samplers that operated during a work activity at approximately 3 lpm. A total of 34 air samples were collected over a period of 23 working days. The total internal exposure resulting from all samples was 7.41 derived air concentration hours (DAC-hrs), based on beta radioactivity measurements of the air filters and the most restrictive occupational air concentration limit (2E-11 microcuries/ml per 10 CFR 20, Appendix B, Table 1, Class Y) for U-238. Of this total potential exposure, 6.31 DAC-hrs was associated with breathing zone samplers and 1.10 DAC-hrs were associated with general area air samples. The highest general area and breathing zone air samples were recounted to verify that the measurements were reproducible.

The general area air samples were simultaneously collected in the general area of indoor decontamination activities and immediately outside the building's roll-up doors. The conversion factor for assigning dose from internal exposures is 2.5 millirem per DAC-hr. The general area

internal dose for the project was, therefore, approximately 3 millirem. This dose is below the US NRC threshold for recording internal or external radiation doses from occupational exposures (500 millirem) and below the US NRC limit for exposure to members of the public (100 millirem) (US NRC, 2018).

Breathing zone samplers were carried by individuals when decontamination work would likely result in potential airborne radioactivity. Such work was always performed by workers who wore respirators. Among the workers who wore respirators and carried breathing zone air samplers, the highest exposure was 3.37 DAC-hrs. The corresponding radiation dose was 7 millirem. This dose is below the US NRC threshold for recording internal or external radiation doses from occupational exposures (500 millirem) (US NRC, 2018) and below the US NRC limit for exposure to members of the public (100 millirem) (US NRC, 2018). The affected workers wore a negative pressure airpurifying respirator, which would have significantly reduced the inhalation dose. For conservatism, the natural airborne radioactivity was not subtracted from the air sample result. Air sampling data are provided in Table 3. Exposure was calculated by converting air sample readings to radioactivity concentrations and applying a conversion factor. For example, Air Sample No 1:

$$EXP_{U-238} = (A_{beta}/2.22E+6)/(AF*T_{AF}+*1E+3*2E-11) = 0.04$$

where:

- EXPU-238 is the internal exposure (DAC-hrs);
- Abeta is the U-238 activity (dpm);
- 2.22E+6 is the conversion factor from activity in dpm to microcuries (μCi);
- AF is the flow rate of air into the filter sample (lpm);
- TAF is the duration of air sampling (minutes);
- 1E+3 is the conversion factor from volume in liters to milliliters (mL); and
- 2E+11 is the conversion factor from concentration in µCi/mL to DAC-hrs.

For Air Sample No. 1, this calculation yields:

•
$$EXP_{U-238} = (5.4E+0/2.22E+6) (600/60)/(50*600*1E+3*2E-11) = 0.04$$

An air sample number with an "R" indicates a recount of a previous result.

5.0 Survey Results

This section provides details of the radiological FSS measurements that were performed in each SU. The results are summarized in Table 4, which provides the highest readings and the highest MDCs in each survey unit. The highest MDC is provided to show that all measurements were performed with adequate sensitivity. The highest measurements are provided to show that all survey units in Phase 1 comply with the DCGL requirement. The highest MDC may not be applicable to the highest contamination reading. The MDCs for static readings and for scanning with the LM43-37 class instruments were calculated for each survey report. In cases where the LM43-37 class instruments were not used for scanning, the scanning MDC was obtained from Table 2. Note that negative readings are expected in large surveys due to variations in natural background between the location of sampling and the location of the background measurement. These variations may be due to differences in materials, temporal changes, or statistical fluctuations. In an ideal environment in the absence of regulated radioactivity, 50 percent of all measurements would be negative due to statistical fluctuations. Additional analyses and reviews are provided in Section 6.0 (Analysis of Data).

5.1 Survey Unit FSS-1

This survey unit area is divided into two Class 1 SUs: (i) FSS-1A, the south and east lower walls of Cell 5; and (ii) FSS-1B, the north and west lower walls of Cell 5.

5.1.1 FSS-1A

This SU is comprised of 68 grid elements that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 26 dpm/100 cm² of removable beta contamination and 318 dpm/100 cm² of total contamination.

One grid element on the south wall, SW-P2, presented a 30 second scan count above the investigation level. The grid element was later rescanned with an LM43-93 probe. The rescan recorded 47 dpm/ 100 cm^2 of removable beta contamination and 134 dpm/ 100 cm^2 of total contamination. The MDCs were 132 and 292 dpm/ 100 cm^2 , respectively.

There were 30 systematic measurement locations in FSS-1A; the highest smear and static readings recorded were 111 dpm/100 cm² of removable beta contamination and 155 dpm/100 cm² of total contamination.

The standard deviation of the systematic static measurements was $319 \text{ dpm}/100 \text{ cm}^2$. The highest scan MDC was $765 \text{ dpm}/100 \text{ cm}^2$. The highest smear and statics MDCs were $133 \text{ and } 371 \text{ dpm}/100 \text{ cm}^2$, respectively.

5.1.2 FSS-1B

This SU is comprised of 68 grid elements that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 53 dpm/100 cm² of removable beta contamination and 357 dpm/100 cm² of total contamination.

No grid element presented a 30 second scan count above the investigation level.

There were 30 systematic measurement locations; the highest smear and static readings recorded were 62 dpm/100 cm² of removable beta contamination and 309 dpm/100 cm² of total contamination.

The standard deviation of the systematic static measurements was 297 dpm/100 cm². The highest scan MDC was 765 dpm/100 cm². The highest smear and statics MDCs were 135 and 417 dpm/100 cm², respectively.

5.2 Survey Unit FSS-2

FSS-2 is a Class 3 survey unit comprising of the floor of Cell 5, which includes 96 m² of scannable floor area. Because the survey unit is entirely flooring, every grid element was surveyed as an ALARA protocol. This exceeds the minimum requirements for a Class 3 survey unit, which is 10 percent of the area.

This SU is comprised of 99 grid elements that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 58 dpm/100 cm² of removable beta contamination and 272 dpm/100 cm² of total contamination.

No grid element presented a 30 second scan count above the investigation level. However, two grid elements were rescanned based on the HPT's judgment. The highest results from the rescans were 17 dpm/100 cm2 of removable beta contamination and 456 dpm/100 cm2 of total contamination.

There were 28 systematic measurement locations; the highest smear and static readings recorded were 83 dpm/100 cm² of removable beta contamination and 544 dpm/100 cm² of total contamination.

The standard deviation of the systematic measurements was 248 dpm/100 cm². The scan MDC was 683 dpm/100 cm². The highest smear and statics MDCs were 133 and 411 dpm/100 cm², respectively.

5.3 Survey Unit FSS-3

FSS-3 is a Class 3 survey unit comprising the upper walls of Cell 5 (136 m²) and the ceiling of Cell 5 (131 m²). The minimum number of 1 m² grid elements for a Class 3 survey unit, which is 10 percent of the area, is 27. In the field, 24 square meters were scanned on the upper walls and 15 grid elements were scanned on the ceiling as an ALARA activity. The grid elements were selected by the judgment of the HPT, according to likely locations for contamination. This exceeds the minimum requirements. The light fixtures were surveyed as additional measurements. The highest reading on a light fixture was 85 dpm/100 cm² of total contamination.

This SU was scanned with the LM43-89 probe. A static and a smear were collected at the location of the highest count rate in each selected grid element. The highest smear and static readings recorded in association with the scan were 59 dpm/100 cm² of removable beta contamination and 196 dpm/100 cm² of total contamination.

There were 22 judgmental systematic measurement locations. The highest smear and static readings recorded were 45 dpm/100 cm² of removable beta contamination and 641 dpm/100 cm² of total contamination. Seven of the 22 systematic measurements presented residual contamination above the MDC. The average beta reading was 179 dpm/100 cm² of total contamination.

The standard deviation of the systematic measurements was $138 \text{ dpm}/100 \text{ cm}^2$. The MDC was $1,000 \text{ dpm}/100 \text{ cm}^2$ (Table 2). The highest smear and static MDCs were $133 \text{ and } 417 \text{ dpm}/100 \text{ cm}^2$, respectively.

5.4 Survey Unit FSS-4

FSS-4 is a Class 1 SU comprising 59 m² of the main floor of Room 6B1, 2 m² in a foyer, and 9 m² of the bathroom that is within Room 6B1. The SU was divided into the bathroom floor and the main floor because the floor grid numbering of the main floor could not be carried into the bathroom floor.

The main floor was scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were $67 \text{ dpm}/100 \text{ cm}^2$ of removable beta contamination and $551 \text{ dpm}/100 \text{ cm}^2$ of total contamination.

Of the 59 grid elements, 28 presented a 30 second scan count above the investigation level. The grid elements were later rescanned with an LM43-93 probe. The highest levels recorded by the rescan were 45 dpm/100 cm² of removable beta contamination and 605 dpm/100 cm² of total contamination. The concrete floor of Room 6B1 is different than the concrete used as the reference

area in Cell 4. All 89 of the grid elements presented positive direct frisk readings, indicating that there is a difference in the radiological composition of the floor of Room 6B1, compared to the reference area.

In addition, 9 m² were scanned on the bathroom floor with an LM43-37. Eight of these results were above the investigation level and were rescanned with an LM43-93. The highest smear and static readings recorded in association with the bathroom floor scan were 36 dpm/100 cm² of removable beta contamination and 769 dpm/100 cm² of total contamination. The highest levels recorded by the bathroom floor rescan were 46 dpm/100 cm² of removable beta contamination and 1,012 dpm/100 cm² of total contamination.

There is a small floor slab (2 m²) in a foyer that provides access to Room 6B1 from the outside. The floor was scanned with an LM43-93 probe. The highest readings were 73 dpm/100 cm² of removable beta contamination and 1,127 dpm/100 cm² of total contamination.

There were 25 systematic measurement locations on the main floor; the highest smear and static readings recorded were 87 dpm/100 cm² of removable beta contamination and 663 dpm/100 cm² of total contamination.

The standard deviation of the systematic floor measurements was 208 dpm/100 cm². The highest scan MDC was 730 dpm/100 cm², except for the two square meters of the foyer that were scanned with the LM43-93, where the scan MDC was 1,250 dpm/100 cm². The scan MDC for the LM43-93 probe is taken from Table 2. The highest smear and static MDCs were 127 and 425 dpm/100 cm², respectively.

5.5 Survey Unit FSS-5

FSS-5 is a Class 1 SU comprising 65 m² of the lower walls of room 6B1 and 18 m² of the lower walls of the bathroom that is within Room 6B1. The SU was subdivided into the bathroom walls and the main room walls because the grid numbering of the main room's lower walls could not be carried onto the bathroom's lower walls.

The lower walls were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 94 dpm/100 cm² of removable beta contamination and -170 dpm/100 cm² of total contamination.

Of the 83 total grid elements, one grid element presented a 30 second scan count above the investigation level. The grid element was rescanned with an LM43-93 probe. The highest levels recorded by the rescan were 31 dpm/100 cm² of removable beta contamination and -236 dpm/100 cm² of total contamination.

There were 36 systematic measurement locations on the main lower walls and four systematic measurements on the lower walls of the bathroom. The highest smear and static readings recorded were 65 dpm/100 cm² of removable beta contamination and -189 dpm/100 cm² of total contamination.

The scan MDC was 730 dpm/100 cm². The highest smear and static MDCs were 133 and 425 dpm/100 cm², respectively.

The lower and upper walls of Room 6B1 are lined with gypsum board. This gypsum board apparently emits lower amounts of natural radioactivity than the concrete used as the reference area in Cell 4. The average direct frisk associated with scans is $-446 \text{ dpm}/100 \text{ cm}^2$, which is -17 percent of the DCGL (-446/2570 = -17 percent). This bias is, therefore, within the 20 percent error specification of the DP. Therefore, the negative bias does not confound the determination that potential DU concentrations do not exceed the DCGL on the lower walls.

5.6 Survey Unit FSS-6

FSS-6 is a Class 1 SU comprising the upper walls of Room 6B1, plus a LAW-only survey of the ceiling surfaces. FSS-6 includes 79 m² of the upper walls of room 6B1 and 12 m² of the upper walls of the bathroom that is within Room 6B1. The SU was subdivided into the bathroom and the main room because the grid numbering of the main upper wall could not be carried onto the bathroom upper wall.

Of the 91 total grid elements, 24 were located on the ceiling. Although these 25 grid elements were, technically speaking, categorized as ceiling surfaces, they were scanned along with the upper wall surfaces. The survey of SU FSS-6, therefore, exceeded the minimum requirement of the DP, which specified LAW-only surveying.

The upper walls were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 95 dpm/ 100 cm^2 of removable beta contamination and 453 dpm/ 100 cm^2 of total contamination.

Of the 91 total grid elements, seven grid elements presented a 30 second scan count above the investigation level. Those grid elements were rescanned with an LM43-93 probe. The highest levels recorded by the rescan were 65 dpm/100 cm² of removable beta contamination and 453 dpm/100 cm² of total contamination. The MDCs were 81 and 281 dpm/100 cm², respectively.

There were 34 systematic measurement locations on the main upper walls and two systematic measurements on the upper walls of the bathroom. The highest smear and static readings recorded

were $104 \text{ dpm}/100 \text{ cm}^2$ of removable beta contamination and $91 \text{ dpm}/100 \text{ cm}^2$ of total contamination. The MDCs were $125 \text{ and } 371 \text{ dpm}/100 \text{ cm}^2$, respectively.

The standard deviation of the systematic measurements was 202 dpm/100 cm². The highest MDCs were 744 dpm/100 cm² for scans, 133 dpm/100 cm² for removeable contamination and 373 dpm/100 cm² for direct frisks.

The lower and upper walls of Room 6B1 are lined with gypsum board. This gypsum board apparently emits lower amounts of natural radioactivity than the concrete used as the reference area in Cell 4. The average direct frisk associated with systematic statics is $-343 \text{ dpm}/100 \text{ cm}^2$, which is -13 percent of the DCGL (-343/2570 = -13 percent). This bias is, therefore, within the 20 percent error specification of the DP. Therefore, the negative bias does not confound the determination that potential DU concentrations do not exceed the DCGL on the lower walls.

Eight LAW measurements were collected from accessible areas of the ceiling by wiping a large area of the ceiling with a masslin cloth. The HPT then performed a direct frisk on the masslin cloth with an LM43-89 probe. The highest LAW reading was 29 dpm/100 cm². Note that 24 m² of the ceiling area were included in the upper wall surveys. These grid elements are distinguished by the number "5" or "6" in the location number (e.g., C5 or H5).

5.7 Survey Unit FSS-7

This survey unit area is divided into two Class 1 survey units: (i) FSS-7A, the west end of the floor of Room 6A1, comprising rows A through H; and (ii) FSS-7B, the eastern portion of the floor of Room 6A1, comprising rows I through Q.

5.7.1 FSS-7A

This SU is comprised of 48 grid elements that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 126 dpm/100 cm² of removable beta contamination and 1,672 dpm/100 cm² of total contamination.

Twelve grid elements presented 30 second scan counts above the investigation level. The grid elements were later rescanned with an LM43-93 probe. The rescan recorded maximum readings of 88 dpm/100 cm² of removable beta contamination and 2,126 dpm/100 cm² of total contamination.

There were 18 systematic measurement locations; the highest smear and static readings recorded were 83 dpm/100 cm² of removable beta contamination and 1,203 dpm/100 cm² of total contamination.

The standard deviation was 362 dpm/100 cm². The scan MDC was 712 dpm/100 cm². The smear and static MDCs were 127 and 419 dpm/100 cm², respectively.

5.7.2 FSS-7B

This SU is comprised of 48 grid elements in rows I to Q that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 74 dpm/100 cm² of removable beta contamination and 1121 dpm/100 cm² of total contamination.

Eleven grid elements presented 30 second scan counts above the investigation level. The grid elements were later rescanned with an LM43-93 probe. The rescan recorded maximum readings of 46 dpm/100 cm² of removable beta contamination and 1,360 dpm/100 cm² of total contamination.

There were 15 systematic measurement locations; the highest smear and static readings recorded were 97 dpm/ 100 cm^2 of removable beta contamination and 1,318 dpm/ 100 cm^2 of total contamination.

The standard deviation was $402 \text{ dpm}/100 \text{ cm}^2$. The scan MDC was $712 \text{ dpm}/100 \text{ cm}^2$. The smear and static MDCs were $127 \text{ and } 419 \text{ dpm}/100 \text{ cm}^2$, respectively.

5.8 Survey Unit FSS-8

This survey unit area is a Class 1 survey unit comprised of the lower walls of Room 6A1. This SU is comprised of 90 grid elements that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 89 dpm/100 cm² of removable beta contamination and 958 dpm/100 cm² of total contamination.

Twenty-seven grid elements presented 30 second scan counts above the investigation level. The grid elements were later rescanned with an LM43-89 or LM43-93 probe. The highest rescan results were 15 dpm/100 cm² of removable beta contamination and 1,326 dpm/100 cm² of total contamination.

There were 15 systematic measurement locations; the highest smear and static readings recorded were 118 dpm/100 cm² of removable beta contamination and 783 dpm/100 cm² of total contamination.

The standard deviation was $532 \text{ dpm}/100 \text{ cm}^2$. The scan MDC was $704 \text{ dpm}/100 \text{ cm}^2$. The smear and static MDCs were $109 \text{ and } 419 \text{ dpm}/100 \text{ cm}^2$, respectively.

5.9 Survey Unit FSS-9

According to the DP, the required scope of FSS-9 is a Class 1 survey of the upper walls of Room 6A1, plus a LAW-only survey of the ceiling. Survey Unit 9 is a Class 1 SU comprising 79 m² of the upper walls of room 6B1, plus the ceiling survey. That is, the survey is constituted as a Class 1 survey of the upper walls, plus a limited additional effort in the ceiling area. The LAW survey is mentioned in the narrative of the DP, but not listed in the summary of the FSS scope (DP, Table 21).

5.9.1 FSS-9 Ceiling

The LAW survey of the ceiling was expanded into an LM43-93 scan survey of 20 m² of ceiling due to a reference to contamination in an "overhead pipe chase" in the baseline survey. Because the specific location of the "overhead pipe chase" was not recorded in the baseline survey, the LAW survey was expanded to comprise 20 locations of 1 m² each. The locations were selected to correspond to potential "overhead pipe chase" locations and other areas judged to potentially be contaminated. Each location was scanned, and a direct frisk and a smear was collected at the highest reading spot in each 1 m² area.

The 20 ceiling locations were scanned with the LM43-93 probe. The scan MDC was 1,250 dpm/100 cm²(Table 2). The highest smear and static readings recorded in association with the scan were 100 dpm/100 cm² of removable beta contamination and 1,021 dpm/100 cm² of total contamination. The highest MDCs were 133 dpm/100 cm² for removable contamination and 418 dpm/100 cm², for direct frisks. The average of these biased smear samples is 16 dpm/100 cm² of removable beta contamination and the average biased static reading was 292 dpm/100 cm² of total contamination.

Contamination was found in the overhead pipe area associated with the HVAC system in Room 6A1. This equipment was surveyed as part of the HVAC SU, FSS-13. The HVAC contamination is reported in FSS-13. The survey of the ceiling surface is reported here. The ceiling survey did not uncover contamination that exceeded the DCGL.

5.9.2 FSS-9 Upper Walls

There were 92 grid elements laid out on the upper walls, each 1 m² in area. The upper walls were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 123 dpm/100 cm² of removable beta contamination and 442 dpm/100 cm² of total contamination.

Of the 92 total grid elements, 15 grid elements presented a 30 second scan count above the investigation level. Those grid elements were rescanned with an LM43-93 probe. The highest levels recorded by the rescan were 27 dpm/100 cm² of removable beta contamination and 109 dpm/100 cm² of total contamination.

There were 15 systematic measurement locations; the highest smear and static readings recorded were 83 dpm/100 cm² of removable beta contamination and -55 dpm/100 cm² of total contamination.

The standard deviation of the systematic measurements was 150 dpm/100 cm². The scan MDC was 704 dpm/100 cm². The highest MDCs were 133 dpm/100 cm² for removeable contamination and 418 dpm/100 cm², for direct frisks.

5.10 Survey Unit FSS-10

This characterization survey includes the utility spaces under Cell 6 and the connecting pipe chase that is outdoors on the east side of Building 181. The subsurface vault entrance in Room 6A1 and the pipe chase exit of Room 6B1 exit were treated as non-permitted confined spaces. The entrance to the vault that is inside Cell 6 consisted of a 2-feet by 2-feet iron grate in Room 6A1. The grate allowed material to migrate from the floor of Room 6A1 into the vault. The grate and a metal bucket that was found in the vault were contaminated and classified as LLRW. The lip of the concrete floor that held the grate was decontaminated. An entry into the vault was performed as a follow-up activity. The radiological status of the vault and proposed actions will be described in a separate work plan.

The surface contamination survey data at the vault entrance indicate that the building surfaces of the utility chase under Cell 6 are radiologically impacted.

5.10.1 Subsurface Vault Entrance in Room 6A1

The accessible portions of the entrance of the vault were 100 percent probed and smeared. The accessible portion consisted of the lip of the entrance and the underside of the floor slab that could be reached by hand. The lip was found to be contaminated above the DCGL and was decontaminated prior to the FSS measurements. The floor of the vault was observed to be covered with sediment and debris. A bucket found inside the utility vault removed and found to be contaminated and was classified as LLRW. The sediment in the pipe chase prevented survey measurements of the floor of the vault.

The FSS scans and direct frisks showed that surface contamination levels did not exceed the DCGL. The smear and static readings recorded in association with the scan were 2 to 130 dpm/100

cm² of removable beta contamination and 360 to 2,255 dpm/100 cm² of total contamination. The MDCs were 132 dpm/100 cm² for removeable contamination, 1,250 dpm/100 cm² for scans and 303 dpm/100 cm² for direct frisks. The scan MDC for the LM43-93 probe was taken from Table 2.

A sample of the sediment was collected for U-238, U-235, and U-234 analyses. The laboratory analysis report of the sediment sample is provided in Attachment 6, and the analytical results are summarized in Table 5. The sediment in the vault presented a U-234/U-238 ratio indicative of DU and a U-238 sediment concentration above the soil DCGL. The analysis of isotope ratios is provided for information only. The sediment was packaged for disposal as LLRW. Release decisions are solely based on the concentration of U-238.

5.10.2 Pipe Chase Exit

The accessible impacted portions of the exit of the pipe chase were probed. Scanning did not indicate the presence of DU contamination. The floor of the chase was covered with sediment and obstructed by the piping. Therefore, a direct frisk of the concrete floor could not be obtained. The piping was hung above the floor, such that the absence of contamination on the exit piping could not be judged representative of absence of contamination on the floor of the pipe chase. The piping presumably includes the sink and shower drains from Room 6B1. Therefore, the absence of contamination on the exterior of the piping is not an indication of the absence of contamination on the interior of the drain piping. Available data regarding contamination surveys of the floor in Room 6B1 are provided in the results of Survey Unit FSS-4. Since the drain pipes are inside the utility chase, material, and equipment surveys of the interior of the pipes are in the scope of work for the Phase 2 survey of the utility chase.

A sample of the sediment at the pipe chase exit was collected for isotopic analysis of U-238, U-235 and U-234. The laboratory analysis report of the sediment sample is provided in Attachment 6, and the analytical results are summarized in Table 5. The gamma spectroscopy data indicate that the total U-238 concentration in sediment in the east exit of the pipe chase was below the DCGL for soil. This sediment was left in place.

5.11 Survey Unit FSS-11

This Class 1 survey unit is comprised of the floor of Room 3A, which connects Room 6A1 to the personnel entrance on the west side of Building 181. Because the survey unit is Class 1, every grid element was surveyed.

This SU is comprised of 39 grid elements that were scanned with the LM43-37 probe. The highest smear and static readings recorded in association with the scan were 50 dpm/100 cm² of removable beta contamination and 1286 dpm/100 cm² of total contamination.

Twenty grid elements presented a 30 second scan count above the investigation level. These grid elements were rescanned. A static frisk and a smear were collected at the location of the highest count rate on each grid element. The highest results from the rescans were 23 dpm/100 cm² of removable beta contamination and 1,344 dpm/100 cm² of total contamination. The average direct frisk result was 723 dpm/100 cm² of total contamination.

There were 37 systematic measurement locations; the highest smear and static readings recorded were 76 dpm/100 cm² of removable beta contamination and 1,463 dpm/100 cm² of total contamination.

The standard deviation was 321 dpm/100 cm². The scan MDC was 650 dpm/100 cm². The highest smear and static MDCs were 133 and 423 dpm/100 cm², respectively.

5.12 Survey Unit FSS-12

This survey includes the powered exhaust vent that is above the impacted cells and the surrounding roof area. The exhaust vent is located above a small "doghouse" structure on the main roof of Building 181. The fan, motor, and ductwork were 100 percent scanned and surveyed. There was a 100 percent scan survey of the roof of the doghouse.

The roof survey is comprised of 18 grid elements of 1 m² area. The roof was 100 percent scanned with the LM43-93 probe. A direct static frisk and a smear were collected at the location of the highest count rate in each grid element. The storm water drain on the roof was separately scanned and smear sampled. In addition, an air conditioning unit on the roof was scanned. Five statics and smears were collected on the air conditioning unit. The powered exhaust ventilator stack was scanned. Five statics and smears were collected on the exhaust unit.

The smears were counted on an LM2929 after a 1-minute background count. Upon review, the resulting MDC was found to be inappropriate due to an inadequate background time. A second set of smears was collected and counted with a 10-minute background. Both sets of data are provided in the survey records. The highest smear result in the second set of samples was 59 dpm/100 cm² of removable beta contamination. The highest static reading recorded in association with the scan was -328 dpm/100 cm² of total contamination. The negative results may be due to differences in materials or temporal changes in natural background. The MDCs were 135 dpm/100 cm² for removeable contamination, 1,250 dpm/100 cm² for scans, and 584 dpm/100 cm² for direct frisks. The scan MDC for the LM43-93 probe was taken from Table 2.

5.13 Survey Unit FSS-13

This survey includes the HVAC equipment in Cell 5 and Cell 6. In Cell 5, the HVAC equipment consists of two space heaters located in the overhead area, one on each end of the cell. These heaters operated with piped hot water; there are no supply, return, or exhaust ducts. In Room 6B1, the HVAC equipment consists of supply and exhaust ducts only. The mechanical and heating equipment are in Room 6A1. In Room 6A1, a large overhead pipe chase and platform support the mechanical equipment. The ducts only supply and return air from Room 6B1. Space heaters were installed in the overhead of Room 6A1. DU contamination was measured on the exterior of HVAC ducts in the overhead pipe chase of Room 6A1 and on the overhead space heaters in Room 6A1. These space heaters were removed and disposed as LLRW. The FSS activity included a total of 43 locations where statics and smears were collected. The highest MDCs were 133 dpm/100 cm² for removeable contamination, 1,250 dpm/100 cm² for scans, and 471 dpm/100 cm² for direct frisks. The scan MDC for the LM43-93 probe was taken from Table 2.

5.13.1 Cell 5

The space heaters in Cell 5 consist of a heat exchanger and a fan in a single overhead enclosure. These units are relatively compact. Each unit was 100 percent scanned. A direct frisk and a smear were taken at the location of the highest count rate. The highest smear result in the second set of samples was 62 dpm/100 cm² of removable beta contamination. The highest static reading was negative (-14 dpm/100 cm²) of total contamination. The negative results may be due to differences in materials or temporal changes in natural background.

5.13.2 Room 6B1

In Room 6B1, the HVAC equipment consists of heating supply and exhaust ducts in the overhead. The supply duct is in the center of the ceiling with two discharge plenums in series. The return ducts are on the north and south sides of the ceiling with one large return register on each duct. The ducts connect to a heat exchanger and air handler in the overhead pipe chase in Room 6A1. There is also an air conditioning unit located on the east wall of Room 6B1. The inside of the ducts and the outside of the register of the wall unit were surveyed with LAWs. The results were negative for DU contamination.

The grill covers of the overhead north and south return ducts were removed, and the accessible interior of the ducts was surveyed. The exteriors of the return ducts were scanned, including the west end of the duct, where it penetrated the wall into Room 6A1. A four-inch-diameter coupon was cut from the sheet metal of the return ducts at a low point of the horizontal run of both return ducts. The results were negative for DU contamination. Coupons were also collected at the bends in the return ducts, which are in the overhead of Room 6A1. The highest smear result from the

coupons was 112 dpm/100 cm² of removable beta contamination. The highest static reading on the coupons was 184 dpm/100 cm² of total contamination.

The supply ducts have large flared discharge vents that are accessible to the LM43-93 probe. Therefore, no disassembly of the supply vents was performed. Each unit was scanned on the exterior and to the extent of discharge vent accessibility. The flow directors in the flared openings of the supply vents were surveyed. A direct frisk and a smear were taken at the location of the highest count rates. Two LAWs were also collected on the vents. A total of 23 locations were recorded for statics and smears.

5.13.3 Room 6A1

The space heaters in Room 6A1 consisted of a compact heat exchanger and a fan in a single enclosure located in the overhead space. These units were heavily corroded, compared to the units in Cell 5. The results of the scoping survey indicated that the units were contaminated. The survey was terminated; the units were removed for disposal as LLRW.

The mechanical HVAC equipment and the associated overhead pipe chase and platform were also surveyed. Contamination was discovered on exterior horizontal surfaces. To be conservative and meet ALARA requirements, the HVAC equipment and the overhead chase were decontaminated. The highest smear result in the final FSS samples was 60 dpm/100 cm² of removable beta contamination. The highest static reading was 644 dpm/100 cm² of total contamination. A total of 18 statics and smears were collected on the HVAC equipment that remained in Room 6A1.

5.14 Survey Unit FSS-14

This survey unit area is divided into one Class 1 survey unit and one Class 3 buffer unit: (i) FSS-14A, the concrete apron at the west end outside of Cell 6, is the Class 1 SU; and (ii) FSS-14B, a Class 3 buffer zone, extends to the north, west, and south of FSS-14A. FSS-14A was upgraded to a Class 1 SU following discovery of contamination, and FSS-14B was added as a buffer zone because FSS-14A is outdoors and because it was prudent to extend the survey to the storm drain in the yard.

5.14.1 FSS-14A

This SU is comprised of 38 grid elements of concrete pavement that were 100 percent scanned with the LM43-93 probe, and a concrete electrical vault that was scanned with an LM43-93 probe. For this survey unit, the systematic measurement locations were organized on a square grid and the data were collected during the scan survey by measuring a static count in every grid element.

For a survey unit of 38 square meters, where 15 survey locations are required, MARSSIM equation 5-6 gives the grid spacing requirement of a square grid as:

$$L = SQRT (38 \text{ m}^2/15) = 1.6 \text{ m}.$$

For FSS-14A, the grid spacing was one meter and 38 measurement locations were recorded, which exceeds the MARSSIM requirement.

The scan MDC (see Table 2) for the LM43-93 is 1,250 dpm/100 cm². The highest smear and static readings recorded in association with the pavement scan were 70 dpm/100 cm² of removable beta contamination and 1,191 dpm/100 cm² of total contamination. The highest smear and static MDCs were 130 and 206 dpm/100 cm², respectively.

An electrical vault is located within the boundary of the survey unit. The lid of the vault was surveyed as part of the pavement surface. The lids were opened, and the interior walls of the vault and the deactivated electrical cables were scanned. Direct frisks and smears were collected. No measurements exceeded the DCGL. The floor of the vault was covered with debris and sediment, which prevented surveying the concrete floor of the vault. Two samples of the sediment were collected for U-238, U-235, and U-234 analyses. The laboratory analyses are provided in Attachment 6, and the analytical results are summarized in Table 5. The sediment in the electrical vault presented a U-234/U-238 ratio indicative of DU. The U-238 concentration was below the DCGL for soil. The sediment was left in place.

The highest smear and static readings recorded in association with the electrical vault scan were 98 dpm/100 cm² of removable beta contamination and 1,058 dpm/100 cm² of total contamination. The highest MDCs were 130 and 306 dpm/100 cm², respectively.

5.14.2 FSS-14B

This SU is comprised of 32 grid elements scanned with the LM43-89 probe. Each grid element was 10 percent scanned, rather than 100 percent scanning of 10 percent of the grid elements, to ensure that the outdoor contamination was bounded by the buffer zone. The scan MDC (see Table 2) was 1,000 dpm/100 cm². The highest smear and static readings recorded in association with the scan were 81 dpm/100 cm² of removable beta contamination and 499 dpm/100 cm² of total contamination. The MDCs were 130 and 309 dpm/100 cm², respectively.

For this survey unit, the systematic measurement locations were organized on a square grid and the data were collected during the scan survey by measuring a static count in every grid element. For a survey unit of 32 square meters that requires 15 survey locations, MARSSIM Equation 5-6 gives the grid spacing requirement of a square grid as:

$$L = SQRT (32 \text{ m}^2/15) = 1.5$$

For FSS-14A, the grid spacing was one meter, which exceeds the MARSSIM requirement.

5.15 Survey Unit FC-1

This survey completes the baseline survey of Cell 4. The prior Cell 4 baseline survey did not include sufficient area to satisfy the DQOs. Two additional square meters were required for completion. This SU is comprised of two grid elements that were scanned with the LM43-37 probe. The scan MDC was 626 dpm/100 cm². None of the LM43-37 scan readings exceeded the investigation level, which was 145 counts above background. The smear readings recorded in association with the scan were -23 and -78 dpm/100 cm² of removable beta contamination. The direct frisk readings recorded in association with the scan were 120 and 203 dpm/100 cm² of total contamination. The MDCs were 83 and 330 dpm/100 cm², respectively. None of these values exceeded a small fraction of the DCGL. The categorization of Cell 4 as non-impacted was confirmed.

5.16 Survey Unit FC-2

This section discusses data that were collected during the survey of Rooms 3D and 3E following the abatement/removal of ACM floor tiles and mastic. The floors cover 98 m². The data are included here to provide a complete record of the structural surveys. As reported in the DP, the floors were scanned with a 10 percent MARSSIM Class 3 method (17 m²). No contamination was detected. All measurements were less than the MDC. The floors were then resurveyed with a 10 percent MARSSIM Class 3 method. These resurvey data are provided in the DP (Table 12). The survey forms and map are included in Attachment 4. The survey included scans, direct measurements, and smears. All results were below the MDC. No contamination was observed. No removable contamination was detected.

6.0 Analysis of Data

As indicated above, the survey data were compared directly with the DCGLs to evaluate the level and extent of contamination. The data demonstrate that the release survey data satisfy the guideline requirements. This section summarizes the: (i) QC measurements; (ii) retrospective measurement uncertainty; (iii) validation and verification of data; and (iv) sediment concentration results.

The preponderance of the QC measurements was performed by an experienced FSS radiation control technician (RCT) who functioned as a dedicated QC technician. In a few cases, the RCT supervisor performed QC measurements. The QC technician generally used an LM 2360 meter (#253248) with a dedicated LM 43-93 probe (PR312654). For example, the QC surveys of Room 3A, Room 6A1, Cell 5 and the Cell 6 apron were performed with this meter and probe combination. The QC survey of the grids in Room 6A1 were performed with LM 2360 (#310179) and LM 43-89 (PR337815). The QC survey of Room 6B1 was performed with an LM 2360 (#253248) and LM 43-93 (PR244541). All QC smears were counted with LM 2929 (#190602) and LM 43-10-1 probe (PR199159). Although the dedicated QC meter (LM 2360 #253248) was reserved for independent QC measurements, meters 310179 and 253248 were used for QC measurements when damaged mylar windows and other instrument defects confounded the primary instrument assignments. In such cases, AAR ensured that the same meter was not used for initial and QC measurements.

6.1 Quality Control Measurements

The QC measurements are discussed in terms of Cell 5 (FSS-1 through FSS-3), Cell 6 (FSS-4 through FSS-6), Room 6A (FSS-7 through FSS-9), and other adjoining areas to Cells 5 and 6 (FSS-11 through FSS-14). The survey plan includes both smear and static measurements; therefore, the QC measurement locations do not coincide with the initial FSS locations. Although static measurements can be repeated exactly on the original measurement locations, smearing the same spot twice was not considered to be appropriate. Therefore, the QC samples were collected near the original locations. As a result, the QC data cannot be compared to the original data, other than to compare both data sets to the DCGL.

6.1.1 FSS-1 through FSS-3 (Cell 5)

In Cell 5, there were a total of 153 required FSS measurements on the floor, walls, and ceiling, and a total of 20 QC measurements were completed. The QC measurements were performed as specified in the DP. The maximum, mean, and standard deviation of the FSS measurements and the QC measurements are shown in Table 6. Table 6 provides a conservative estimate of the t-statistic to demonstrate that the QC results agree with the FSS data. The value 1.96 is a conservative estimate of the 95 percent confidence level of the t-statistic:

$$t_{QC} = (Mean_{FSS} - Mean_{QC})/\sigma_{QC} = (-252 + 40)/378 = 0.56$$

where:

- toc is a conservative estimate of the t-statistic;
- Mean_{FSS} is the mean of the systematic FSS measurements;
- Mean_{QC} is the mean of the corresponding QC measurements; and
- sqc is a conservative estimate of the standard deviation of the difference between the means.

The QC results validated the findings of the FSS survey. No contamination was found that exceeded the DCGL. The absolute difference between the mean FSS measurement and the mean QC measurement was divided by the standard deviation of the QC measurements to obtain the standard deviation of the means, which is also called the z-score. The z-score value is 0.56. The 95 percent confidence level for a two-tailed test has a critical level of 1.96, which means that a z-score below 1.96 is consistent with random variation between the FSS and QC data. The QC test of Cell 5 data indicates that the FSS results are valid and reproducible.

6.1.2 FSS-4 through FSS-6 (Room 6B1)

In Room 6B1, there were a total of 232 required FSS measurements on the floor, walls, and ceiling, and a total of 26 QC measurements were completed. The QC measurements were performed as specified in the DP. The maximum, mean, and standard deviation of the FSS measurements and the QC measurements are shown in Table 7. The QC results validated the findings of the FSS survey. No contamination was found that exceeded the DCGL. The absolute difference between the mean FSS measurement and the mean QC measurement was divided by the standard deviation of the QC measurements to obtain the standard deviation of the means, which is also called the z-score. The z-score value is 1.39. The 95 percent confidence level for a two-tailed test has a critical level of 1.96, which means that a z-score below 1.96 is consistent with random variation between the FSS and QC data. The QC test of Room 6B1 data indicates that the FSS results are valid and reproducible.

6.1.3 FSS-7 through FSS-9 (Room 6A1)

In Room 6A1, there were a total of 265 required FSS measurements on the floor, walls, and ceiling and, a total of 36 QC measurements were completed. The QC measurements were performed as specified in the DP. The maximum, mean, and standard deviation of the FSS measurements and the QC measurements are shown in Table 8. The QC results validated the findings of the FSS survey. No contamination was found that exceeded the DCGL. The absolute difference between the mean FSS measurement and the mean QC measurement was divided by the standard deviation

of the QC measurements to obtain the standard deviation of the means, which is also called the z-score. The z-score value is 0.47. The 95 percent confidence level for a two-tailed test has a critical level of 1.96, which means that a z-score below 1.96 is consistent with random variation between the FSS and QC data. The QC test of Room 6A1 data indicates that the FSS results are valid and reproducible.

6.1.4 FSS-11 through FSS-14

An additional total of 20 QC measurements were collected for the four SUs that included the floor of Room 3A, the roof and stack of Cell 6, the HVAC, and the concrete apron and pavement outside Cell 6 (FSS-14A and FSS-14B). The QC measurements were performed as specified in the DP at a minimum 10 percent rate. A statistical analysis was not performed for these other QC measurements because the number of QC measurements was limited to four measurements in each SU. The CHP evaluated the additional QC data. The additional QC results did not uncover contamination that exceeded the DCGL and were evaluated to be in general agreement with the FSS measurements. The QC data were, therefore, found to validate the accuracy and reproducibility of the FSS measurements.

6.2 Retrospective Measurement Uncertainty

The minimum number of required FSS measurements in each survey unit was fifteen measurements, as established in the DP. At least fifteen systematically located measurement points were planned for each SU based on the MARSSIM approach for calculating the number of measurement data points to demonstrate compliance for release purposes. To ensure representativeness, the actual number of systematic measurements ranged from 27 to 97. The MARSSIM approach relies, in part, on the expected standard deviation (σ) of the measurements. After completing the measurements, the standard deviation may be calculated and the adequacy of the number of measurements may be validated retrospectively. The retrospective calculation of the minimum number of systematic samples points is provided in Table 9. For example, the relative shift for FSS-1A was calculated as:

$$\Delta/\sigma = (DCGL - MDC/2)/\sigma = (2.570 - 289/2)/319 = 7.6$$

where:

- DCGL = $2,570 \text{ dpm}/100 \text{ cm}^2$;
- $MDC = 289 \text{ dpm}/100 \text{ cm}^2$; and
- $\sigma = 319 \text{ dpm}/100 \text{ cm}^2$.

The relative shift is rounded down to one decimal place. For convenience, Table 5.3 of MARSSIM was used to determine the minimum number of planned samples. The minimum number of samples is nine when the relative shift is at least four. As an additional example, the relative shift for FSS-5 was calculated as:

$$\Delta/\sigma = (DCGL - MDC/2)/\sigma = (2,570 - 411/2)/153 = 15.4$$

For convenience, Table 5.3 of MARSSIM was used to determine the minimum number of planned samples. The minimum number of samples is nine when the relative shift is at least four.

The number of planned samples in each survey unit was obtained by measuring σ in each data set and applying the following assumptions:

- The alpha and beta errors are both 0.05.
- The background count rate is significant.
- The lower bound of the grey region (LBGR) is 50 percent of the MDC.

In Table 5.3 of MARSSIM, the number of planned samples has been increased by 50 percent above the number of required samples to account for unusable data. The results of this evaluation are provided in Table 9.

FSS-10, FSS-12, and FSS-13 were not evaluated by this method because the data point locations were not laid out on a systematic grid. Therefore, the calculation of σ , which uses a simple Gaussian model, could not be strictly applied. The retrospective adequacy of the number of measurements in these SUs was evaluated by observing that the minimum value of the relative shift in the FSS data were 4.4 (SU FSS-8). In MARSSIM Table 5.3, any SU with a relative shift that is at least 4.0 would require nine planned samples, including a 20 percent margin for loss. Therefore, the minimum number of valid sample results is seven. In this FSS activity, the minimum number of samples collected in the field was 15. Assuming the relative shifts of the 14 SUs in Table 9 that were explicitly calculated are representative of FSS 10, 12 and 13, collecting 15 valid results exceeded the MARSSIM requirements.

6.3 Validation and Verification of Data

The field HP Supervisor oversaw the collection of data and daily instrument checks. The field HP Supervisor also reviewed the raw data sheets and entered raw data into daily report spreadsheets. A CHP observed field measurements and provided technical direction to the field staff. When the data spreadsheets were completed, the CHP compared the data to the type and quantity of required

measurements, the instrument specifications, the assumptions that support the survey unit classifications, and the FSSR requirements.

The CHP validated the data as follows:

- Ensured that the measurement process satisfied the survey plan requirements.
- Compared the actual standard deviations to the estimated standard deviations.
- Confirmed the number of measurements in each survey unit to be sufficient.
- Checked that transcription of data values was accurate.
- Confirmed that actual results were reported.
- Performed an independent data review.
- Confirmed that repetitive (i.e., QC) measurements agree with initial measurements.
- Compared the reported values to the DCGL.
- Confirmed that the assumptions of the survey design were valid.

The CHP verified the data as follows:

- Reviewed daily instrument checks and control charts.
- Verified the calculations of MDC and investigation levels.
- Verified that instrument backgrounds were consistent with the desired MDCs.
- Verified that the number of measurements was adequate.
- Reviewed investigation results when scans exceeded investigation levels.
- Reviewed the spreadsheets for completeness, reasonableness, and internal reviews.

The FSS results for Phase 1 activities were verified.

The DQO process and a graded approach were integrated within the survey design to assure valid data. Compliance with the DCGL was demonstrated because no single post-remediation

measurement of radioactivity exceeded the DCGL. The hand-held instruments used for the survey had detection limits lower than the DCGL.

An administrative MDC of 129 dpm/100 cm² was imposed on removable gross beta contamination measurements. The field measurements typically presented MDCs in the range of 127 to 135 dpm/100 cm². This administrative MDC was subject to the overall FSS DQO for measurement accuracy and precision, which is 20 percent.

The MDC describes the sensitivity of an individual measurement, based on a calculation of 3.29 standard deviations times the propagated uncertainty of a single net measurement in a one-tailed test. The survey units in the DP included at least 18 measurements. The standard error of the mean measurement in a survey unit, which is indicative of the sensitivity of a set of measurements, is equal to the standard deviation of the individual measurement divided by the square root of the number of measurements. For a set of 18 measurements, the sensitivity of the mean smear measurement is smaller than the sensitivity of an individual smear measurement according to the factor 1/SQRT(18) (or 24 percent). The number of smears exceeded 18 in every survey unit (Table 9). The data reported in Table 4 indicate that the highest MDC for a single measurement is 135 dpm/100cm² (FSS-1B). Therefore, the worst-case calculated sensitivity for the mean removeable contamination in a survey unit is 135/SQRT(18) (or 32 dpm/100cm²).

Compliance with the DCGL was demonstrated because no single post-remediation measurement of total radioactivity exceeded the DCGL, and the measured removable radioactivity did not exceed ten percent of the DCGL. The highest measured total reading was 2,255 dpm/100cm² and the highest single smear reading was 130 dpm/100cm² (Table 4).

The non-parametric statistical analyses in MARSSIM are not necessary because all measurement results were less than the DCGL following decontamination. Likewise, there are no areas with measured contamination values averaged over 1 m² that exceed the DCGL. Survey data were reviewed to assure that the DP was followed.

This review also included evaluation of quality control data. The daily source checks included short background measurements to ensure accurate efficiency checks. The daily source checks were reviewed. All instruments satisfied the daily efficiency check requirements. The daily checks demonstrated that efficiencies were relative stable. Daily source check results are provided in Attachment 5.

The potential effect of background on sensitivity was controlled by automatically calculating the MDC daily on the survey forms and verifying compliance. Generally, high background results were undesirable because high backgrounds require extended counting times to meet sensitivity requirements. Trending backgrounds could also have been regarded as precursors to instrument

failure. The high background issues were generally limited to alpha count rates, which were not used to calculate activity. The FSS HPTs were equipped with a sufficient number of spare instruments so that an adequate inventory of usable instruments was available during the FSS activities. The daily beta backgrounds for survey use were recorded in Cell 4. Figures 9 and 10 provide the beta background data and data trends for the 22 days when FSS measurements were performed. Field backgrounds were 10-minute durations and only recorded on days where the instrument was expected to be used. The LM2929 backgrounds were 60-minute backgrounds.

6.4 Sediment Concentration Results

The sediment sampling results are provided in Attachment 6, and the results are summarized in Table 5. The analysis of isotope ratios is provided for information only. Release decisions are solely based on the concentration of U-238. The natural U-234/U-238 ratio in the environment varies from 0.5 to 1.2. The U-234 to U-238 ratios in all sediment samples indicate that the samples contain some DU because the U-234/U-238 ratios are less than 0.5, which is typically the lower limit of the U-234/U-238 ratio in natural soil. Upon inspection of the results, it is apparent that, if all measured U-238 was associated with DU, only the sediment sampled inside the subsurface vault in Room 6A1 exceeded the DCGL for soil.

An algorithm, presented below, was developed to analyze soil sample results at Robins AFB. The isotopic data indicate that the U-234/U-238 ratio from the sample collected inside the subsurface vault in Room 6A1 is 14.4 percent. Assuming this ratio is representative of DU at Robins AFB, the following equation may be derived to conservatively estimate the maximum amount of U-238 attributable to DU in a soil sample.

$$U238_{DU} = U238_{GS} - (U234_{AS} - U238_{AS} * DUR_{234/238})/1.2$$

Where:

 $U238_{DU}$ = the maximum U-238 attributed to DU;

 $U238_{GS}$ = the activity concentration of U-238 by gamma spectroscopy;

 $U234_{AS}$ = the activity concentration of U-234 by alpha spectroscopy;

 $U238_{AS}$ = the activity concentration of U-238 by alpha spectroscopy;

1.2 = the maximum natural ratio of U-234/U-238; and

 $DUR_{234/238}$ = the activity ratio of U-234 to U-238 in DU at Robins AFB.

The equation overestimates U-238 DU because DUR234/238 is biased high and the factor 1.2 underestimates the natural U-238. The gamma spectroscopy value is used to measure compliance because alpha spectroscopy results typically underestimate true soil concentrations at environmental levels due to the relatively small analytical aliquot mass and the heterogenous nature of soil. This typical relationship between gamma spectroscopy and alpha spectroscopy in soil is consistent with the sediment sample results at Robins AFB, where the gamma spectroscopy results are higher than the alpha spectroscopy results at environmental levels, but not for the elevated results for the sample inside the utility chase.

7.0 Conclusion

All Phase 1 FSS measurements are less than the building surface DCGL of 2,570 dpm/100 cm²; and therefore, the applicable Phase 1 survey units satisfy the release criteria. The removeable contamination measurements do not exceed 10 percent of the DCGL. The subsurface vault, the utility chase, the soil under the building, and the soil under the concrete apron and pavement will be surveyed in Phase 2. An addendum to the DP will be submitted to address the subsurface vault under Room 6A1 and the concrete apron and pavement on the west side of Cell 6. The Phase 2 activities include final status surveys of: (i) the subsurface vault under Room 6A1; (ii) the piping and the pipe chase located under Room 6B1; (iii) the soil underneath Cells 5 and 6; (iv) the underside of the pavement and the soil under the concrete apron and pavement on the west side of Cell 6; and (v) the sink and shower drain lines from the Room 6B1 restroom and any drain lines encountered under the pavement on the west side of Cell 6. A separate FSS report will be prepared for Phase 2.

8.0 References

AAR, 2017	Decommissioning Plan for Robins Air Force Base, ARS Aleut Remediation, LLC, June 2017
US NRC, 2000	Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) NUREG-1575, Revision 1, August 2000
US NRC, 2006	Consolidated Decommissioning Guidance, Decommissioning Process for Materials Licenses, NUREG-1757, Vol. 1, Revision 2, September 2006
US NRC, 2018	Standards for Protection Against Radiation, 10 CFR Part 20, September 2018

TABLES

Table 1 Building 181 MARSSIM Survey Units

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Survey Unit ID	Description	Survey Class	Survey Phase	Comments
FSS-1A	Cell 5, south and east lower walls	1	1	The walls were decontaminated by removing LBP and then surveyed.
FSS-1B	Cell 5, north and west walls	1	1	The walls were decontaminated by removing LBP and then surveyed.
FSS-2	Cell 5 floor	3	1	Floor was surveyed after decontamination of walls.
FSS-3	Cell 5 upper walls and ceiling	3	1	LBP was removed from the ceiling, upper walls, and light fixtures and then surveyed.
FSS-4	Room 6B1 floor	1	1	The floor was surveyed, including the floor of the bathroom.
FSS-5	Room 6B1 lower walls	1	1	The lower walls were surveyed, including the lower walls of the bathroom
FSS-6	Room 6B1 upper walls and ceiling	1	1	The required scope of FSS-6 is a Class 1 survey of the upper walls, plus an LAW-only survey of the ceiling.
FSS-7A	Room 6A1 floor	1	1	The floor was decontaminated. Rows "A" through "H" were surveyed.

Table 1 Building 181 MARSSIM Survey Units

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Survey Unit ID	Description	Survey Class	Survey Phase	Comments
FSS-7B	Room 6A1 floor	1	1	The floor was decontaminated. Rows "I" through "Z" were surveyed.
FSS-8	Room 6A1 lower walls	1	1	The walls were decontaminated by removing LBP and then surveyed.
FSS-9	Room 6A1 upper walls and ceiling	1	1	Space heaters were removed for disposal as LLRW. The upper walls and ceiling were surveyed.
FSS-10	Cell 6 subsurface vault	2	2	A subsurface vault was discovered under Room 6A1. Characterization surveys indicate direct frisks up to 90 percent of the DCGL and DU in sediments above the soil DCGL. Further effort will be performed under a separate work plan.
FSS-11	Room 3A floor	1	1	LBP was removed from the floor and the floor was surveyed.
FSS-12	Roof ventilator and surrounding roof	1	1	The roof was surveyed.

Table 1 Building 181 MARSSIM Survey Units

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Survey Unit ID	Description	Survey Class	Survey Phase	Comments
FSS-13	HVAC	1	1	The HVAC equipment in Cell 5 and Cell 6 was surveyed. This includes the "upper pipe chase" described in the FSSP.
FSS-14A	Cell 6 exterior concrete apron and electrical vault	1	1	Upgraded to Class 1 due to discovery of contamination above DCGL and surveyed.
FSS-14B	Cell 6 concrete apron buffer zone	3	1	Nominal two-meter wide buffer zone around FSS-14A was surveyed.
FSS-15	Soil under Cell 5 and Cell 6	3	2	Placeholder for future soil survey under building slab after demolition
FSS-16	Soil adjacent to Cell 5 and Cell 6	3	2	Placeholder for future survey of soil adjacent to Cell 6 after demolition
FC-1	Two square meters of Cell 4 floor	3	1	Data needed to complete baseline survey was collected.
FC-2	Rooms 3D and 3E	3	1	Prior characterization surveys of floors after asbestos removal.

Notes:

DCGL - Derived Concentration Guideline Level

DU - Depleted Uranium

FSS - Final Status Survey

HVAC - Heating, Venting, and Air Conditioning

LAW - Large Area Wipe

LBP - Lead-Based Paint

LLRW - Low-Level Radioactive Waste

MARSSIM - Multi-Agency Radiation Site Survey Implementation Manual

Table 2

Typical Beta Detection MDCs

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Detector	Application	Efficiency ¹	Background	Scan MDC	Static MDC
הנינונו	Application	(counts/disintegration)	(cbm)	$(dpm/100 cm^2)$	$(dpm/100 cm^2)$
2929	Beta	0.25	100	N/A	06
43-93	Beta	0.22	200	1,250	490
43-89	Beta	0.22	200	1,000	390
43-37	Beta	0.22	1,000	1,250	850^{2}

Notes:

MDC: Minimum Detectable Concentration.

N/A: Not Applicable.

⁽¹⁾ Calculated by multiplying the surface efficiency (50%) by the 2 pi source efficiency.

⁽²⁾ The LM43-37 detector was used in a static 30-second count mode for scans.

Table 3
Air Sampling Data

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Air Comple	Air Comple			Air Sample	Dun Timo	Sample	Sample Rote	II 238 Boto	II 238 Boto
No.	No.	Location	Date	Flow Rate (lpm)	(minutes)	Alpha Counts	Sample Deta	(dpm)	(DAC-hrs)
1	4198	Cell 5	14-Dec-17	50	009	2	2153	5.36E+00	0.04
2	4190	Cell5	14-Dec-17	20	009	4	2137	1.88E+00	0.01
3	4190	Cell 6	18-Dec-17	20	570	4	2136	1.67E+00	0.01
4	4198	Cell 6	18-Dec-17	09	570	4	2180	1.12E+01	0.08
5	12408	Cell 6	18-Dec-17	3	265	2	2183	1.19E+01	1.49
9	14279	Cell 6	18-Dec-17	3	265	3	2199	1.54E+01	1.92
L	4190	Cell 6	19-Dec-17	95	385	19	2288	3.47E+01	0.26
8	4198	Cell 6	19-Dec-17	50	385	4	2140	2.54E+00	0.02
6	4190	Cell 6	20-Dec-17	50	345	4	2191	1.36E+01	0.10
10	4198	Cell 6	20-Dec-17	95	345	2	2097	-6.81E+00	-0.05
11	14279	Cell 6	20-Dec-17	3	325	2	2145	3.62E+00	0.45
12	12408	Cell 6	20-Dec-17	3	325	5	2199	1.54E+01	1.92
13	4198	Cell 5	12-Dec-17	95	480	17	2236	2.34E+01	0.18
14	4190	Cell 5	12-Dec-17	50	570	9	2086	-9.20E+00	-0.07
15	4198	Cell 5	13-Dec-17	50	570	8	2180	1.12E+01	0.08
16	12408	Cell 6	4-Jan-18	3	435	4	2079	-1.07E+01	-1.34
17	4190	Cell 6	4-Jan-18	3	540	19	2068	-1.31E+01	-1.64
18	4190	Cell 6	5-Jan-18	09	470	38	2159	6.67E+00	0.04
19	14279	Cell 6	5-Jan-18	3	460	5	2047	-1.77E+01	-2.21
20	4190	Cell 6	9-Jan-18	50	535	7	1957	4.38E+00	0.03
21	4198	Cell 6	9-Jan-18	50	525	4	2115	4.02E+01	0.30
22	12409	Cell 6	9-Jan-18	3	505	10	1994	1.28E+01	1.60
23	4198	Cell 6	10-Jan-18	50	540	12	1890	-1.08E+01	-0.08
24	4198	Cell 6	11-Jan-18	50	455	4	1866	-1.62E+01	-0.12
25	4198	Cell 6	16-Jan-18	50	580	10	1960	0.00E+00	0.00
26	4198	Cell 6	18-Jan-18	50	515	12	1908	-1.18E+01	-0.09

Table 3
Air Sampling Data

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Air Sample No.	Air Sample Air Sampler No. No.	Location	Date	Air Sample Flow Rate (Ipm)	Run Time (minutes)	Sample Alpha Counts	Sample Beta Counts	U-238 Beta (dpm)	U-238 Beta (DAC-hrs)
27	4198	Cell 6	17-Jan-18	50	575	5	1917	-9.75E+00	0.00
28	4198	Cell 6	15-Jan-18	50	580	1	1918	-9.52E+00	-0.07
29	12408	Cell 6	18-Jan-18	3	255	12	1871	-2.02E+01	-2.52
30	4198	Cell 6	22-Jan-18	50	545	23	1898	-1.41E+01	-0.11
31	4198	Cell 6	23-Jan-18	50	580	8	1949	-2.49E+00	-0.02
32	4198	Cell 6	24-Jan-18	50	575	33	1960	0.00E+00	0.00
33	4198	Cell 6	25-Jan-18	50	595	14	1932	-6.35E+00	-0.05
34	4198	Cell 6	26-Jan-18	50	575	25	1961	-3.79E+01	-0.28
18R	4190	Cell 6	5-Jan-18	09	470	11	1917	1.74E+01	0.11
32R	4198	Cell 6	24-Jan-18	50	575	13	1914	1.67E+01	0.13
34R	4198	Cell 6	26-Jan-18	50	575	15	1874	7.63E+00	0.06
17R	4190	Cell 6	4-Jan-18	3	540	19	1959	2.69E+01	3.37
7R	4190	Cell 6	19-Dec-17	50	385	6	1841	1.51E-01	0.00
13R	4198	Cell 5	12-Dec-17	50	480	14	2010	3.85E+01	0.29
33R	4198	Cell 6	25-Jan-18	50	595	9	1893	1.19E+01	0.09
26R	4198	Cell 6	18-Jan-18	50	515	10	2001	3.64E+01	0.27
29R	12408	Cell 6	18-Jan-18	3	255	8	1956	2.62E+01	3.28

Notes:

DAC-hrs - derived air concentration hours

dpm - disintegration per minute

lpm - liters per minute

Table 4
Building 181 MARSSIM Survey Summary

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Survey Unit ID	Highest Smear (dpm/100 cm²)	Smear Highest MDC	Highest Static (dpm/100 cm ²)	LM43-93/LM43-89 Highest MDC	Highest Scan MDC (dpm/100 cm²)
FSS-1A	111	(apm/100 cm) 133	318	(apm/100 cm)	292
FSS-1B	62	135	357	417	765
FSS-2	83	133	544	411	683
FSS-3	59	133	641	417	$1,000^{1}$
FSS-4	87	127	1,127	425	730
FSS-5	94	133	-170	425	730
FSS-6	104	133	453	373	744
FSS-7A	126	127	2,126	419	712
FSS-7B	26	127	1,360	419	712
FSS-8	118	109	1,326	419	704
FSS-9 Walls	123	133	442	418	704
FSS-9 Ceiling	100	133	1,021	418	1,250 1
FSS-10	130	132	2,255	303	$1,250^{-1}$
FSS-11	92	133	1,463	423	650
FSS-12	69	135	-328	584	$1,250^{-1}$
FSS-13	112	133	664	471	$1,250^{-1}$
FSS-14A	86	130	1,058	306	$1,250^{2}$
FSS-14B	81	130	499	309	$1,000^{2}$
FC-1	-23	83	203	340	650

Notes:

 $dpm/100 cm^2$ - disintegrations per minute per 100 square centimeters

MDC - Maximum Detectable Concentration

⁽¹⁾ Roof, ceiling, utility trench, and HVAC equipment surveys were performed with LM43-93 and LM43-89 probes. The MDCs are taken from Table 2.

⁽²⁾ Contamination was concentrated in cracks in the pavement. The survey was performed with LM43-93 and LM43-89 probes for enhanced sensitivity to small areas of elevated contamination. The MDCs are taken from Table 2.

Sediment Sample Analytical Results⁽¹⁾

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

1	U-234 Alpha Spec.	U-234 Alpha Spec. U-235 Alpha Spec. U-238 Alpha	U-238 Alpha Spec.	U-234 to U-238	U-238 Gamma Spec.	U-238 DCGL	Max. U-234 as DU	Max. U-234 as DU Min. U-234 as U _{nat} Max. U-238 as DU	Max. U-238 as DU
Госацоп	(pCi/g)	(pCi/g)	(pCi/g)	Ratio	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
Electrical Vault (NW)	0.436	0.042	1.624	0.268	3.310	4.600	0.234	0.202	3.1
Electrical Vault (NE)	0.489	0.055	1.084	0.451	1.110	4.600	0.156	0.333	0.8
I/S R6A1 Utility Trench	4.155	0.254	28.850	0.144	27.512	4.600	4.155	0.000	27.5
Utility Trench East End	0.420	0.028	1.201	0.350	3.282	4.600	0.173	0.247	3.1

⁽¹⁾ For information purposes only.

DU - Depleted Uranium

pCi/g - picocuries per gram

Unat - Natural Uranium

Final Status Survey Report for Building 181 Cell 5 Quality Control Data Table 6

|--|

Max. Reading Mean Reading Standard Deviation dpm/100 cm²) (dpm/100 cm²) (σ) (dpm/100 cm²) 544 -252 520 805 40 378
Max. Reading dpm/100 cm 544

σ - standard deviation

dpm/100 cm 2 - disintegrations per minute per 100 square centimeters FSS - Final Status Survey QC - Quality Control

Att

Table 7 Room 6B1 Quality Control Data

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Type	Max. Reading (dpm/100 cm ²)	Mean Reading (dpm/100 cm²)	Standard Deviation (σ) (dpm/100 cm²)	[(Mean _{FSS} -Mean _{QC}) /o _{QC}]	95 percent QC Pas Confidence Level or Fail	QC Pass or Fail
FSS	999	-226	328	N/A	N/A	N/A
OC	-82	899-	318	1.39	1.96	Pass

Notes.

σ - standard deviation

 $dpm/100 cm^2$ - disintegrations per minute per 100 square centimeters

FSS - Final Status Survey

QC - Quality Control

Room 6A1 Quality Control Data Table 8

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Type	Max. Reading (dpm/100 cm ²)	Mean Reading $(dpm/100 cm^2)$	Standard Deviation (σ) (dpm/100 cm²)	$[(Mean_{FSS}\text{-}Mean_{QC}) \\ /\sigma_{QC}]$	95 percent Confidence Level	QC Pass or Fail
FSS	1672	14	773	N/A	N/A	N/A
QC	1049	202	404	0.47	1.96	Pass

σ - standard deviation

 $dpm/100 cm^2$ - disintegrations per minute per 100 square centimeters

FSS - Final Status Survey

QC - Quality Control

Table 9
Retrospective Review of Uncertainty

•

Final Status Survey Report for Building 181 Robins Air Force Base, Georgia

Survey Unit No.	LBGR = MDC/2	$\Delta = DCGL - LBGR$	Mean Static	Static o* (dpm/ccm²)	Relative Shift (∆/o)	Table 5.3 Min. No.	Min. No. Statics
FSS-1A	145	2.426	(apm/cem) -263	319	7.6	9	89
FSS-1B	202	2,369	-301	297	7.9	6	89
FSS-2	200	2,371	-156	248	9.5	6	26
FSS-3	201	2,369	-511	138	17.1	6	27
FSS-4	206	2,365	242	208	11.3	6	70
FSS-5	206	2,365	-490	153	15.4	6	83
FSS-6	186	2,385	-345	202	11.8	6	62
FSS-7A	203	2,367	408	362	6.5	6	48
FSS-7B	203	2,367	445	402	5.8	6	48
FSS-8	203	2,367	-168	532	4.4	6	06
FSS-9	223	2,348	-304	150	15.6	6	62
FSS-11	205	2,366	204	321	7.4	6	39
FSS-14A	149	2,422	158	432	5.6	6	38
FSS-14B	151	2,420	-34	274	8.8	6	32

Note:

 Δ - Delta between DCGL and LBGR

σ - standard deviation

 ccm^2 - 100 square centimeters

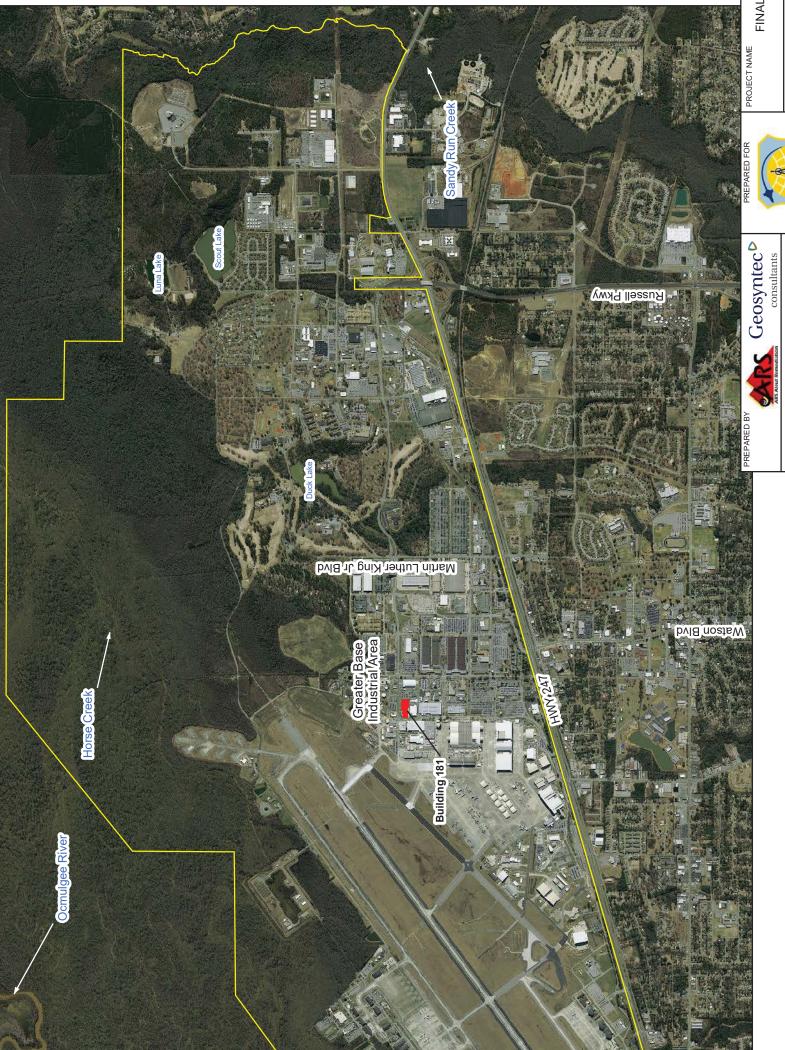
DCGL - Derived Concentration Guideline Level

dpm - disintegration per minute

LBGR - Lower Bound of the Gray Region

MDC - Minimum Detectable Concentration

FIGURES



SITE DESCRIPTION

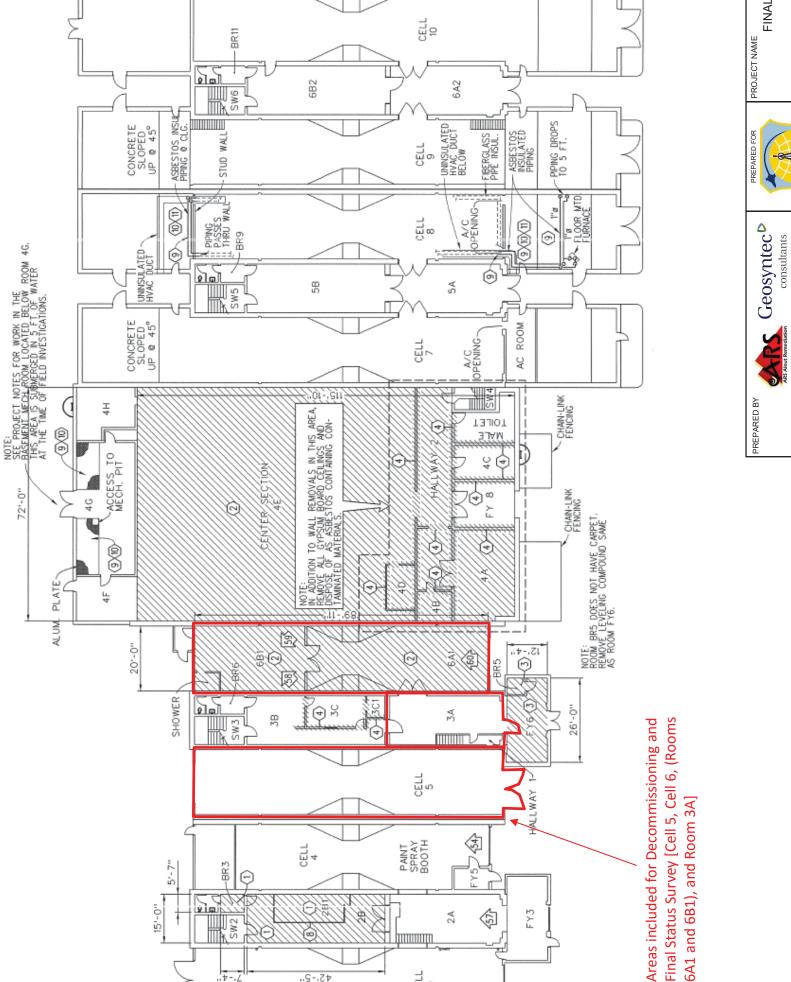
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GELL 3

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72'-0"

Figure 3 Cell 5 "Lay Flat" View

)				
EWA2	B3	C2	D2	E2	F2
EWA1	B1	C1	D1	E1	F1

NWBBI NWAAI NWYI NWXI NWWI NWWI NWWI

BB2 AA2

		ı																												
F2	F1		BB6	AA6	9Z	9 A	9X	9M	9/	9N	9L	9S	R6	90	P6	90	9N	9W	9T	K6	9f	91	9H	95	F6	E6	9Q	9)	B6	A6
E2	E1		BB5	AA5	Z2	Y5	X5	W5	V5	US	T5	S5	R5	95	P5	05	N5	M5	L5	K5	15	15	H5	G5	F5	E5	D5	C5	B5	A5
D2	D1		BB4	AA4	Z4	Y4	X4	W4	V4	U4	T4	S4	R4	64	P4	04	N4	M4	L4	K4	J4	14	H4	G4	F4	E4	D4	C4	B4	A4
C2	C1		BB3	AA3	Z3	Y3	X3	W3	V3	U3	T3	S3	R3	Q3	P3	03	N3	M3	L3	K3	13	I3	H3	G3	F3	E3	D3	C3	B3	A3
B3	B1		BB2	AA2	Z2	Y2	X2	W2	V2	U2	Т2	S2	R2	Q2	P2	02	N2	M2	L2	K2	J2	12	H2	G2	F2	E2	D2	C2	B2	A2
EWA2	EWA1		BB1	AA1	Z1	Y1	X1	W1	V1	Ul	T1	S1	R1	Q1	P1	01	N1	M1	L1	K1	J1	I1	H1	G1	F1	E1	D1	C1	B1	A1

H2 **G**2

M2 N2

07

U2

02

WWA1	B1	C1	D1	E1	F1
WWA2	B2	C2	D2	E2	F2

SWBB1 SWA11 SWA11 SWX1 SWY1 SWY1 SWW11 SWW11 SWW11 SWW11 SWW11 SWM11 SWM	BB2	SWAA2	Z2	Y2	X2	W2	V2	U2	Т2	S2	R2	Q2	P2	02	N2	M2	L2	K2	J2		H2	G2	F2	E2	D2	C2	B2	
	SWBB1	SWAA1		SWY1	SWX1	W	SWV1	SWU1	SWT1	SWS1		SWQ1	SWP1	SW01	SWN1			SWK1	SWJ1	SWI1	SWH1		\geq	\geq	SWD1	SWC1	\geq	SWA1

Figure 4
Cell 6 Room 6B1 "Lay Flat" View

					K4	14	14	H4	G4	F4	E4	D4	C4	B4	A4
					К3	13	I3	H3	G3	F3	E3	D3	C3	B3	A3
					C2	J2	12	H2	G2	F2	E2	D2	C2	B2	A2
					SWK1	SWJ1	SWI1	SWH1	SWG1	SWF1	SWE1	SWD1	SWC1	SWB1	SWA1
				1											
F4	F3	F2	F1		K6	J6	91	9H	95	F6	E6	9Q	92	B6	A6
E4	E3	E2	E1		K5	J5	SI	H5	G5	F5	E5	D5	C5	B5	A5
D4	D3	D2	D1		K4	14	14	H4	G4	F4	E4	D4	C4	B4	A4
C4	C3	C2	C1		K3	13	I3	H3	G3	F3	E3	D3	C3	B3	A3
B1	B2	B3	B1		C2	12	12	H2	G2	F2	E2	D2	C2	B2	A2
EWA4	EWA3	EWA2	EWA1		K1	J1	11	H1	G1	F1	E1	D1	C1	B1	A1
					NWK1	NWJ1	NWI1	NWH1	NWG1	NWF1	NWE1	NWD1	NWC1	NWB1	NWA1
					C2	J2	12	H2	G2	F2	E2	D2	C2	B2	A2
					K3	J3	I3	H3	G3	F3	E3	D3	C3	B3	A3
					K4	J4	14	H4	G4	F4	E4	D4	C4	B4	A4

WWA1	B1	C1	D1	E1	F1
WWA2	B2	C2	D2	E2	F2
WWA3	B3	C3	D3	E3	F3
WWA4	B4	C4	D4	E4	F4

Figure 5 Cell 6 Room 6A1 "Lay Flat" View

				Q3	P3	03	N3	M3	L3	K3	J3	SWI3	H3	G3	F3	E3	D3	C3	B3	A3
				Q2	P2	02	N2	M2	L2	K2	J2	SWI2	H2	G2	F2	E2	D2	C2	B2	A2
				SWQ1	SWP1	SWO1	SWN1	SWM1	SWL1	SWK1	SWJ1	SWI1	SWH1	SWG1	SWF1	SWE1	SWD1	SWC1	SWB1	SWA1
	ı										ı	ı				T	T			
F4	F3	F2	F1	90	P6	90	9N	9W	9T	K6	9f	91	9H	95	F6	E6	9Q	92	B6	A6
E4	E3	E2	E1	Q5	P5	05	N5	M5	L5	K5	J5	15	H5	G5	F5	E5	D5	C5	B5	A5
D4	D3	D2	D1	Q4	P4	04	N4	M4	L4	K4	J4	I4	H4	G4	F4	E4	D4	C4	B4	A4
C4	C3	C2	C1	Q3	P3	03	N3	M3	L3	K3	J3	I3	H3	G3	F3	E3	D3	C3	B3	A3
B1	B2	B3	B1	Q2	P2]	02	N2	M2	L2	K2	J2		H2]	G2	F2]	E2	D2	C2	B2	A2
EWA4 I	EWA3 I	EWA2 I	EWA1 I	Q1 (P1 I	01 (NI IN	M1 IN	L1 II	K1 I	J1 J	II II	HI	G1 (F1 I	E1 I	D1 I	C1 (Bl	A1 /
				NWQ1	NWP1	NWOI	NWNI	NWM1	NW11	NWK1	NWJ1	NWI1	NWH1	NWG1	NWF1	NWE1	NWD1	NWC1	NWB1	NWA1
				Q2	P2	02	N2	M2	L2	K2	12	12	H2	G2	F2	E2	D2	C2	B2	A2
				Q 3	P3	03	N3	M3	L3	K3	K3	J3	H3	G3	F3	E3	D3	C3	B3	A3
				Q4	P4	04	N4	M4	L4	K4	14	14	H4	G4	F4	E4	D4	C4	B4	A4

J4 SWI4

H4 G4 G4 B4 C4 B4 A4

M4

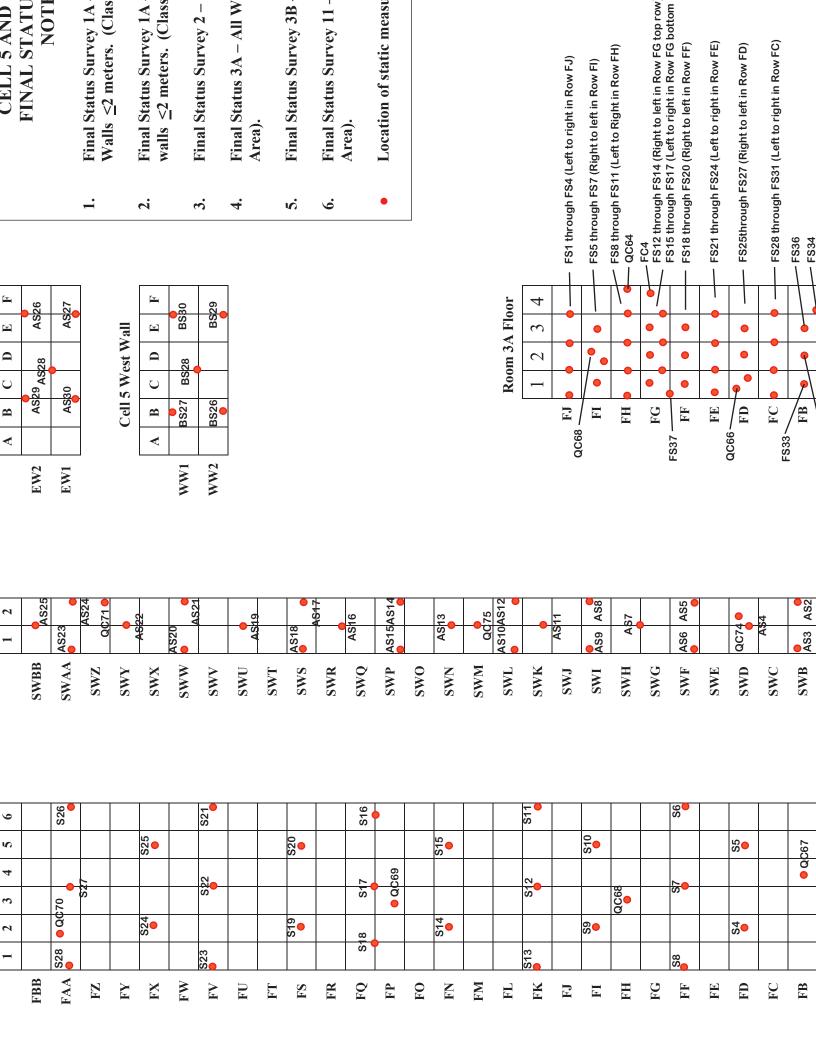
7 7 7

WWA1	B1	C1	D1	E1	F1
WWA2 B2		C2	D2	E2	F2
WWA3	B3	C3	D3	E3	F3
WWA4	B4	C4	D4	E4	F4

DOOR DOOR

Figure 6 Room 3A "Lay Flat" View

J4	I4	H4	G4	F4	E4	D4	C4	B4	A4
						D3			
						D2			
						D1			



DE	0830	EW3 U\$27 U\$31 U\$33	28 US32	EW1 S27 S31 SB3 S35		Cell 6B1 West Wall	A B C D E F	WW4 US18 US16 US14 US12 U	17 US	WW2 S16 S14 S12 L	WW1 S17 S45 S13 S11		Cell 6A1 East Wall	A B C D E F	EW4 QC49	EW3 UB8	EW2 WB8 WS7	QC40		Cell 6A1 West Wall	A B C D E F	WW4 US14 US15	WW3 QC56	WW2 WS15	WW1	
					BI	9 w o	Ко												IA9	wo0	В					
1 2 3 4	S36 US11	\$10	US10 S9 US9	88 US8	S7 US7	9SO 9S	SS	QC17	S3 US4	QC21 S2 US2	S1	980	98%			QC42	WS\$	US4 QC43	WS4	QC52	•00		WS3	USP	WS2 D	QC55
	SWK	SWJ	SWI	HMS	SWS	SWF	SWE	SWD	SWC	SWB	SWA	ÒMS	SWP	OMS	SWN	SWM	SWL	SWK	SWJ	SWI	HMS	SWS	SWF	SWE	SWD	SWC
						9 WC	Rod										,		IA9							
1 2 3 4 5 6	FS22 FS21 FS20 FS19	QC9	FS16 FS15	FS18	FS17 FS14	F\$8 F\$10 F\$12		FS24 FS9 FS11 FS13		F\$6 F\$4 F\$2 QC5	FS7 F\$5 F\$3 FS1	FS15 FS14 FS13	FS11 FS12		EST0			• 8 8		FS4 F\$3 F\$2 FS1	FS15 FS16 FS17 FS18		FS14 FS13 FS12		FS8 FS9 FS10 FS11	F\$6 F\$4 F\$2
Ī	FK	FJ	FI	FH	FG	HH	FE	FD	FC	FB	FA	FQ	FP	FO	FN	FM	FL	FK	FJ	FI	FH	FG	FF	FE	FD	FC
					[tin	ey U	nlv	S						7	ìin∪	LAGA	ins						I tin	ιU γ θ	nlv	S
					BI	9 wc	Вод												IV9	woo	В					

Upper Wall

Lower Wall

Upper Wall

Lower Wall

Upper Wall

Lower Wall

Upper Wall

Lower Wall

Beta Background for LM2929 (Alpha Beta Sample Counter) and LM43-93 (Alpha and Beta Probe) Instruments

Figure 9

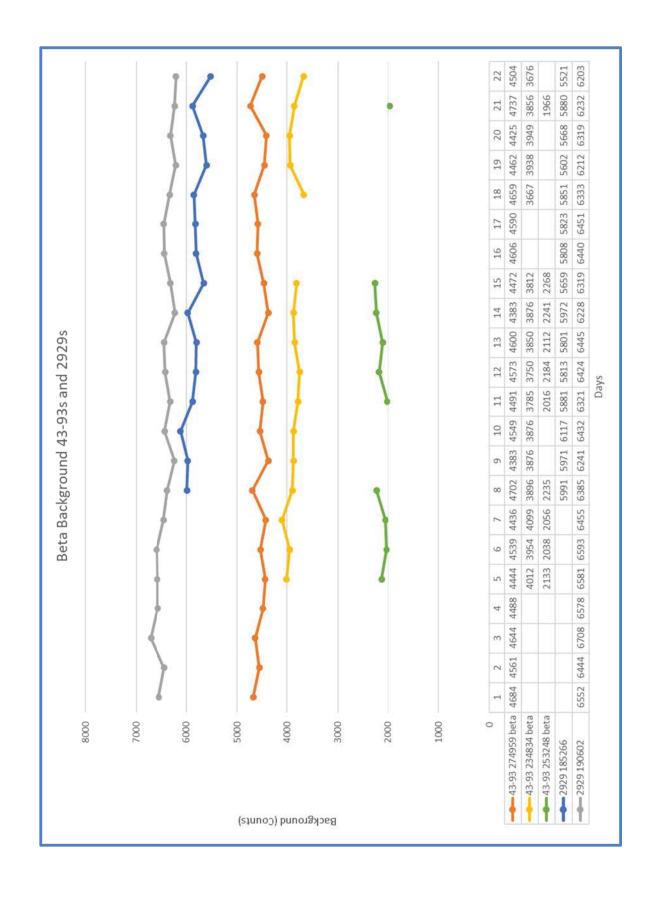
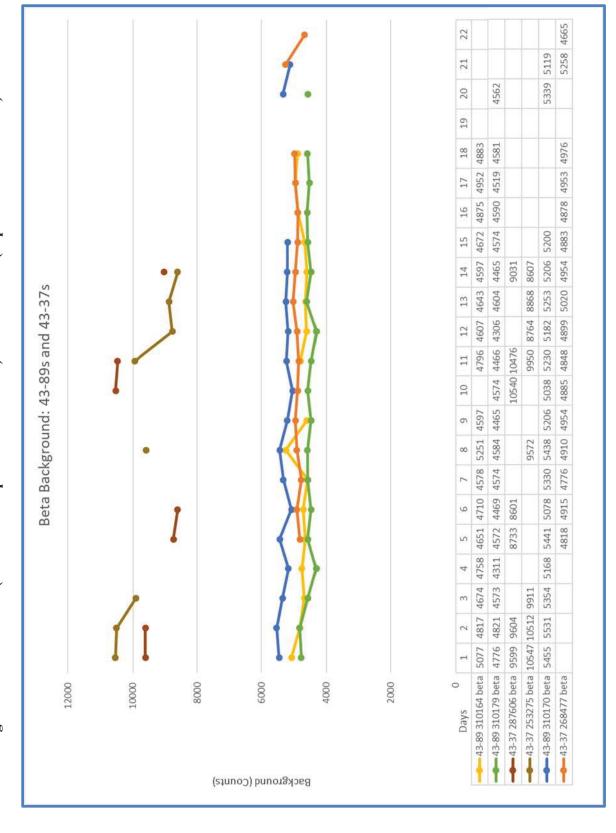


Figure 10

Beta Background for LM43-37 (Gas Flow Proportional Counter) and LM43-89 (Alpha and Beta Probe) Instruments



ATTACHMENT 1

Decommissioning Plan for Robins Air Force Base Building 181, June 2017

Decommissioning Plan

for

Robins Air Force Base Building 181

June 2017

Prepared for: Robins Air Force Base



Prepared by:
ARS Aleut Remediation, LLC
2609 N. River Road
Port Allen, LA 70767

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Acronyms

AAR ARS Aleut Remediation, LLC

AFB Air Force Base

ANSI American National Standards Institute

ARS American Radiation Services C&D Construction and Demolition

cm centimeter

cpm count per minute

DCGL Derived Concentration Guideline

DOE Department of Energy
dpm disintegration per minute
dps disintegration per second
DQO Data Quality Objective
DU Depleted Uranium

FIDLER Field Instrument for Detecting Low Energy Radiation

FSS Final Status Survey FSSP Final Status Survey Plan

g gram

GPS Global Positioning System
GWS Gamma Walkover Survey
HPT Health Physics Technician

IFB Indistinguishable from Background

LAW Large Area Wipe LBP Lead-Based Paint

m meter

MARSAME Multi-Agency Radiation Survey and Assessment of Materials and Equipment

Manual

MARSSIM Multi-Agency Radiation Site Survey Implementation Manual

MDA Minimum Detectable Activity
MDC Minimum Detectable Concentration

N/A Not Applicable

NIST National Institute of Science and Technology

NRC Nuclear Regulatory Commission

Pa protactinium pCi picocurie

RP Radiation Protection

SF Square Foot

TEDE Total effective dose equivalent

Th thorium TRU transuranic

TSDF Treatment Storage Disposal Facility

U uranium

USAF United States Air Force

USNRC United States Nuclear Regulatory Commission

Executive Summary

Building 181, Cells 1 through 8 at Robins Air Force Base (AFB) is scheduled for demolition. This portion of Building 181 was characterized for radiological contamination resulting from depleted uranium (DU) operations within the facility. Preliminary radiation surveys performed by others and by ARS Aleut Remediation, LLC (AAR) in August 2015 detected radiological contamination in Building 181 Cells 5 and 6. Because of this, these and other cells and rooms of Building 181, excluding Cells 9-12, were surveyed for radioactive contamination. The objective of this survey, referred to as a Baseline Survey, was to delineate where radiological contamination is present in excess of Building-specific Derived Concentration Guidelines (DCGLs). DCGLs were derived for the interior surfaces of Building 181 and for the soil beneath Cells 5 and 6 using the Residual Radioactivity computer codes (RESRAD) (ANL 2001 and ANL 2003). Details of the derivation of the DCGLs are contained in the technical memorandum: "Building 181 RESRAD Modeling Robins Air Force Base, Georgia" (Geosyntec 2016). This Decommissioning Plan for Building 181, Cells 1 through 8 presents the radiological contamination status of the building; the plan that was followed to perform the survey; the plans to remove the contamination, some of which is contained in lead-based paint; the status of pallets, furniture, and miscellaneous equipment within the building; and a Final Status Survey Plan (FSSP) for the building. Based on the results of these historical and recent baseline surveys, it was determined that the decommissioning of Building 181 Cells 5 and 6 are classified as a Group 4 decommissioning project under NUREG 1757 Volume 1 Figure 1.1.

The Baseline Survey was performed according to the guidelines and requirements of the Multi-Agency Radiation Site Survey Implementation Manual (MARSSIM) (NUREG-1575, Rev. 1) and its companion manual the Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME) (NUREG-1575, Supp.1). The Baseline Survey was completed in November 2015. The survey found radioactive contamination in Cell 5; the carpet in Rooms 3A, 3B, 3C, and FY 6; and Cell 6. Some pallets and other equipment were also found with contamination in excess of background. These items, the contaminated carpet, and some contaminated floor tiles are properly packaged, stored, and await disposal as low level radioactive material.

Radioactive contamination found on the concrete floor of Cell 6 will be removed by scabbling or other appropriate means. Lead-based paint on the walls of Cell 6 and on the lower walls to a height of two meters in Cell 5 will be abated. This abated material will be disposed as low level radioactive waste or mixed waste depending on the results of waste characterization following abatement.

During survey activities, standing water (presumably stormwater from leaky roof) was observed in Cell 7 and Rooms 5a and 5b. A total of approximately 160 gallons of water was removed and containerized in 55-gallon drums. Samples of that water were analyzed for lead and gross alpha/beta and isotopic uranium via alpha spectroscopy and the laboratory analytical results were provided to the Base. Per direction provided by the Base, the water was disposed of at the Base's industrial wastewater treatment plant (IWTP). The solids mixed in with the water were filtered out during discharge to the IWTP and will be disposed of separately as low level radioactive waste during Building 181 decommissioning efforts.

Contamination is not anticipated below the concrete floors of Cells 5 and 6. To verify, the soil underneath the two cells will undergo a Final Status Survey as a Class 3 survey unit. The survey will consist of a thorough gamma walk-over scan of the entire soil surface footprint. In addition, systematic and biased soil samples will be collected. The biased soil samples will be collected at elevated areas of activity as compared to the reference background to ensure the soil DGCL is not exceeded.

Decontamination and abatement will begin upon approval of this Decommissioning Plan. The decontamination will be properly and safely performed in accordance with a license with the U.S. Nuclear Regulatory Commission and Robins Air Force Base radioactive materials license. A Final Status Survey (FSS) will be conducted thereafter to prove the success of the decontamination and allow the rest of the building to be disposed in a construction landfill.

1.0 Introduction

Building 181 at Robins Air Force Base (AFB) consists of cells on the first floor, interconnecting rooms on the first floor, and rooms on the second and third floors. There are a total of 12 cells and ancillary rooms in Building 181. Building 181, Cells 1 through 8 and interconnecting rooms on the first, second, and third stories is scheduled for decommissioning and demolition. Review of NUREG 1757 Volume 1 Figure 1.1, shows that the decommissioning of Robins AFB Building 181 Cells 5 and 6 to fall under a Group 4 project. Licensed material was used in a manner that resulted in persistent contamination of work areas, but did not contaminate groundwater. Residual radioactive material remains at the site and will be remediated to levels that are As Low As Reasonably Achievable (ALARA) and below levels that meet U. S. Nuclear Regulatory Commission (NRC) criteria for unrestricted use by applying site-specific criteria developed using RESRAD modeling.

The portion of Building 181 that will be demolished was characterized for radiological contamination resulting from depleted uranium (DU) operations within the facility. Preliminary radiation surveys performed by the 78 MDG Bioenvironmental Engineering team completed forty-six (46) measurements for total radioactive contamination. Contamination was detected exceeding the Regulatory Guide 1.86 value of 5,000 dpm/100 cm². The date of this survey is not known. To corroborate these previous surveys, ARS Aleut Remediation, LLC (AAR) performed a follow-up scoping survey in August 2015 that also detected radiological contamination in Building 181 Cells 5 and 6. The survey maps and affiliated results of all surveys performed in August 2015 are depicted in Attachment 2 and are summarized within Section 3.0 of this decommissioning plan. There were no operations in the other portions of Building 181 where contamination was expected.

A Baseline Survey was performed in November and December of 2015 in the portions of Building 181 that will be demolished. Contamination from DU was found in Cells 5 and 6. The purpose was to delineate contamination so that it could be removed prior to building demolition. This report details the results of the Baseline Survey. Removal of the contamination would assure that the building demolition debris did not pose a risk to human health or the environment.

The other portions of Building 181, excluding Cells 9-12, were also surveyed for radioactive contamination. The objective of this survey was to provide evidence as to whether these areas were impacted by operations with DU in Cells 5 and 6 and to demonstrate that the demolition debris did not pose a risk to human health or the environment.

The survey was designed to allow contamination levels of from ten percent to 50 percent of the DCGL for DU to be detected (2,570 dpm/100 cm²). This detection capability is reasonably achieved through a combination of one minute fixed point (static measurements) and surface scans with large area gas proportional detectors. Lower detection levels would require significantly lower instrument scan speeds, more static measurements, and make the use of large area gas proportional detectors infeasible (except for highly sophisticated and expensive specialty detectors). Lower detection levels were not needed to meet the overall project objectives.

The DCGL was derived using RESRAD-Build. The dose criterion used was 25 mrem/y total effective dose equivalent (TEDE) and a full working year of building occupancy even though the

building is not currently occupied and is scheduled to be demolished. The attached Technical Memorandum (Appendix B) provides the details of the DCGL derivation.

Surfaces with DU exceeding the DCGL will be decontaminated. The removed, decontaminated material will be packaged and disposed as low level radioactive waste. Once decontamination is complete and the decontaminated surfaces are resurveyed and proven to meet the DCGL, the building will be demolished and disposed in a construction debris landfill.

Once decontamination is complete, a FSS will be conducted to demonstrate that the radioactive contamination has been successfully removed. This Decommissioning Plan describes the Baseline Survey design, presents the Baseline Survey Results, and describes the proposed building decontamination methods. The proposed FSS Plan is also provided.

Contamination is not anticipated below the concrete floors of Cells 5 and 6. To verify, the soil underneath the two cells will undergo a Final Status Survey as a Class 3 survey unit. The survey will consist of a thorough gamma walk-over scan of the entire soil surface footprint. In addition, systematic and biased soil samples will be collected. The biased soil samples will be collected at elevated areas of activity as compared to the reference background to ensure the soil DGCL is not exceeded.

The location of Building 181 at Robins AFB is shown in *Figure 1*. Building 181 is three stories high and is arranged as 12 cells with adjoining rooms and a center section. Appendix B provides a photographic log presenting pictures of Building 181. Those cells and adjoining rooms that were characterized for radioactive contamination are discussed further as follows. Cell 1A and room FY1 is between and connects cells 1 and 2. Rooms 2A, 2B, 2B1, and FY3 are between and connect cells 3 and 4. Rooms 3A, 3B, and FY6 are between and connect cells 5 and 6. Rooms 3C and 3D are on the second floor above rooms 3A and 3B. Rooms 5A and 5B are between cells 7 and 8. A plan view of Building 181 is shown in *Figure 2*. Building 181 has a total footprint of ~70,000 square feet (SF), with ~ 64,000 SF within Cells 1-8. The various cells and rooms are labeled on *Figure 2*.

Building 181 was originally used for testing aircraft engines. After the testing of engines was curtailed, the Building 181 Cells were re-purposed for other uses. Building 181 Cells 5 and 6 were converted to and used to remove DU oxidation products from depleted uranium counterweights used in various aircraft. The DU oxidation products were removed from the counterweights using manual and mechanical processes that included scraping and scrubbing the oxidation until it was removed. The cleaned DU counterweights were then wiped down with isopropyl alcohol prior to the clean DU counterweights being encased in aluminum screening. This process is believed to be the only source of radiological contamination within Building 181 Cells 5 and 6. Other cells and rooms of Building 181 were characterized to determine if radioactive material was spread into these other building areas. The radioactive contamination survey was performed according to the principles of MARSSIM and its companion manual MARSAME.

The Baseline Survey Plan that was used comprises Section 2.0. Baseline Survey results are presented in Section 3.0. Decontamination plans and methods are in Section 4.0. The Final Status Survey Plan is presented in Section 5.0.

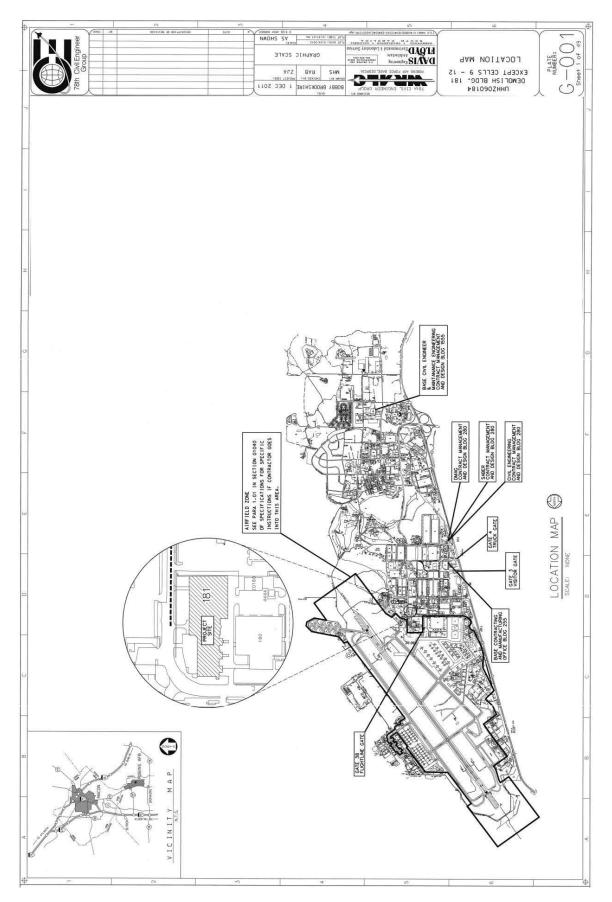


Figure 1. Locator Map

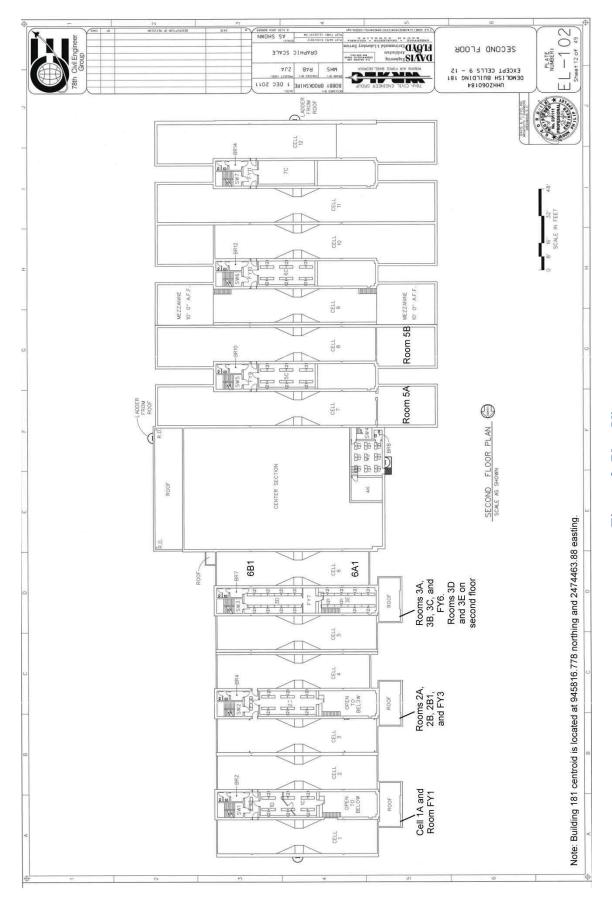


Figure 2. Plan View

2.0 Baseline Survey Plan

This section of the Decommissioning Plan documents the approach and results of the Robins Building 181 Cell 1-8 Baseline Survey conducted to obtain data and other information needed to develop the Building 181 Cells 6 and 6 Decommissioning Plan and Final Status Survey Plan. Sections 4.0 and 5.0 of this document provides the specifics related to the Decommissioning Plan and Final Status Survey Plan. The baseline survey for radiological contamination was performed by ARS Aleut Remediation, LLC (AAR) under its subcontract to Geosyntec Consulting, Inc. (Geosyntec). It includes the comprehensive survey in Building 181, Cells 5 and 6 as well as the scoping surveys performed in the other parts of Building 181 Cells 1-4, the Building Center, Cell 7, and Cell 8 to determine whether contamination has been spread to these areas. It also discusses how the miscellaneous equipment and material within the building was evaluated for contamination.

The Baseline Survey was performed according to the principles of MARSSIM (NUREG-1575, Rev. 1) and its companion manual the Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME) (NUREG-1575, Supp.1).

2.1. Radioactive Contaminant of Concern

The assumed radioactive contaminant of concern, based on operational knowledge, is DU because of the counterweight cleaning operations. This was confirmed by collection of paint chip samples that were flaking off of the floor/walls of Building 181 Cell 6 and a sample of metal shavings found in a trash can located in the corner of the Cell 6 High-bay area. The samples were analyzed by gamma spectroscopy, alpha spectroscopy, gross alpha, and gross beta. *Table 1* summarizes the alpha spectroscopy isotopic uranium analytical results. The laboratory report is shown in Attachment 1, *Building 181 Cells 1-8 Baseline Survey Analytical Reports*. Based on these sample results, the site-specific radionuclide activity fractions for U-238, U-235, and U-234 are 85%, 4%, and 11%, respectively. The sample results show that the uranium-234 concentration is depleted when compared to the uranium-238 concentration. None of the daughters of U-234 were detected in excess of the laboratory MDA.

Table 1. Summarized Analytical Results ¹						
Radionuclide	Sample 1 Paint Chips (pCi/g)	Sample 2 Paint Chips (pCi/g)	Sample 3 Metal Shavings (pCi/g)	Average (pCi/g)	Radionuclide Percent	Ratio To U-238
U-238	901.7	98.29	3,221	1,407.00	85%	1
U-235	53.71	2.124	161.9	72.58	4%	0.0516
U-234	105.5	12.03	418.1	178.54	11%	0.1269

Footnote 1 The isotopic uranium results were ascertained via alpha spectroscopy (Eichrom ACW-03).

Footnote 2 - The radionuclide percent was calculated as the average individual radionuclide concentration divided by the average total uranium concentration. The normalized concentrations were calculated as the average individual radionuclide concentration divided by the average U-238 concentration. All three samples were used for calculating the averages because depleted uranium is the sole radioactive contaminant of concern and the isotopic ratios for the two types of samples (paint chips and metal shavings) are consistent with depleted uranium.

2.2. Applicable Guidelines

Building 181 will be decontaminated such that the TEDE to an occupant for one working year will be as far below 25 mrem as is reasonably achievable. RESRAD-Build was used to derive the DU surface contamination value that would cause a TEDE of 25 mrem/y. The value so derived was 2,570 dpm/100 cm². This value was derived using the assumption that ten percent of the total amount of radioactivity was removable contamination. This DCGL includes the radioactivity contributions from all three uranium isotopes, uranium-238, uranium-235, and uranium-234 that are present in DU. This combined DCGL was used because the hand-held radiation detectors used for the survey sum the contribution of the radiations emitted from all isotopes. The radiation dose equivalent contributed by each of the uranium isotopes is included in the DCGL calculation. No sum of fractions calculation for each of the isotopes is required because DCGL was computed taking into account the percentage of each uranium isotope in the single radioactive contaminant, DU. The attached Technical Memorandum provides the details of the DCGL derivation.

2.3. Radiological Survey Design

This section contains a discussion of data quality objectives, instruments, MARSSIM Survey Unit classification, data requirements, survey locations, data evaluations, and background determination.

A MARSSIM-based survey was performed in Building 181, Cells 1-8. The purpose of the survey in Cells 5 and 6 was to delineate and mark potentially contaminated areas for decontamination. The purpose of the survey in the rest of the building (except Cells 9-12 which will not be demolished) was to demonstrate that the likelihood that these other areas were contaminated from former operations in Cells 5 and 6 was low, thus allowing the demolition debris to be disposed in a construction debris landfill with radioactivity concentrations indistinguishable from natural background.

A second survey shall be performed after decontamination/decommissioning of Cells 5, 6 and any other Building 181 areas found to have radiological contamination in excess of the regulatory limits. The surveys performed before and after will be identical, except the area surveyed during the second survey will be limited to those areas requiring decontamination. The second survey will serve as the FSS and will be performed to demonstrate that contamination identified during the first survey has been successfully removed to levels that are below the DCGL and are ALARA.

2.3.1 General

The survey design and implementation is consistent with concepts and terminology within MARSSIM and MARSAME. The data quality objective (DQO) process and a graded approach are integrated within the MARSSIM and MARSAME process, and within this plan, to assure defensible data with cost effectiveness. Compliance with the DCGL established above was determined by demonstrating that no single measurement exceeds the DCGL as an ALARA measure. The hand-held instruments used for the survey easily detect the DCGL such that it was reasonably achievable to find and then eventually to remediate all areas that exceed the DCGL. The non-parametric statistical analyses in MARSSIM are not necessary given this approach because all measurement results will be less than the DCGL following decontamination. Likewise, there will be no areas with contamination values when averaged over one m² that exceed the DCGL

following decontamination; therefore, there will be no need to perform elevated measurement comparisons (EMC).

Surveys were performed by trained HPTs who are following standard, written procedures, and are using properly calibrated instruments sensitive to the alpha and beta radiation from uranium-238 (DU) and daughter products to include Thorium-234, Protactinium-234, and Uranium-234. A small amount of Uranium-235 is also present, and its radiations will also be detected. The following requirements also applied:

- HPTs performing surveys were qualified in accordance with ARS procedure RP-29, *Radiological Control and Survey Technician Training* (Shown in Appendix A).
- Surveys were performed in accordance with ARS procedure RP-10, *Radioactive Contamination Control and Monitoring* and the ARS Operational Guide for Contamination Monitoring (Shown in Appendix A).
- Instrument calibrated and performance was checked each day an instrument was used according to ARS procedures RP-52 and RP-53, *Setup and Operability Tests of Portable Field Instruments* and *Operability Tests Field Instruments* (Shown in Appendix A).
- Surveys were performed in accordance with applicable AAR instrument operating guides (On file).

2.3.2 Data Quality Objectives

The objective of the surveys was to develop data to identify and mark locations within Building 181 where DU contamination exceeds the DCGLs (for total and removable contamination). Identified areas with contamination greater than the DCGLs shall be decontaminated. A second survey shall be performed to document that the radioactive contamination has been successfully removed to support the termination of Building 181 Cells 5 and 6 from the Robins AFB Permit No. GA-00462-03/01AFP, which is authorized under U.S. Nuclear Regulatory Commission (USNRC) Master Material License No. 42-23539-XXAFP. This second survey shall be the MARSSIM FSS.

The DCGLs for radiological contamination established by the USNRC (and other agencies), independent of the DQO process. For the purposes of unconditional release of the building to another demolition contractor, the data developed by the approach described Section 4, shall be used to demonstrate, at the 95% confidence level, that the DCGLs are met.

The following Sections describe the survey design, equipment, and techniques to achieve these objectives. Measurement sensitivities are defined as the Minimum Detectable Activity (MDA), at the 95 percent confidence level. The measurements shall be 10 to 50 percent of the DCGLs.

Measurement accuracy and precision are $\pm 20\%$. Completeness is assured by meeting the minimum surface area scan coverage requirements of MARSSIM, i.e., >80% useable data.

2.3.3 Radiation Detection Instruments

The instrument used to measure total surface contamination at a specific location was a 100 cm² Ludlum Model 43-93 dual phosphor detectors coupled with a Ludlum Model 2360 ratemeter/scaler that simultaneously measure and record beta-gamma and alpha radiation. The Ludlum Model 43-

93 detector was used to obtain and record the results of direct radiation measurements with the detector held over and at contact with a specific area for one minute time period.

The instruments used to scan for contamination were the 500 cm² Ludlum Model 43-37 gas flow monitor to be used for walls and ceilings and the 609 cm² Ludlum 43-37-1 gas flow proportional floor monitor detector. These detectors were coupled with Ludlum Model 2221 ratemeter/scalers. The two gas flow detectors were operated with a high voltage setting that allowed a combined reading from alpha, beta, and gamma radiation. Two Ludlum gas flow proportional detectors were used to scan a surface area of one square meter to measure the average contamination level.

A Ludlum model 2929 ratemeter/scaler was coupled with a Ludlum 43-1-10-1 dual phosphor detector was used to analyze swipes for removable alpha and beta/gamma contamination. The swipes were collected over 100 cm² areas and analyzed for removable alpha and beta/gamma contamination.

With typical background counts and detector efficiencies, the sensitivity, or MDA, of the radiation detection instrument used for this survey were adequate to meet the DCGLs. The MDA is used to express radiation detection instrument sensitivity. The MDC is the level at which one can be 95 percent confident that a statistically elevated measurement exceeds background. The MDC (sometimes referred to as the Lower Limit of Detection) is a combined parameter that includes the statistical variation in the background count rate and the statistical variation in the actual count rate.

The condition of the surface being surveyed can result in decreased detection sensitivity. Surfaces that are rough or have small crevasses can cause attenuation of alpha and beta particles. Correction factors can be applied to account for the decreased detection sensitivity. The overall measurement efficiency is comprised of detector response (4 pi efficiency, ϵ_i) and a factor for surface condition correction (source efficiency, ϵ_s). Four (4) pi efficiency is lower than 2 pi efficiency and was employed during the baseline survey activities for conservatism. A 2-pi efficiency will be used for the FSS as recommended in MARSSIM. The surface detection sensitivity for alpha radiation is at least a factor of two less than for beta radiation and the surface detection sensitivity for alpha radiation will be much more variable than for beta radiation. The survey design is therefore keyed to the detection of beta radiation, primarily. The surface efficiency used is 0.50 for beta instruments per NUREG 1507. The comparison of beta/gamma measurement results to the DCGL was used to determine whether a surface met the DCGL or required decontamination. The surface efficiency used for alpha radiation was 0.25 also per NUREG 1507, although the alpha radiation measurement results were recorded and reported simply for information.

The beta source efficiency was determined using a Strontium-90/Ytrium-90 radiation source traceable to the National Institute of Science and Technology (NIST). The beta radiation energies from Strontium-90/Ytrium-90 closely match the beta radiation energies from Thorium-234 and Protactinium-234. The alpha source efficiency was determined using a Thorium-230 source traceable to NIST, which closely matches the alpha energy of uranium-238.

The beta efficiencies for both detectors for static and scanning measurements based on the formulas in MARSSIM are shown in *Table 2*. A surveyor efficiency factor of 0.75 for an

experienced surveyor and a scan time of 1.5 second (one probe area/1.5 seconds) for the Ludlum Model 43-37 and Ludlum Model 43-37-1 and 1 second for the Ludlum Model 43-93) were used in the calculation of scan MDA. Equation 1 is the equation used to calculate the scanning MDA. Equation 2 shows the equation for calculating the static MDA.

Equation 1 Scan MDC (derived by combining equations 6-8 and 6-9 of MARSSIM and using two beta emissions for every one alpha emission from U-238)

$$MDA = (1.38 * (bcs * i)^{0.5} *60/i)/(0.75^{0.5} * es * ei *2)$$
 where

1.38 is the index of sensitivity for a true positive proportion of 0.95 and a false positive proportion of 0.60;

bes is the background count rate in counts per second;

i is the measurement interval (for this survey 1.5 seconds for the Ludlum 43-37 and 43-37-1 detectors and 1 second for the Ludlum 43-93 detector);

0.75 is the observer efficiency (for experienced surveyors);

es is the surface efficiency;

ei is the source efficiency; and

2 is the factor accounting for two beta emissions for each disintegration of U-238.

Equation 2 Static MDC (from equation 6-7 of MARSSIM and using two beta emissions for every one alpha emission from -238)

$$MDA = (3 + 4.65 * b^{0.5})/(2 * es * ei)$$
 where:

3 is a factor from combined error terms;

4.65 represents 95% confidence and equal background and static count times of one minute;

b is the number of background counts in one minute; and

2 is the factor accounting for two beta emissions for each disintegration of U-238.

Note that the efficiency terms in the MDA equation are equivalent to use of the factor "C" in MARSSIM equation 6-7. An area correction factor, also part of "C" is not required because the detector surface area is 100 cm².

Daily performance tests were conducted prior to survey activities. No instruments exhibiting questionable performance were used for developing quantitative data.

Table 2. Detector MDA					
Detector	Application	*Combined Efficiency (intrinsic and surface)	Typical Background Recorded During the Survey (cpm)	Scanning MDA (dpm/detector area)	Static MDA (dpm/detector area)
43-93	Beta	0.125	250	781	306
43-37-1	Beta	0.125	1000	1275	N/A

^{*}Determined by multiplying the surface efficiency by the source intrinsic efficiency.

Example Calculation for Ludlum Model 43-37-1 detector of Scanning MDA Using Parameters in Table 2

bcs = 1000 cpm/60 (s/min) = 16.7 cpsMDA = $(1.38 * (16.7 * 1.5)^{0.5} * 60/1.5)/(0.75^{0.5} * 0.25 * 0.5 * 2) = 1275 \text{ dpm/}detector area}$ Example Calculation of Static MDA Using Parameters in Table 2

 $MDA = (3 + 4.65 * 250^{0.5})/(0.25 * 0.5 * 2) = 306 \text{ dpm}$

2.3.4 MARSSIM Classification and Survey Units

For the purposes of guiding the degree and nature of survey coverage, MARSSIM identifies two categories of radiological status: *impacted*, or having a possibility of containing radioactive contamination, and *non-impacted*, or not considered as possibly containing radioactivity in excess of background levels. In addition, for applications to demonstrate compliance with guidelines for purposes of release from radiological control, MARSSIM identifies three classifications of impacted areas on the basis of contamination potential:

- Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) greater than release criteria.
- Class 2 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination, or known contamination, but are not expected to exceed release criteria.
- Class 3 Areas: Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the release criteria.

MARSSIM recommends the following Survey Unit areas for building surfaces:

- Class 1 Up to 100 m²
- Class $2 \text{Up to } 2,000 \text{ m}^2$
- Class 3 Unlimited

A Survey Unit is defined as system, structure, or part of a structure that is likely to have similar potential contamination characteristics. Six Survey Units were identified. The Survey Units, MARRSIM Class, and classification rationale are shown in *Table 3* below. Note that the walls and ceilings of all rooms and cells of Building 181, other than Cells 5 and 6, were considered non-impacted. Only the floors of these other portions of the building were surveyed. If the results of the Baseline Survey showed that the floors in these areas meet the DCGL, then classifying the walls and ceilings as non-impacted is valid.

Table 3. Baseline Survey Plan – Survey Units			
Survey Unit MARSSIM		Rationale	
	Class		
1. Floors in Cells 5 and 6	1	Contamination has been found in excess of the DCGL in Cell 5 and may exceed the DCGL in Cell 6.	

Table 3. Baseline Survey Plan – Survey Units				
Survey Unit	MARSSIM	Rationale		
	Class			
2. Walls in Cells	2	Lower wall surfaces have a higher potential for contamination,		
5 and 6 up to 2 m		but contamination levels found on the floors during surveys		
above the floor		performed before this current survey effort began were relatively		
		low therefore the probability that these surfaces have		
0 777 11 1 0		contamination greater than the DCGLs is low.		
3. Walls above 2	3	Contamination could be present, but this is considered unlikely.		
m and ceilings in Cells 5 and 6				
	2			
4. Floors in other	3	Contamination could be present, but this is considered unlikely.		
Building 181				
cells and rooms				
5. Surfaces	2	Water could have carried contamination into this pipe		
currently in the		chase/trench. The probability that such contamination could		
pipe chase trench		exceed the DCGL is low. This Survey Unit will be surveyed as		
under Cells 5 and		part of the FSS following decontamination inside Cell 5 and 6		
6		and conducted when the USAF demolition contractor initiates		
		the removal of this portion of the Cell 5 and 6 floors.		
6. Areas outside	3	The potential for track out of contamination is slight given the		
of cells 5 and 6		removable contamination results found before this current		
(e.g., roof,		survey effort began.		
concrete apron(s)				
at doors, asphalt,				
etc.)				

The purpose for the Baseline Survey in Survey Units 1, 2, and 3 was to find contaminated areas that required decontamination prior to building demolition. The purpose of the Baseline Survey in Survey Units 4 and 6 was to demonstrate that these building areas were not contaminated using a survey design that would satisfy the requirements for a MARSSIM FSS. Survey Unit 5 will be surveyed during the FSS following decontamination in Cell 5.

2.3.5 Data Requirements

Fifteen direct systematically located measurement points were planned for each Survey Unit based on the recommended MARSSIM approach for calculating the number of measurement data points to demonstrate compliance for release purposes. Assumptions for this data point determination were a) the lower bound of the gray region is equal to 2500 dpm/ 100 cm², or ½ the total contamination DCGL; b) Type 1 and Type II decision errors are each 0.05; c) the uncertainty in data is equal to the detection sensitivity; and d) the background level is significant. These systematic measurements are in addition to any measurements performed as a result of positive scans; i.e. where the HPT believed the instrument MDC has been exceeded (judgmental measurements). Removable contamination measurements using swipes were performed at each systematic measurement location and at each of the judgmental measurement locations.

Scanning coverage was 100% for Class 1 units, 25% for Class 2 units, and 10% for Class 3 units (as allowed by MARSSIM). If scans of any unit reveal contamination exceeding the clearance level any such unit will be upgraded to Class 1 during the follow-on FSS survey.

2.3.6 Referencing Survey Locations

Measurement locations are shown on the facility drawing in Attachment 2. A one (1) meter square grid was established on MARSSIM Class 1 and Class 2 Survey Units. This was done using laser distance measurement devices. Grid node intersections were marked. The numbering convention for the square meter grid will be as follows:

F, W, or C-R-C-X where:

F denotes floor, W denotes wall, and C denotes ceiling;

R denotes rows, which will be a letter;

C denoted columns, which will be a number; and

X denotes whether the measurement is an average per square meter (A), an evenly spaced static measurement (S), or a biased measurement (B).

For example, F-A-01 will denote floor, Row A, Column 01.

Average measurement results for each square meter along with direct systematic measurements and direct biased measurements were made and referenced to the square meter grid system. These measurement locations were denoted by appending an "A" for average, "S" for systematic and "B" for biased as a suffix to the grid number. For example, F-A-01-A denotes the average result for floor row 01, column A.

Class 3 Survey Units were not gridded. This is consistent with MARSSIM. Measurement locations were denoted and numbered on a survey map as there was not a square meter grid. The notations "A", "S", and "B" were still used.

2.3.7 Surveying Material and Equipment for Contamination

Many times, miscellaneous material and equipment that may contain radioactive contamination is cheaper to dispose as radioactive waste than to perform surveys necessary to demonstrate the DCGLs are met. This is often the fastest course of action to disposition these items.

Items in Building 181 consist of numerous wooden pallets and miscellaneous office furnishings. Pallets are difficult to survey because the wood is porous and contamination may be within crevasses and holes. AAR considered pallets to have a low probability of contamination and surveyed then 10 percent as a MARSAME Class 3 Survey Unit. AAR performed a statistically-based scan survey of pallets by selecting 10 percent of them at random. The entire surface area of these selected pallets was surveyed for total beta contamination using the Ludlum 43-93 detector. Removable contamination was checked using Large Area Wipes (LAWs). A LAW is taken using an oil-impregnated cloth, called masslin. The surface area wiped was many times greater than 100 cm². The LAW is then analyzed by checking its surface with the 43-93 detector. LAWs are a quick way to demonstrate the absence of removable radioactive contamination.

If any of these pallets and/or office furnishing had contamination detected above background, all pallets were designated for disposal as radioactive waste. If none of the pallets were found to contain radioactivity above background, surveying continued at a rate of 10% of the remaining pallets. If all pallets were uncontaminated at background levels, all pallets were labeled as "clean" and shall be left for disposal as Construction and Demolition (C&D) debris by the Building 181

demolition contractor. If any pallet was found to be contaminated, all pallets were considered to be contaminated and shall be disposed as low level radioactive waste and/or mixed wastes. Please refer to Section 3 and the survey results in Attachment 2.

Miscellaneous office furnishings have a lower potential for contamination. They were surveyed and evaluated on a case-by-case basis for each piece of furniture. These furnishings were surveyed ≥25% of their surface area as allowed by MARSAME for a Class 3 Survey Unit. If the furnishings had no detectable contamination above background, they were labeled as "clean" and shall be left for disposal as C&D debris by the Building 181 demolition contractor. Otherwise the individual items will be disposed as radioactive waste.

A photo was taken of items surveyed. Photos are appended to survey forms used to document survey results and are included in Attachment 2.

2.3.8 Data Evaluation

As indicated above, all survey data were compared directly with guideline values to determine the level and extent of contamination exceeding guidelines or to demonstrate that release survey data satisfy the guideline requirements. By definition, all measurements must be less than the DCGLs for total and removable contamination to consider for release, thus statistical testing will not be required.

2.3.9 Background Determination

Facility-specific background levels were determined for comparison and correction of scanning and direct measurement data and to enable calculation of appropriate detection/measurement sensitivity levels. Locations where natural material content or elevated ambient gamma background levels result in high measurement sensitivity values were evaluated on an individual basis by the AAR Survey Team Lead. Background was determined for each day in the Building 181 Center Section and is included on the survey results discussed in Section 3.0 and provided in Attachment 2.

2.4. Survey Techniques and Sampling Methods

The Ludlum detectors were used to scan surfaces and to make the direct one minute counts for the Survey Units. The results were compared directly to the DCGLs to determine whether these units may be released to the demolition contractor.

2.4.1 Scan Measurements

Scan measurements were made with the detector held approximately one cm from the surface. The scan speed for the Ludlum Model 49-93 will be one detector probe width per every one second, approximately. The scan speeds for the Ludlum Model 43-37 and 43-37-1 detectors were one probe width every 1.5 seconds, approximately. These scan speeds achieved scan MDCs lower than the DCGL.

Scan measurements with the Ludlum 43-37 and 43-37-1 detectors were made with the detector voltages set such that they summed both alpha and beta radiation measurements emitted from the surfaces. The detector did not distinguish between alpha and beta radiation events detected. Two beta radiations occur from the radioactive decay of U-238. The alpha radiation from U-238, U-

235, and U-234 was also detected, although less effectively than the beta radiation because of the lower source efficiency.

Scan measurements were made with the large area gas flow proportional monitors with a surface area equal to or greater than 500 cm². There are twenty 500 cm² areas per m². Each square meter was scanned at a uniform rate for 30 seconds. The Ludlum Model 2221Scaler has a 30 second integration time. At a minimum, 20 detector surfaces areas traversed an entire square meter in 30 seconds. Thus, a detector probe surface area dwelled over the surface for an average of 1.5 seconds (30/20).

The gas flow proportional detector operating voltages were set to detect all radiation events emitted from the surfaces (alpha, beta, and gamma). There are two beta radiations emitted from the daughters in secular equilibrium with the U-238 isotope. U-238 is more prevalent than the U-235 and U-234 isotopes when DU is the contaminant. Approximately 70% of the uranium radioactivity was assumed to be from U-238, 28% is from U-234, and 2% is from U-235. Therefore 3.3 radiation events are capable of being detected for each molecule of DU deposited as a contaminant on surfaces (1 alpha from U-238 plus one beta from Pa-234 plus 1 beta from Th-234 plus 0.28 alpha from U-234 plus 0.02 alpha from U-235). The net radiation signal from all radiation events will, at a minimum, overestimate the amount of DU on surfaces by a factor of two. Therefore, the radiation signal detected and corrected by surface and source efficiency was halved when reporting the average scan measurement result over each 1 m² when compared to the DCGL of 2,570 dpm/100 cm². This is how results of this Baseline Survey are reported herein. This factor of two reduction will not be used during the FSS to ensure that residual contamination is reduced to As Low As Reasonably Achievable (ALARA) levels.

Note that the instrument results were not corrected for the detector area for the 609 cm² Ludlum 43-37-1 or the 500 cm² Ludlum 43-37. The surface areas of both these detectors are greater than the 100 cm² DCGL area factor. No correction was made because the distribution of contamination under the detectors was not necessarily uniform. In many cases the area of contamination under the detector was greater than 100 cm². However, in cases where the contaminated area was less than or equal to 100 cm², then dividing the instrument result by the detector area (either 609 cm² or 500 cm²) would underestimate the actual contamination present when compared to the DCGL which is stated in unit areas of 100 cm². Because in most cases the contaminated area exceeded 100 cm², scan results reported typically overestimated the contamination present. Areas identified as exceeding the DCGL using surface scanning measurements will be remediated and this will provide additional assurance that contamination will be removed to levels that are ALARA.

The HPT also evaluated whether any specific locations within each m^2 exceed three times background (nominally expected to be 800 - 1,000 cpm). The HPT investigated any areas greater than three times background within the m^2 once the 30 second scan is completed. This was done to evaluate whether any single area of 100 cm^2 potentially exceeds 2,570 dpm. Any such areas were the focus of biased measurements made using the Ludlum 43-93 detector held stationary over the area for one minute.

2.4.2 Direct Measurements

The 43-93 detector, different than the 43-37-1 detector, was used to differentiate between alpha and beta radiation. This detector does not rely on changes in detector voltage to distinguish between alpha only events (lower voltage setting on the 43-37-1) and alpha plus beta events (higher voltage setting on the 43-37-1). The 43-93 detector is made of two detectors layered on top of each other to detect alpha and beta radiation separately when the detector is set to the same operating voltage. There were direct systematic measurements for both alpha and beta radiation made as well as biased measurements for both alpha and beta radiation made at locations with higher readings recorded while scanning measurements are made. All direct systematic locations were uniformly and evenly spaced over the particular Survey Unit. Direct measurements were made with the Ludlum 43-93. Measurements were made with the detector held at contact with the surface being measured. A timed one minute count was performed to achieve a MDC less than the total contamination DCGL.

Biased direct measurements were made at areas where the HPT noted a scan measurement result greater than three times background. The purpose of this was to check for smaller areas of contamination that exceeded the DCGL because the scan measurements represent surface contamination averaged over one m².

A smear for removable contamination was obtained at each location where a direct radiation measurement is made. Quantitative smears or wipes with cloth filters was conducted over an area of approximately 100 cm² and alpha and beta activity collected on the sample determined by counting in the Ludlum Model 2929 sensitive, low-background counter.

The gross detector response in the alpha channel was reduced by the area background (net count) and corrected for detector efficiency (both source and intrinsic) to yield the dpm/100 cm² readings. This quantitated the alpha response for direct comparison to the DCGL because the alpha events detected are directly comparable to the DU on the surface (comprised of the sum of alpha signal from U-238 plus U-234 plus U-235). The gross detector response in the beta channel was reduced by the area background (net count) and corrected for detector efficiency (both source and intrinsic). This result was halved and recorded as the amount of radioactivity due to U-238 per 100 cm² because two beta radiation events occur as a result of one radiation decay of U-238. U-238 is the predominant component of DU, therefore this represents only a slight underestimate of the DU on the surface. Note that the decisions to decontaminate an area and the success of the decontamination in meeting the DCGL are preferentially based on the scanning measurements, which always exceeded the results of the direct measurements at the same location.

Results of this Baseline Survey are reported herein using the factor of two to account for the two beta radiation events for every one radioactive decay of U-238. This factor of two reduction will not be used during the FSS as a result of comments received during Nuclear Regulatory Commission (NRC) review of this decommissioning plan. Elimination of the factor of two will help assure that residual contamination is reduced to As Low As Reasonably Achievable (ALARA) levels.

2.5. Evaluation of Results

Survey data were reviewed to assure all aspects of this plan were followed and that surveyed items were properly characterized and segregated and/or released. This review also included evaluation of documentation and acceptable quality assurance/quality control data.

2.6. Documentation and Proposed Format of Site Characterization Report

Survey data was documented in accordance with applicable AAR procedures. The results of the survey are documented in Section 3.0

2.7. Baseline Survey Quality Assurance

Instruments were calibrated according to ANSI N323A-1997. Survey instruments and methods specified in applicable AAR operating and technical procedures have been documented as to their ability to provide a 95% confidence level in detection of surface contamination at levels, which meet the requirements of this characterization plan. Instruments were checked daily before use to assure they are operating within $\pm 20\%$ of their calibrated intrinsic efficiencies. Results are on file. Supporting data is provided on each survey form.

ARS ES&H Manager and Radiation Safety Officer, Steven Green (CSP/CHP), reviewed the data and information from the survey; assisted, as requested, in evaluation of the survey data; and prepared this report. His interpretations of the data are provided herein in Section 3.0.

3.0 Baseline Survey Results

The results of the surveys performed to quantify the DU contamination on the interior surfaces of Building 181 and on miscellaneous equipment within the building is summarized in this section.

3.1. Cell 1

The Cell 1 floor is approximately 154 m^2 . A total of 20 m^2 were scanned and 19 systematic measurements were made. This exceeds the minimum number of 15 systematic measurements required for this Class 3 area.

Cell 1 was not expected to have any DU contamination. It was considered a MARSSIM Class 3 area. Only the floor was surveyed. Survey coverage was 10% of the floor for scans. Twenty square meters were surveyed. Results of scans, direct measurements, and smears are summarized in *Table 4*. The summary table shows the measurement type, the MDA for the instruments used in the survey, the number of measurements taken, the number of measurements that were less than the MDA, the average of any of the results that exceeded the MDA, and the average of all results whether above or below the MDA. All results were less than the DCGL.

Equipment/materials in Cell 1 consisted of boxes of lights and a cart. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 4. Summarized Measurements							
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum result (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm²)	Minimum/ Maximum result (dpm/100 cm²)		
Beta/gamma scans	1618	20	19	2123	678	-146/2123		
Alpha Direct	56	19	0	200	200	56/412		
Beta/gamma Direct	269	19	0	640	640	433/875		
Alpha Smear	23	19	19	N/A	-2	-3/0		
Beta/gamma smear	49	19	19	N/A	-28	-51/2		

3.2. Cell 1A/Room FY1

The Cell 1A and Room FY1 floor area combined is approximately 141 m². A total of 18 m² were scanned and 18 systematic measurements were taken. This exceeds the minimum surface area requiring scanning and the minimum number of 15 systematic measurements required for this Class 3 area.

Cell 1A is between Cells 1 and 2. Room FY1 spans across and connects all three cells on the west side of Building 181. They were not expected to contain DU contamination. Cell 1A and Room FY1 were considered MARSSIM Class 3 areas. Survey coverage was 10% of the floor for scans. Eighteen square meters were surveyed. Results of scans, direct measurements, and smears are summarized in *Table 5*. All results were less than the DCGL.

Equipment/materials in Cell 1A consisted of pallets, a hoist, and electrical equipment. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 5. Summarized Measurements								
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum result (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum result (dpm/100 cm²)			
Beta/gamma scans	1565	18	18	N/A	-1030	-2037/550			
Alpha Direct	144	18	18	N/A	18	-19/56			
Beta/gamma Direct	287	18	17	291	47	-178/291			
Alpha Smear	23	18	18	N/A	-2	-3/0			
Beta/gamma smear	46	18	18	N/A	-2	-16/7			

3.3. Cell 2

Cell 2 floor is approximately 162 m². A total of 19 m² were scanned and 15 systematic measurements were made in this Class 3 area which meets survey design requirements.

Cell 2 was not expected to contain DU contamination. Cell 2 was considered a MARSSIM Class 3 area. Survey coverage was 10% of the floor for scans. Nineteen square meters were surveyed. Results of the scans, direct measurements, and smears are summarized in *Table 6*. All results were less than the DCGL.

Equipment/materials in Cell 2 consisted of a metal stand, buckets, drums, hoses, tables, a cart, a port-a-cool, a ladder, and a shelf. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 6. Summarized Measurements								
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Result (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Result (dpm/100 cm²)			
Beta/gamma scans	1663	19	19	N/A	-599	-2028/455			
Alpha Direct	143	15	12	181	83	0/243			
Beta/gamma Direct	276	15	12	336	132	-65/387			
Alpha Smear	23	15	15	N/A	-2	-3/0			
Beta/gamma smear	45	15	15	N/A	1	-16/21			

3.4. Cell 3

Cell 3 floor is approximately 162 m². A total of 20 m² were scanned and 16 systematic measurements were made in this Class 3 area which exceeds survey design requirements.

Cell 3 was not expected to contain DU contamination. Cell 3 was considered a MARSSIM Class 3 area. Survey coverage was 10% of the floor for scans. Twenty square meters were surveyed. Results of scans, direct measurements, and smears are summarized in *Table 7*. All results were less than the DCGL.

Equipment/materials in Cell 3 consisted of a metal table and a blue drum with aluminum pellets. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 7. Summarized Measurements							
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Result (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Result (dpm/100 cm²)		
Beta/gamma scans	1571	20	20	N/A	-358	-2123/275		
Alpha Direct	144	16	16	N/A	49	0/112		
Beta/gamma Direct	280	16	11	422	212	-301/508		
Alpha Smear	23	16	16	N/A	-2	-3/0		
Beta/gamma smear	46	16	16	N/A	0	-14/31		

3.5. Rooms 2A, 2B, 2B1, FY

Rooms 2A, 2B, 2B1, and FY combined had a floor area of 156 m². A total of 22 m² were scanned and 22 systematic measurements were made. This exceeds the survey design requirements for this Class 3 area.

Rooms 2A, 2B, 2B1, and FY were not expected to contain DU contamination. They were considered MARSSIM Class 3 areas. Survey coverage was 10% of the floor for scans. Twenty-two square meters were surveyed. Results of scans, direct measurements, and smears are summarized in *Table 8*. All results were less than the DCGL.

There was no equipment in these rooms.

	Table 8. Summarized Measurements								
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Maximum/ Minimum Result (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Maximum/ Minimum Result (dpm/100 cm²)			
Beta/gamma scans	1692	22	22	N/A	-1760	-2845/-696			
Alpha Direct	207	22	22	N/A	26	-56/94			
Beta/gamma Direct	264	22	16	568	234	-56/1109			
Alpha Smear	23	22	22	N/A	-2	-3/0			
Beta/gamma smear	46	22	22	N/A	-5	-23/12			

3.6. Cell 4

Cell 4 had a floor area of approximately 140 m². A total of 12 m² were scanned and 12 systematic measurements were made. An additional 2 m² are needed to meet the minimum requirement of 10%. However, the relative shift in the beta/gamma direct measurements was determined to be 122. This exceeds a value of 4 stipulated in MARSSIM Table 5.3. Therefore, only nine (9) systematic measurements were required for this floor area, which eliminates the need for surveying the additional 2 m² required to meet the 10% of floor area.

Cell 4 was not expected to contain DU contamination. Cell 4 was considered a MARSSIM Class 3 area. Survey coverage was 10% of the floor for scans. Twelve square meters were surveyed. Results of scans, direct measurements, and smears are summarized in *Table 9*. All results were less than the DCGL.

Equipment/materials in Cell 4 consisted of pallets. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

Table 9. Summarized Measurements							
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Result (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Result (dpm/100 cm²)	
Beta/gamma scans	1484	12	12	N/A	342	-430/971	
Alpha Direct	144	12	12	N/A	9	-19/37	
Beta/gamma Direct	249	12	2	389	351	138/580	
Alpha Smear	23	12	11	27	0	-3/27	
Beta/gamma smear	46	12	12	N/A	0	-22/9	

3.7. Cell 5

Cell 5 floor area was 166 m². Cell 5 was anticipated/suspected to contain DU contamination based on prior survey results and historical operational knowledge. The floor was considered a MARSSIM Class 1 area. The walls below two meters in height were considered a MARSSIM Class 2 area. The walls above two meters and the ceiling and overhead structures/equipment were considered a MARSSIM Class 3 area. Survey coverage was 100% of the floor and 25% of the lower walls. The upper walls above two meters, ceiling, and overhead structure were not scanned because the peeling paint would have destroyed the detectors. Direct measurements were made on these areas and the measurements in the overhead structure were made on the top surfaces of the light fixtures. Results of scans, direct measurements, and smears are summarized in *Table 10*.

A total of 162 m² of floor were scanned representing 100% of the surface area available for scanning. A total of 46 systematic measurements were performed. This exceeds the MARSSIM survey design for the floor.

All results were less than the DCGL. The scans for contamination on the lower walls detected radioactivity above background on the lead-based paint. Two of 11 direct measurements on the lower walls detected radioactivity above background on the lead-based paint. No measurements, either scans or directs detected radioactivity above background on the upper walls. The paint may be a hazardous waste and would then be considered a mixed low level radioactive waste. AAR recommends that the lower 2 meters of Cell 5's painted walls have the lead based paint (LBP) removed as radiologically contaminated and that the resulting wastes be packaged and disposed of as low level radioactive and/or mixed wastes. The lead-based paint that is peeling off the upper walls and ceiling should be removed and then sampled to determine whether it is a hazardous waste or a radioactive-mixed waste.

The walls and ceiling will be decontaminated for lead-based paint. The walls and ceiling will be surveyed during the FSS as a MARSSIM Class 3 area following this decontamination to demonstrate the DCGL is met. During the baseline survey, the Cell 5 floor was surveyed as a Class 1 area (see Table 3 "Baseline Survey Units."). However, to confirm that the floor was not contaminated above the DCGL during the LBP removal operations, the floor will be resurveyed as a FSS Class 3 area (see Table 21 for FSS classifications).

There were no equipment/materials in Cell 5.

A representative of Robins AFB requested that vents on the roof and areas surrounding the vents be checked for contamination. This, however, was mistakenly not performed. The roof vents for Cells 5 and 6 and surrounding areas will be checked before these cells are demolished and decontamination, if warranted, will be performed.

Table 10. Summarized Measurements							
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm ²)	Average of all DU Results (dpm/100 cm²)	Minimum/ Maximum Results (dpm/100 cm²)	
Beta/gamma scans, floors	1451	162	158	2194	342	-894/3816	

	Table 10. Summarized Measurements								
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm ²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Results (dpm/100 cm ²)			
Beta/gamma scans, lower	1451	14	0	2125	2125	498/2664			
walls									
Alpha Direct, floors	143	46	41	317	38	-19/505			
Beta/gamma Direct, floors	276	46	46	N/A	103	-71/423			
Alpha Smear, floors	23	46	46	N/A	-1	-3/6			
Beta/gamma smear, floors	45	46	46	N/A	4	-14/25			
Alpha Direct, lower walls	143	10	10	N/A	-4	-19/37			
Beta/gamma Direct, lower walls	276	10	10	N/A	-1	-331/245			
Alpha Smear, lower walls	23	10	10	N/A	-2	-3/0			
Beta/gamma smear, lower walls	45	10	10	N/A	3	-21/15			
Alpha Direct, upper walls	143	7	7	N/A	29	0/93			
Beta/gamma Direct, upper walls	276	7	7	N/A	69	-65/365			
Alpha Smear, upper walls	23	7	7	N/A	-2	-3/3			
Beta/gamma smear, upper walls	45	7	7	N/A	10	5/15			
Alpha Direct, top of light fixtures	143	16	16	N/A	44	-19/112			
Beta/gamma Direct, top of light fixtures	276	16	11	568	211	-238/836			
Alpha Smear, top of light fixtures	23	16	16	N/A	-1	-3/0			
Beta/gamma smear, top of light fixtures	45	16	16	N/A	8	-5/30			

3.8. Rooms 3A, 3B, 3C, and FY6

Rooms 3A, 3B, 3C, and FY6 were not suspected to contain DU. The room area was approximately 136 m². The plan was to survey only the floor throughout all of these rooms 10% as a MARSSIM Class 3 area.

Room 3A had a concrete floor and was surveyed one time. Room 3A has a door on the south side that opens into Cell 6, which has contamination above the DCGL. Contamination was detected in the doorway between Room 3A and Cell 6 because it appears that drums were moved from Cell 6 into Room 3A as evidenced by "drag marks" on the floor. The contamination in the doorway between Cell 6 and Room 3A will be cleaned when Cell 6 is decontaminated and this area, to include all of Room 3A, will be resurveyed during the FSS as a MARSSIM Class 1 area.

Rooms 3B, 3C, and FY6 were surveyed twice. Room 3B and 3C had tile above a concrete floor. The tile contained asbestos and was removed. The surface of the tile was surveyed before it was removed. The concrete floor underneath was then surveyed after tile removal. Neither the tile nor the concrete underneath exceeded the DCGL. The walls in Rooms 3B and 3C were surveyed 25% to demonstrate there was no reason to suspect these surfaces were impacted.

Room FY6 was carpeted. The northern portion of the carpet was dry and was surveyed and found to be contaminated, therefore the entire carpet was removed and is stored as radioactive waste. The concrete floor throughout the entire room was then surveyed after the carpet had been removed.

The approximate surface area of the floors in Rooms 3B, 3C, and FY6 is 85 m². These concrete floors had either tile or carper flooring removed. This concrete was scanned 100% as a single MARSSIM Class 1 area. A total of 85 m² were scanned and 19 systematic measurements were performed. This exceeds the survey design requirements for this Class 1 area. None of these measurements exceeded the DCGL.

All survey results both pre- and post-tile and carpet removal are shown in Table 11. A total of 18 of 39 systematic and biased measurements taken before tile and carpet removal were lost and are not included in this report. This has no impact on the survey outcome as they were made before the tile and carpet was removed.

There were no equipment/materials in Rooms 3A, 3B, 3C, and FY6.

	Table 11. Summarized Measurements							
Measurement Type	MDA (dpm/ 100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm ²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Results (dpm/100 cm ²)		
		Results before t	ile and carp	pet removal				
Beta/gamma scans, floors	1455	91	13	5247	4613	-524/31001		
Beta/gamma scans, walls	1455	15	15	N/A	-219	-653/1083		
Alpha Direct, floors	14	21	4	65	53	0/127		

	Table 11. Summarized Measurements							
Measurement Type	MDA (dpm/ 100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm²)	Minimum/ Maximum Results (dpm/100 cm²)		
Beta/gamma Direct, floors	229	21	5	680	562	132/2111		
Alpha Smear, floors	23	39	38	30	1	-3/30		
Beta/gamma smear, floors	49	39	38	63	-2	-14/109		
		Results after ti	le and carp	et removal				
Beta/gamma scans, floors	Range d from 1332 – 1455	85	63	1536	658	-1238/1882		
Alpha Direct, floors	139	19	17	470	68	-18/217		
Beta/gamma Direct, floors	245	19	4	507	421	31/676		
Alpha Smear, floors	9	19	19	N/A	0	0/3		
Beta/gamma smear, floors	46	19	19	N/A	-1	-17/13		

3.9. *Rooms* **3D** *and* **3E**

Rooms 3D and 3E had a floor area of 96 m². Rooms 3D and 3E were not suspected to contain DU. There was asbestos containing material in the tile floor. The floor was scanned over 10% of its surface as a MARSSIM Class 3 area to determine whether the tile needed to be disposed as low level radioactive waste. Seventeen square meters were scanned which exceeds the survey design requirement. Direct measurements and smears were taken but the results were lost. As such, AAR will resurvey Rooms 3D and 3E during the decommissioning phase to replace the lost data and to validate the former data points.

Results of scans before the tiles were removed are listed in *Table 12*. Results of the scan measurements were all less than the MDA. This data is considered sufficient to allow the abated tile to not require disposal as low level radioactive waste. This is because the scan MDA was less than the DCGL. Additionally, the MDA was less than the surface contamination guidelines in Regulatory Guide 1.86 which is applicable to the release of material and equipment for unrestricted use.

The floor was then resurveyed 10% as a MARSSIM Class 3 area after removal of the tile. Results of scans, direct measurements, and smears are summarized in *Table 12*. All results were less than the DCGL after the tile was removed. A total of 24 m² were scanned and 18 direct measurements and smears were taken. This exceeds the MARSSIM survey design requirements.

The equipment/materials consisted of chairs, doors, lamps, and a cabinet. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 12. Summarized Measurements							
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Maximum/ Minimum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm²)	Maximum/ Minimum Results (dpm/100 cm²)		
		Results	before tile r	removal				
Beta/gamma scans, floors	977	17	17	N/A	44	-421/456		
		Results	after tile re	emoval				
Beta/gamma scans, floors	1568	24	24	N/A	-889	-1762/-154		
Alpha Direct, floors	139	18	18	N/A	35	-18/91		
Beta/gamma Direct, floors	297	18	18	N/A	-129	-329/180		
Alpha Smear, floors	9	18	18	N/A	0	0/0		
Beta/gamma smear, floors	35	18	18	N/A	-3	-21/14		

3.10. Cell 6

Cell 6 consists of a western and eastern room. The western room is approximately 102 m² and the eastern room is approximately 70 m². There is a 15 m² concrete apron outside Cell 6 on the western side.

Cell 6 was suspected to contain DU contamination based on prior survey results. The floor of the western room, 6A1, was considered a MARSSIM Class 1 area. The walls below two meters in height in both rooms of Cell 6 were considered a MARSSIM Class 2 area. The walls above two meters and the ceiling and overhead structure in both rooms of Cell 6 were considered MARSSIM Class 3 areas. Survey coverage was 100% of the floor, 25% of the lower walls and 10% of the walls above two meters. The tops of the light fixtures were evaluated with direct measurements and smears.

The eastern room, Room 6B1, had a tile floor that was abated for asbestos containing material. The tile floor was surveyed 25% before abatement to determine if it required disposal as low level radioactive waste. The floor underneath the tile was re-surveyed 100% following tile removal.

One hundred twenty square meters of floor were scanned in both rooms combined before tile removal in room 6B1. Results of scans, direct measurements, and smears are summarized in Table 13. The survey results for the floors and walls in Rooms 6A1 and 6B1 are combined and reported together in *Table 13*. Two different detectors with different backgrounds were used for the scan and direct surveys.

The majority of the floor, both bare concrete and tile, exceeded the DCGL before tile removal. The tile will be disposed as low level radioactive waste.

All measurements, including those above two meters, of the 20 square meters scanned on the walls in Room 6A1 exceeded the MDA. Many approached and exceeded the DCGL. No measurements on the ceiling or light fixtures exceeded the DCGL although ten of 16 exceeded the MDA. A single measurement on the top side of a pipe chase near the ceiling exceeded the DCGL. The lead-based paint, once abated, will be disposed as low level radioactive waste and possibly as mixed waste depending on the results of characterization samples collected once abated.

Once the tile was removed in Room 6B1, the 70-square meter concrete floor underneath was resurvey at 100%. Smears and direct measurements were also made. Results are summarized in *Table 13*. No measurement result exceeded the DCGL.

The concrete apron outside Cell 6 on the western side only had three systematic measurements made on it. This did not meet the MARSSIM survey design. This apron will be resurveyed during the FSS.

Pallets in Cell 6 had detectable contamination. All pallets from Cell 6 are stored in a Radioactive Materials Area awaiting disposal as low level radioactive waste. Other equipment/materials included a couch, office partitions, a refrigerator, a sink and water heater, a break table, a brown chair, a grey chair, shelves, pipes, a trash can, and broken office chairs. Some items had detectable contamination and are stored awaiting disposal as low level radioactive waste.

Cell 6 will be decontaminated and resurveyed during the FSS. The walls both above and below two meters will be surveyed as a Class 1 area. The floor in room 6A1 will be decontaminated and resurveyed as a Class 1 area. The floor under the removed tile in room 6B1 met the DCGL. A total of 70 m² was scanned and 10 systematic measurements were made. This floor will be resurveyed as a MARSSIM Class 1 area during the FSS following decontamination of the walls to demonstrate that contamination did not occur during the clean-up work on the walls.

	Table 13. Summarized Measurements							
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Results (dpm/100 cm²)		
		Results befor	e floor tile	removal				
Beta/gamma scan, floors	1156 - 1475	120	29	7396	6717	-3799/19896		
Alpha Direct, floors	56-139	62	6	964	878	19/3712		
Beta/gamma Direct, floors	242-261	62	1	3271	3220	110/15335		
Alpha Smear, floors	9-70	62	52	26	6	-3/92		
Beta/gamma smear, floors	35 - 44	62	52	114	29	-15/256		
Beta/gamma scans, walls	895	20	0	6864	6864	2846/16872		

	Table 13. Summarized Measurements						
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm ²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Results (dpm/100 cm²)	
Alpha Direct, walls	56-139	30	16	640	293	0/1720	
Beta/gamma Direct, walls	242-261	30	16	1876	929	-25/2531 (11782 pipe chase)	
Alpha Smear, walls	9-70	30	23	27	7	-3/51	
Beta/gamma smear, walls	35 - 44	30	23	85	18	-66/164	
Alpha Direct, ceiling and lights	56-139	16	11	376	139	-18/489	
Beta/gamma Direct, ceiling and lights	242-261	16	6	958	638	-14/2128	
Alpha Smear, ceiling, and lights	9-70	16	12	26	8	0/51	
Beta/gamma smear, ceiling, and lights	35 - 44	16	13	77	27	-7/96	
		Results after	r floor tile r	emoval			
Beta/gamma scan, floors	1499	70	69	1530	197	-490/1530	
Alpha Direct, floors	139	10	8	172	81	0/181	
Beta/gamma Direct, floors	297	10	9	360	129	-76/360	
Alpha Smear, floors	9	10	10	N/A	1	0/3	
Beta/gamma smear, floor	46	10	10	N/A	0	-10/12	

3.11. Center Section

The Center Section was approximately 500 m². A total of 98 m² were scanned and 38 systematic direct measurements were made. This exceeds the MARSSIM survey design.

The Center Section between Cells 6 and 7 was not expected to have DU contamination. It was considered MARSSIM Class 3 areas. Only the floor was surveyed. Survey coverage was 10% of the floor for scans. Ninety-eight square meters were surveyed. Two different detectors were used with different backgrounds. Results of scans, direct measurements, and smears are summarized in *Table 14*. All results were less than the DCGL.

Equipment/materials in the Center Section consisted of pallets, bubble wrap, a cart with equipment, a fan, a table, a Tugger, pallets of equipment, trash bins, a metal stand, air hoses, and a cabinet. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 14. Summarized Measurements					
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm ²)	Minimum/ Maximum Results (dpm/100 cm²)
Beta/gamma	1376 -	98	98	N/A	-3006	-4185/
scans	1814					-2062
Alpha Direct	144	38	38	N/A	24	-19/75
Beta/gamma Direct	249	38	33	458	47	-247/567
Alpha Smear	9	38	38	N/A	1	0/6
Beta/gamma smear	48	38	38	N/A	-6	-28/16

3.12. Cell 7

Cell 7 had approximately 280 m² of floor area. A total of 98 m² were scanned and 38 systematic measurements were made. This exceeds the MARSSIM survey design for this Class 3 area.

Cell 7 was not expected to have DU contamination. It was considered MARSSIM Class 3 areas. Only the floor was surveyed. Survey coverage was 10% of the floor for scans. Results of scans, direct measurements, and smears are summarized in *Table 15*. All results were less than the DCGL.

Equipment/materials in the Cell 7 consisted of gas cans, metal frames, cabinets, a fan, a table, an eye wash, and miscellaneous metal. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

Prior to conducting the surveys in Cell 7, AAR and its subcontractors had to remove and containerize approximately 160-gallons of water (presumably stormwater from a leaky roof and other building openings) and sludge that were covering a large portion of the Cell's floor. This water was removed using squeegees/pumps/absorbent materials; sampled for offsite analyses for isotopic uranium, gross alpha/beta, and lead; and containerized in DOT 7A Type A drums for storage. Only gross beta radioactivity was detected at 113.314 pCi/L. Lead was detected at 33.59 ug/L. Results are shown in *Table 16* and the laboratory reports for these samples are presented in *Attachment 1*.

	Table 15. Summarized Measurements					
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm²)	Minimum/ Maximum Results (dpm/100 cm²)
Beta/gamma scans	1687	39	39	N/A	-1961	-3094/-1177
Alpha Direct	139	40	39	145	46	-18/145
Beta/gamma Direct	242	40	3	449	430	-42/876
Alpha Smear	9	40	40	N/A	1	0/3
Beta/gamma smear	44	40	40	N/A	9	-9/41

Table 16. Summarized Measurements Water Analyses						
	Water Analyses Cell 7					
Analyte	Result	MDC	Qualifier	Method		
U-234	0.737 pCi/L	0.883 pCi/L	Q, U	Eichrom ACW-03		
U-235	0.106 pCi/L	0.286 pCi/L	Q, U	Eichrom ACW-03		
U-238	0.610 pCi/L	1.090 pCi/L	Q, U	Eichrom ACW-03		
U-238	-57.025 pCi/L	41.300 pCi/L	U	EPA 901.1		
U-235	-0.473 pCi/L	12.000 pCi/L	U	EPA 901.1		
Gross Alpha	0.662 pCi/L	1.080 pCi/L	U	SM 7110C		
Gross Beta	113.314 pCi/L	1.366 pCi/L		EPA 900.0		
Lead	33.59 ug/L	10.00 ug/L	J	EPA 200.8/EPA		
				6020B		

3.13. Rooms 5A and 5B

Rooms 5A and 5B have a combined floor area of 98 m². A total of 16 m2 and 16 systematic measurements were made. This exceeds the MARSSIM survey design for the Class 3 area.

Cell 7 Rooms 5A and 5B are between Cells 7 and 8. They were not expected to have DU contamination. They were considered MARSSIM Class 3 areas. Only the floor was surveyed. Survey coverage was 10% of the floor for scans. Results of scans, direct measurements, and smears are summarized in *Table 17*. All results were less than the DCGL.

There were no equipment/materials in Rooms 5A and 5B.

Prior to conducting the surveys in Cell 7 Room 5A and 5B, AAR and its subcontractors had to remove and containerize approximately 160-gallons of water (presumably stormwater from a leaky roof and other building openings) and sludge that were covering a large portion of the Cell's floor. This water was removed using squeegees/pumps/absorbent materials; sampled for offsite analyses for isotopic uranium, gross alpha/beta, and lead; and containerized in DOT 7A Type A drums for storage. The results of the analytical analyses of this water/sludge in presented in *Table* 18 and the laboratory reports for these samples are presented in *Attachment 1*. A total of approximately 160 gallons of water was removed and containerized in 55-gallon drums. Samples of that water were analyzed for lead (due to scraping suspected lead-based paint in the areas) and gross

alpha/beta and isotopic uranium via alpha spectroscopy. The lead concentrations in the water were found to range from non-detect to 0.049 mg/L (less than the toxicity limit of 5 mg/L for lead). The analytical results for the gross alpha/beta and isotopic uranium via alpha spectroscopy indicated concentrations below the water effluent screening concentrations listed in 10 CFR Part 20 Appendix B, Table 2. Based on these results Base personnel approved for the water to be disposed of at the Base's industrial wastewater treatment plant (IWTP). The solids mixed in with the water were filtered out during discharge to the IWTP and will be disposed of separately as low-rad waste during Building 181 decommissioning efforts.

	Table 17. Summarized Measurements						
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm²)	Minimum/ Maximum Results (dpm/100 cm²)	
Beta/gamma scans	1486	16	16	N/A	-984	-1529/-60	
Alpha Direct	139	16	16	N/A	6	-18/36	
Beta/gamma Direct	242	16	2	449	414	130/622	
Alpha Smear	9	16	16	N/A	1	0/3	
Beta/gamma smear	44	16	16	N/A	5	-9/16	

Table 18. Summarized Measurements Water Analyses						
	Water Analyses Room 5A					
Analyte	Result	MDC	Qualifier	Method		
U-234	0.367 pCi/L	0.624 pCi/l	Q,U	Eichrom ACW-03		
U-235	0.095 pCi/L	0.526 pCi/L	Q,U	Eichrom ACW-03		
U-238	0.285 pCi/L	0.917 pCi/L	Q,U	Eichrom ACW-03		
U-238	18.342 pCi/L	44.800 pCi/L	U	EPA 901.1		
U-235	0.093 pCi/L	12.400 pCi/L	U	EPA 901.1		
Gross Alpha	1.572 pCi/L	1.062 pCi/L		SM 7110C		
Gross Beta	45.629 pCi/L	0.865 pCi/L		EPA 900.0		
Lead	<50 ug/L	50.0 ug/L	U	EPA 200.8/EPA		
				6020B		
Total Uranium	58.13 ug/L	11.023 ug/L	J	EPA 200.8/EPA		
				6020B		
	1	Water Analyses Room 3	5 <i>B</i>			
Analyte	Result	MDC	Qualifier	Method		
U-234	0.034 pCi/L	0.062 pCi/L	U	Eichrom ACW-03		
U-235	-0.010 pCi/L	0.061 pCi/L	U	Eichrom ACW-03		
U-238	-0.002 pCi/L	0.092 pCi/L	U	Eichrom ACW-03		
U-238	0.326 pCi/L	1.340 pCi/L	U	EPA 901.1		
U-235	0.133 pCi/L	0.372 pCi/L	U	EPA 901.1		
Gross Alpha	0.217 pCi/L	1.737 pCi/L	U	SM 7110C		

Table 18. Summarized Measurements Water Analyses					
	Water Analyses Room 5A				
Gross Beta	1,387 pCi/L	1.650 pCi/L	U	EPA 900.0	
Lead	49.36 ug/L	12.5 ug/L	J	EPA 200.8/EPA 6020B	
Total Uranium	41.04 ug/L	11.221 ug/L	J	EPA 200.8/EPA 6020B	

3.14. Cell 8

The Cell 8 floor area was approximately 190 m². A total of 30 m² were scanned and 30 systematic measurements were made. This exceeds the MARSSIM survey design for this Class 3 area.

Cell 8 was not expected to have DU contamination. It was considered a MARSSIM Class 3 area. Only the floor was surveyed. Survey coverage was 10% of the floor for scans. Results of scans, direct measurements, and smears are summarized in *Table 19*. All results were less than the DCGL.

Equipment/materials in Cell 8 consisted of miscellaneous metal, a white tank, and metal racks. Direct measurements for alpha and beta/gamma contamination were all less than the MDA. The absence of removable contamination was determined by taking a large area wipe with an oil-impregnated cloth. No removable contamination was detected.

	Table 19. Summarized Measurements					
Measurement Type	MDA (dpm/100 cm ²)	Number of Measurements	Number <mda< th=""><th>Average of DU Results >MDA (dpm/100 cm²)</th><th>Average of all DU Results (dpm/100 cm²)</th><th>Minimum/ Maximum Results (dpm/100 cm²)</th></mda<>	Average of DU Results >MDA (dpm/100 cm²)	Average of all DU Results (dpm/100 cm²)	Minimum/ Maximum Results (dpm/100 cm²)
Beta/gamma scans	1435	30	30	N/A	248	-1006/945
Alpha Direct	231	30	30	N/A	-26	-75/56
Beta/gamma Direct	255	30	4	394	356	-59/397
Alpha Smear	23	30	30	N/A	-2	-3/0
Beta/gamma smear	47	30	30	N/A	-4	-21/12

4.0 Building 181 Decontamination and Demolition

This section provides an overview of the decontamination that will be performed in Building 181, Cells 5 and 6, specifies the building areas requiring decontamination, provides the decommissioning management and organization, states the approach to decommissioning task management, and specifies environmental controls.

4.1. Overview

Lead-based paint (LBP) greater than 1.0 mg/cm² or 0.5% by weight and radioactive contamination greater than the DCGL must be removed from all interior surfaces of Building 181 before the building is demolished. Such contamination will be removed to levels that are nearly background of the direct-reading radiation detectors so that radiation exposures are ALARA. This will allow the demolition debris to be disposed in a construction landfill. The removed paint and radioactivity will be properly packaged and disposed at a licensed Treatment, Storage and Disposal Facility (TSDF) capable of receiving low level radioactive wastes and mixed low level radioactive wastes.

Decontamination of the contaminated portions of Building 181 discussed in the previous sections of this document will be performed according to ARS International Radioactive Materials License No. 17-29441-01 and a project-specific License Agreement between USAF and AAR which specifies the responsibilities of Robins AFB under Master Materials License 42-23539-XXAFP and AAR/ARS. In summary, this agreement states that AAR, a wholly-owned subsidiary of ARS International, LLC, shall perform the decontamination/decommissioning work in accordance with its USNRC License No. 17-29441-01. Robins AFB shall continue to possess the radioactive material in Building 181 while it is on and within Building 181 and after it has been removed from the building surfaces and properly contained until such time the material is properly transported and disposed.

Radiologically contaminated equipment/materials within Building 181 has been properly stored in a labeled Radioactive Materials Area in Cell 5. These equipment/materials will be size-reduced as necessary and packaged into DOT 7A Type A drums, B-25containers or IP-1 roll-off containers for transport and disposal as low level radioactive waste.

Decontamination of the radiologically contaminated areas Cells 5 and 6 delineated in previous sections of this document will be performed by scabbling the concrete floors and walls. Other methods of surface cleaning such as scraping, chemical decontamination, and/or use of needle guns will be used as necessary to remove the paint and radioactivity. Removed material will be packaged into 55-gallon 7A Type A drums or other suitable strong tight containers. The waste shall be characterized in accordance with the proposed waste disposal facility's Waste Acceptance Criteria (WAC) and manifested for disposal as low level radioactive waste and mixed low level radioactive waste depending on the results of the waste characterization.

The building, Cells 1 through 8, will be demolished by the USAF selected demolition contractor using conventional means. It should be noted that the demolition of Cells 1 through 4 and Cells 7 and 8 can be initiated prior to the completion of the decontamination/decommissioning efforts in Cells 5 and 6, as long as these demolition activities do not impact the ability to safely and efficiently decontaminate/decommission Cells 5 and 6 by AAR and its subcontractors. Because

the potential exists for radiological contamination to be present under the concrete foundation beneath Cells 5 and 6 (the cells where DU was handled), including the sub-slab utility trench and soils, AAR shall conduct radiological surveys of these areas during the demolition process by the USAF's demolition contractor.

4.2. Building Areas Requiring Decontamination

The following areas of Building 181 require decontamination/decommissioning of lead-based paint and radioactive material:

- Cell 5 Radiologically contaminated LBP on the walls up to two meters within the entire cell.
- Cell 5 LBP on the walls and ceiling above 2 m (which may or may not be radiologically contaminated).
- Cell 6 Radiologically contaminated floors, walls (includes LBP), and utility trench in Cells 5 and 6.
- Cell 6 The entire floor that was not previously covered with tile requires decontamination. The floor in the doorway leading from Cell 6 into Room 3A requires decontamination as well.
- Cell 6 The pipe chase that runs under the floor of Cell 6 requires decontamination or disposal as low level radioactive waste.

The walls throughout the entire Cell 6 require LBP abatement and the waste should be treated as low level radioactive waste or mixed low level radioactive waste depending on the results of waste characterization following abatement.

Equipment, pallets, tile, and carpet that was determined to be contaminated has already been packaged and properly stored in a labeled Radioactive Materials Area in Cell 6. These items shall be disposed as low level radioactive waste and/or mixed waste, depending on the results of disposal site WAC characterization efforts.

4.3 Decommissioning Management Organization

The decommissioning organization is shown in *Figure 3*. The Robins AFB Project Manager has overall authority for the project. The radioactive material within Building 181 and generated during decontamination is possessed under the Robins AFB Nuclear Materials License. The responsibility for this radioactive material while at Robins AFB rests with the Robins Radiation Safety Officer (RSO). The contractor organization is responsible for the safety and health (to include the radiation safety) of the decontamination workforce. The physical decommissioning work will be performed under the AAR Nuclear Materials License and the radiation safety and ALARA practices during the decommissioning work are the responsibility of the AAR RSO. This organization hierarchy, responsibilities, authorities, and accountability are discussed in the subsections below.

4.3.1 Robins AFB RSO

The radioactive material in Building 181 is possessed under the USAF Master Materials License 42-23539-XXAFP. The Robins RSO is responsible for the safe possession of this radioactive material at Robins AFB whether it is on the building surfaces or has been removed by

decontamination and safely packaged. The Robins RSO responsibility for this radioactive material ends when the material is safely shipped for disposal as a radioactive or mixed waste.

The Robins RSO is also responsible for oversight of the radiation safety practices conducted by Geosyntec and their subcontractor, AAR. The Robins RSO may stop work at any time if the conditions of the Robins license are not followed or potentially unsafe practices are observed during work.

4.3.2 Project Management

Geosyntec is contracted to Robins AFB to manage and execute the decontamination of Building 181 Cells 5 and 6. The Geosyntec Project Manager (PM) is accountable to the USAF Robins Project Manager for the safe and efficient conduct of work. The PM has overall responsibility for the planning, execution, compliance, and performance of the project. The PM prepares and approves project deliverables, plans, policies, procedures, and associated guidance. Responsibilities include providing strategic planning for all levels of the project organization; identifying resources needed, performing cost and schedule review, tracking, and control; managing and reporting the project budget; understanding and analyzing project cost and schedule metrics; facilitating inter- and intra-team communication; managing subcontractors; providing leadership and overall direction for project staff; and directing overall contract execution.

The PM ensures coordination of management, safety and health, radiation safety, and quality assurance functions; allocates resources to the project to ensure successful execution and completion of milestones; demonstrates commitment and implementation of Safety and Health, Radiation Safety, Waste Management, and Quality Assurance; and maintains signature authority to commit Geosyntec and its subcontractor AAR. The PM is the primary point of contact with the USAF. The PM is responsible to ensure all work and project activities are executed in accordance with established regulatory requirements and project programs, plans, and procedures.

4.3.3 Decontamination Manager

The Decontamination Manager reports to the Project Manager and is empowered fully responsibly for performing the scope of the building decontamination according to the project schedule and budget. The Decommissioning Manager will prioritize daily work activities and assign resources to determine processes and techniques for work execution; ensure compliance with the Safety Health Program, Radiation Safety Plan, and have overall management responsibility for work operations, including training, and waste management.

4.3.4 AAR RSO

The radiological decontamination work will be performed under the AAR Nuclear Materials License No. 17-29441-01. The AAR RSO reports to the Project Manager and is responsible for meeting the requirements of the AAR License and implementing the Radiation Safety Plan. The RSO is responsible establishing ALARA goals for individuals and the project, providing guidance for the safe and efficient approach to completing radiological work. The AAR RSO will also be responsible for implementing the Final Status Survey Plan in Section 5.0. The RSO or the Site Safety and Health Officer and Quality Manager (SSHO) will be at the site anytime work is performed at the site. The AAR RSO will have stop work authority if the requirements of these documents are not properly followed.

The RSO is responsible to ensure that the resources required to meet the requirements of the Radiation Safety Plan are assigned. The RSO will establish programs for assessing radiation safety performance and reporting deficiencies to program and procedural requirements. He is responsible to ensure all work and project activities are executed in accordance with established regulatory requirements and project programs, plans, and procedures. The RSO may stop work if the Nuclear Material License is not followed.

4.3.5 Site Safety and Health Officer and Quality Assurance Manager

The Geosyntec SSHO recognizes, evaluates, recommends, and implements policies and procedures to assure awareness of and compliance with ES&H requirements of the organization. The SSHO is responsible for monitoring and preventing adverse exposure to chemical, biological, and physical hazards throughout the work sites. The SSHO helps develop and provide basic environmental, safety, and health training to employees and promotes communication programs to enhance and encourage employee awareness of accident prevention, industrial hygiene, and environmental compliance. The SSHO is responsible to ensure all work and project activities are executed in accordance with established regulatory requirements and Geosyntec programs, plans, and procedures. The SSHO may stop work if unsafe conditions are observed.

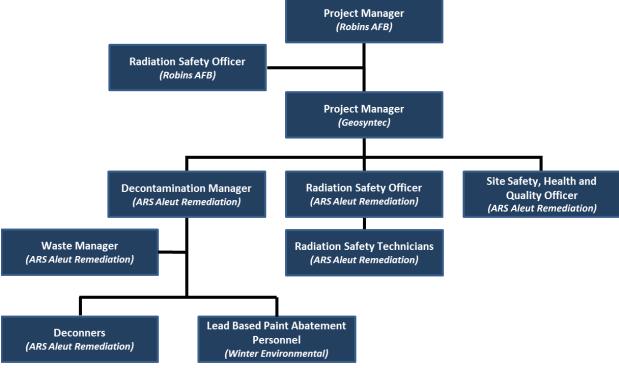


Figure 3. Decommissioning Organization

Figure 4 presents the schedule for the decommissioning and final status survey activities for Building 181 Cells 5 and 6.

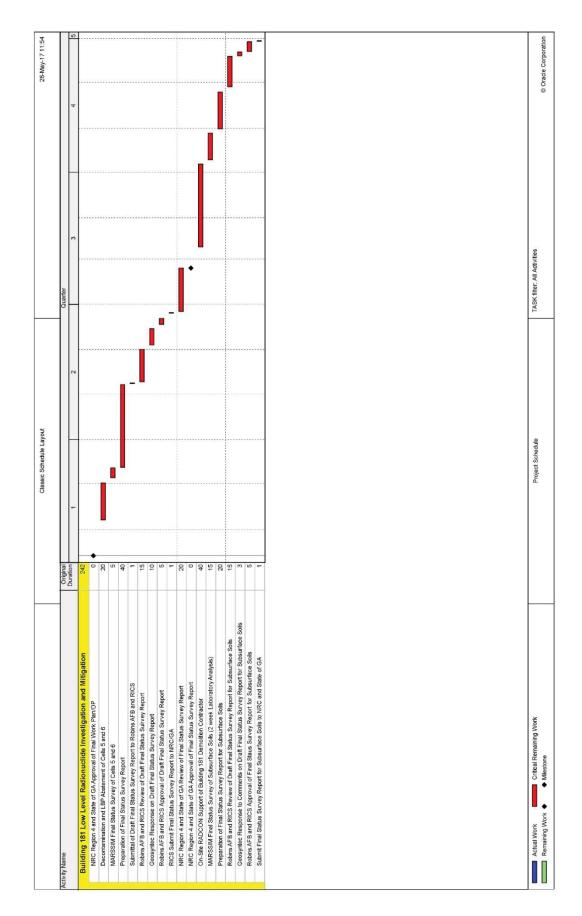


Figure 4. Building 181 Decommissioning and Final Status Survey Project Schedule

4.4 Decommissioning Task Management

Under the direction and oversight of the AAR Project Manager, the Building 181 Cells 5 and 6 decontamination and decommissioning (D&D) operations will directly involve the Decontamination Manager, Waste Manager, decontamination technicians, and lead abatement personnel. These personnel will be supported by the Radiation Safety Officer, SSHO/QA, and Radiation Safety Technicians. This group of personnel, as a team, will identify and plan the necessary D&D work tasks. The planning includes the identification and mitigation of all actual and potential work hazards. Once the work plan is acceptable to all involved skill crafts, the specific work task plan will be reviewed and approved by AAR and Geosyntec Project Managers. Once approval is achieved, the specific work task can commence within the prescribed radiological, industrial hygiene, and industrial safety requirements. The task specific work steps, and "Hold Points" if necessary, will be depicted in the associated work plan.

The required radiological, industrial hygiene, and industrial safety requirements will be presented in the affiliated Hazardous Work Permit (HWP). Note that the HWP includes all the safety requirements, including all of the radiological controls, and thus will be used in lieu of the Radiation Work Permit (RWP).

The work plan and HWP will be reviewed during morning toolbox meetings. As D&D operations continue the need for work plan and/or HWP revisions may become necessary. In addition, "lessons learned" will also be included in work planning and toolbox meetings as the D&D operations progress. As always, the Robins AFB Project Manager and Radiation Safety Officer have a standing invitation to all work planning activities. Furthermore, the team will entertain any recommendations and/or comments relative to the work plans and HWPs.

The paramount item associated with the planned D&D operations is that all associated personnel have "Stop Work" authority in the event of the identification of safety concern. Said work will commence only after safety concern is addressed, minimized, and/or mitigated as necessary.

4.4.1 Decontamination/Decommissioning Work Tasks Description

It is anticipated that the contaminated concrete Building 181 Cells 5 and 6 will mainly be decontaminated with the Pentek Squirrel and Moose scabbling units. These scabbling units are an industry standard and will be operated by decontamination technicians and/or lead abatement personnel that are trained in their use. These scabbling units are equipped with HEPA filtration thus nearly eliminating the generation of airborne particulates. However, personal, work area, and environmental air sampling will be deployed for all aggressive D&D operations. In addition, the work areas will be controlled so to prevent the inadvertent entry of non-project personnel. The scabbling units will remove roughly 1/16 to 1/8 inches of concrete per pass. The scabbling passes will continue until radiological survey results are \leq to the DCGL (2,570 dpm/100 cm²). In addition, other less aggressive and feasible decontamination methods may be used if appropriate (e.g., scraping, brushing, sanding, wiping, etc.).

The floors of Cells 5 and 6 will be decontaminated to remove any radiological contamination in excess of the DCGL. The floors will be decontaminated using scabbling and/or other less aggressive and feasible techniques. The floors will subsequently be surveyed under FSS Class 1 requirements.

The Cells 5 and 6 walls will be decontaminated to remove both Lead Based Paint (LBP) and/or radiological contamination. This work scope is being subcontracted to winter Environmental of Norcross, GA. Winter Environmental is licensed by the State of Georgia for lead and asbestos abatement operations. Any radiological contamination in excess of the DCGL on the walls will be decontaminated using scabbling and/or other less aggressive and feasible techniques. The walls are separated into two survey unit types being walls up to two meters from floor (FSS Class 2) and the remaining walls above two meters to the ceiling (FSS Class 3).

The LBP on the Cells 5 and 6 ceilings must be remediated. Surveys will determine if there is any radiological contamination in excess of the DCGL. Any such contaminated areas will be decontaminated using an appropriate method such needle guns, scraping, brushing, sanding, wiping, etc. No or very small amounts of contamination is anticipated on the ceilings and as such they are considered as FSS Class 3 survey unit types.

The majority of the roof surface associated with Cells 5 and 6 will be surveyed under FSS Class 3 specifications. The roof ducts and adjacent roof surface will be surveyed under FSS Class 1 criteria. No or very small amounts of contamination is anticipated on the majority of the roof (i.e., not adjacent to roof vents). The survey process will determine if there is any contamination in excess of the DCGL. Any such contaminated areas will be decontaminated and/or removed using an appropriate method(s).

All HVAC equipment and affiliated ductwork will, initially, undergo scoping/work control surveys will to ascertain and prescribe the appropriate radiological and industrial hygiene controls. Ultimately the HVAC equipment and ductwork will be surveyed under FSS Class 1 specifications. Ductwork surveys will consist of both exposed exterior surface areas as well as all accessible interior surfaces. If necessary, coupon samples may be obtained to accurately ascertain the ductwork radiological conditions. Any contaminated ductwork will be remediated by removing specific offending sections or even removing entire ductwork systems. If the initial/scoping survey results indicate the presence of contamination, the Waste Manager and the appropriate Robins AFB personnel may opt to totally remove all HVAC equipment/ductwork as an economically feasible alternative.

4.4.2 Hazardous Work Permit

When decommissioning tasks are evaluated using IWCP a determination is made whether a Hazardous Work Permit (HWP) is required to supplement the Activity Hazard Analysis. A HWP fulfills the requirement for a Radiation Work Permit (RWP). The HWP includes protective requirements for hazards in addition to radiation. A copy of the HWP procedure is included in *Appendix A, Additional Procedures*.

HWPs are developed jointly by the SSHO, RSO, HPT, and other project personnel as part of the IWCP. The hazards are analyzed and controls to mitigate the hazards are determined. The HPT then is responsible to prepare the HWP.

The HWP is reviewed and approved by the SSHO and the RSO. The HWP then becomes part of the work controlling documents and supports the Integrated Work Document which is approved by the Decontamination Manager.

Personnel shall not deviate from the requirements, precautions, or other instructions on the HWP. If changes are necessary, the HWP shall be revised to reflect the changed condition before work on that HWP may proceed. A copy of the HWP shall be posted at the work site. The original shall remain at a central location (Safety and Health Office). Associated support documents containing environmental conditions (soil activities, contamination surveys, etc.) shall be maintained by the RSO and be available upon request.

Prior to entry into the area governed by the HWP, all personnel working under an HWP must:

- Satisfy medical and training requirements as established in the Integrated Work Document.
- Be adequately briefed by the RSO regarding the work to be performed and the associated HWP requirements and the safety procedures to be followed for its completion.

4.5 Worker and Environmental Monitoring

Worker safety, health, and radiation protection monitoring is discussed in detail in the Radiation Safety Plan, which is part of Attachment 4. Steps to protect the environment and environmental monitoring for radioactivity are discussed in this section. Controls will be enacted to prevent airborne releases and waterborne contamination. Air monitoring will be performed outside the building. External radiation exposure rates inside the building are already low, such that no radiation monitoring external to the building is necessary.

The objective of the decontamination is to remove radioactivity from interior building surfaces before demolition to prevent insult to the environment. The decontamination of surfaces will be performed indoors which will minimize the potential for airborne releases to the environment. Air monitoring for gross alpha and gross beta radiation on airborne particulates will be performed inside the building for worker protection purposes. This monitoring will consist of general air monitoring with stationary pumps operating at approximately 40 to 60 liters per minute (LPM). This monitoring will characterize the general area conditions inside the building. Selected workers will also wear breathing zone air monitors (BZ) with filters affixed at approximately shoulder height. These BZ monitors will operate at approximately five to ten LPM with the air filters analyzed for gross alpha and beta radiation. Results of this interior air monitoring will be compared to the Derived Air Concentration for Lung Absorption Class Y U-238. DU is primarily U-238. The indoor air monitoring will be used to determine whether respiratory protection is required and will be used for DAC-hour tracking in lieu of bioassay if workers may receive an internal committed effective dose equivalent of 500 mrem.

Environmental air will be monitored at strategic locations that would best represent worst case outdoor airborne conditions. Monitoring will be performed with stationary pumps set inside weather enclosures. These monitors will operate for an entire work shift at approximately 40 to 60 LPM. This will draw sufficient air to allow a minimum detection level of 10% of the 10CFR20, Appendix B, Table 2 airborne effluent limit of 6E-14 uCi/mL of air. The likely monitoring locations will be immediately outside the building bay doors. These doors will be left open because high airborne environmental releases are not likely and to minimize the build-up of

airborne radioactivity inside the work area to help maintain worker exposures ALARA. If outdoor air monitoring finds concentrations exceed 6E-15 uCi/mL, the bay doors will be closed.

Contamination of water will be prevented by plugging drains inside the building during decontamination. If water runoff inside the building can get outside the building, then containment pigs will be placed at the doorways to prevent this.

5.0 Final Status Survey Plan

Following the decontamination of the radiologically contaminated areas of Building 181 as delineated in this document, AAR shall perform a MARSSIM FSS on the floor and walls of Cell 5, Cell 6, and the doorway leading from Cell 6 into Room 3A.

The floor and wall areas that are decontaminated will be scanned using the large area gas flow proportional detectors described in Section 2.3.3. Timed direct one minute measurements will be made using the 100 cm² alpha/beta detectors also described in Section 2.3.3. The gamma radiation background will be measured inside Cells 1 through 4 because they have similar construction materials and have been found to not be contaminated. No statistical testing will be performed as all measurement results will be required to be less than the DCGL.

A FSS will also be performed on the soil underneath cells 5 and 6 once the building is demolished by the USAF demolition contractor. There is little reason to suspect to contamination migration through a five to six-foot-thick concrete slab. Therefore, in-situ scanning results with a Field Instrument for Detecting Low Energy Radiation (FIDLER), will be compared to the reference background survey results. Systematic soil samples will be collected using the random coordinate starting point along with triangular based spacing. In addition, biased soil samples will be collected for areas that indicate gamma levels in excess of twice the reference background gamma levels. The reference background gamma and soil samples will be collected from a non-impacted and similar soil area at Robins AFB. The results at the background area will be compared to the results from the area under Cells 5 and 6 using the Wilcoxon Rank Sum Test. The Final Status Survey Design checklist from NUREG – 1757, Vol. 1, Rev 2 is shown in *Table 20* along with reference to the section of this plan that fulfills the checklist requirement.

Table 20. Final Status Survey Design				
Checklist Item	Plan Reference Section			
A brief overview describing the final status survey design.	5.0 and 5.1			
A description and map or drawing of impacted areas of the	Figures 4 and 5,			
site, area, or building classified by residual radioactivity levels	Section 5.1			
(Class 1, 2, or 3) and divided into Survey Units with an				
explanation of the basis for division of Survey Units.				
A description of the background reference areas and materials,	Section 5.0 for building			
if they will be used, and a justification for their selection.	material			
	Section 5.2.2 for soil			
A summary of the statistical tests that will be used to evaluate	Section 5.0 for building			
the survey results.	surfaces,			
	Section 5.2.2 for soil			
A description of scanning instruments, methods, calculations,	Sections 2.3 and 2.4 for			
operational checks, coverage, and sensitivity for each media	building surfaces,			
and radionuclide.	Section 5.2.1 for soil			
For in-situ sample measurements made by field instruments, a	Sections 2.3 and 2.4 for			
description of the instruments, calibration, operational checks,	building surfaces,			
sensitivity, and sampling methods, with a demonstration that	Section 5.2.1 for soil			
the instrumentation and methods have adequate sensitivity.				

Table 20. Final Status Survey Des	ign
Checklist Item	Plan Reference Section
A description of the analytical instruments for measuring	Section 5.2
samples in the laboratory, as well as calibration, sensitivity,	
and methods with a demonstration that the instruments and	
methods have adequate sensitivity.	
A description of how samples to be analyzed in the laboratory	Section 5.2
will be collected, controlled, and handled.	
A description of the final status survey investigation levels	Section 5.0 for building
and how they will be determined.	surfaces,
	Section 5.2.1 for soil
A summary of any significant additional residual radioactivity	Not applicable
that was not accounted for during site characterization.	
A summary of direct measurement results and/or soil	Section 5.1 for building
concentration levels in units that are comparable to the DCGL,	surfaces,
and if data is used to estimate or update the Survey Unit.	Section 5.2.1 for soil
A summary of the direct measurements or sample data used to	Section 5.0 for building
both evaluate the success of remediation and to estimate the	surfaces,
Survey Unit variance.	Section 5.2.2 for soil

5.1. Final Status Survey Plan for Building 181

The lower walls of Cell 5 and the Floors and Walls, both above and below two meters of Cell 6 will both be considered as MARSSIM Class 1 Survey Units. These areas had radioactive contamination that exceeded the DCGL. Drawings of Cells 5 and of Cell 6 are shown *of Figures 5 and 6*, respectively. These drawings show the results of the baseline survey and are also shown in a larger format in Attachment 2.

The entire lower wall of Cell 5 (all four walls) is considered one Survey Unit. It has a surface area less than 100 m², the MARSSIM upper limit for the size of a Class 1 Survey Unit. The upper walls and ceiling of Cell 5, which were not surveyed during the Baseline Survey, will be surveyed as a single Class 3 survey Unit. The floor of Cell 5, which requires no decontamination, will be considered a MARSSIM Class 3 area following decontamination of the walls in Cell 5. This will be done to assure that no contamination was spread from the walls to the floor during decontamination. The probability of this is considered remote, because the walls in Cell 5 did not have contamination in excess of the DCGL. The entire floor will be a single Survey Unit. If contamination is found on the floor, the floor will be upgraded to a Class 1 Survey Unit and scanned 100%.

The trench in Cells 5 and 6 had water in it and the trench was not surveyed during the Baseline Survey. The water will be removed during the decontamination of Cells 5 and 6. This trench will then be surveyed as a MARSSIM Class 2 area as originally planned.

The eastern room floor of Cell 6, labeled 6B1 in Figure 6, will be a single Class 1 Survey Unit. The western room, Room 6A1 is approximately 130 m² and will be two Class 1 Survey Units. The other Survey Units will be as follows:

• Walls below 2 m, Room 6A1.

- Walls below 2 m, Room 6B1,
- Walls above 2 m, Room 6A1, and
- Walls above 2 m, Room 6B1

The ceilings and overhead structure of Cell 6, except the pipe chase have already been shown, in Section 3, to meet the DCGL. No further survey shall be required of these areas, other than large area wipes taken with masslin cloths to demonstrate no removable contamination has occurred during the decontamination process. The walls of both Cell 5 and 6 are being cleaned of lead-based paint and because the walls had detectable contamination above the MDA, the removed paint will be disposed as low level radioactive waste, or possibly as a mixed low level radioactive waste pending the outcome of waste characterization.

The roof vents and surrounding roof area, Room 3A, Cell 4, and concrete apron outside of Cell 6, were either not surveyed or were not surveyed sufficiently during the Baseline Survey. The roof vents and roof area surrounding the vents were mistakenly omitted during the Baseline Survey. These will be considered a MARSSIM class 1 area because of potential for contamination. Room 3A will be resurveyed as a MARSSIM Class 1 area once the doorway between Cell 6 and Room 3A have been decontaminated. Cell 4 requires two additional m² to be resurveyed to meet the minimum MARSSIM coverage requirement for a Class 3 area. The concrete apron outside Cell 6 requires 11 more systematic measurements to complete this Class 3 area. The areas to be surveyed inside Building 181 during the FSS and their MARSSIM classification are summarized in *Table* 21.

Table 21. Building 18	81 MARSSIM Final	Status Survey Plan Summary
Building Area	MARSSIM	Rationale
	Survey Class	
Cell 5, all four lower walls	Class 1	LBP has detectable radioactivity and are
below 2 m		being decontaminated for the lead.
Cell 5, floor	Class 3	Surveyed to demonstrate it is not re-
		contaminated during LBP removal on
		walls and ceilings.
Cell 5 and 6, trench	Class 2	Had water in it and could not be surveyed
		during Baseline Survey.
Cell 5 and 6, Soil beneath	Class 3	Exposed soil footprint will be surveyed
floors		after USAF D&D contractors remove
		floors of Cells 5 & 6.
Cell 5, walls above 2 m and	Class 3	Could not be surveyed during the
ceiling		Baseline Survey because of peeling
		paint.
Cell 6, Room 6B1, floor	Class 1	This floor was covered with tile and the
		concrete underneath was not
		contaminated. However, the walls are
		contaminated and require
		decontamination. The floor will be
		resurveyed to prove that they have not

Table 21. Building 18	81 MARSSIM Fina	l Status Survey Plan Summary
		become contaminated as a result of the wall decontamination.
Cell 6, Room 6A1, floor	Two Class 1 Survey Units	Floor is contaminated above DCGL.
Cell 6, Room 6A1, walls below 2 m	Class 1	Wall is contaminated above DCGL.
Cell 6, Room 6A1, walls above 2 m	Class 1	Wall is contaminated above DCGL.
Cell 6, Room 6B1, walls below 2 m	Class 1	Wall is contaminated above DCGL.
Cell 6, Room 6B1, walls above 2 m	Class 1	Wall is contaminated above DCGL.
Roof vents and surround roof area above Cells 5 and 6	Class 1	Exhaust air from the cells could have contaminated these locations.
Room 3A, floor	Class 1	Doorway between Room 3A and Cell 6 is contaminated above DCGL. Entire room will be resurveyed to be thorough.
Cell 4, floor	Class 3	Two additional m ² require survey to meet survey design minimum coverage.
Concrete apron on west side of Cell 6	Class 3	Insufficient systematic measurements were performed during Baseline Survey.

Survey design, methods, and approach will be similar to those used during the Baseline Survey and as already described in Section 2.0 of this Decommissioning Plan. The changes to the approach are:

- Survey results will not be divided by two as an ALARA measure. Most building surfaces already are well less than the DCGL over the majority of the surface area that is planned for decontamination. It is the LBP that causes widespread removal of material from the walls and ceilings of Cells 5 and 6. Building decontamination methods will effectively remove most all contamination to levels that approach or equal background.
- During the FSS, 2 pi source efficiency as recommended by MARSSIM will be used.

Decontamination of radioactivity, in areas where this is required, shall be considered complete when contamination measurement results show that radioactivity levels are less than the DCGL.

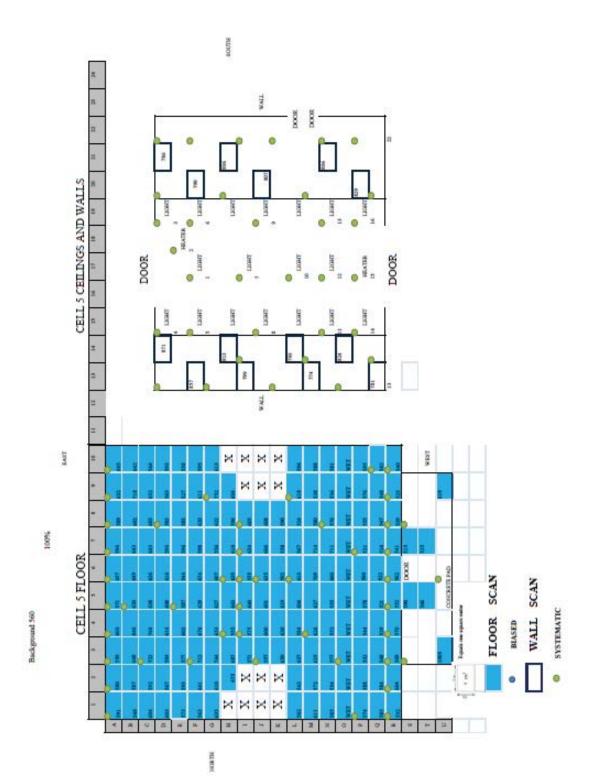


Figure 5. Drawing of Cell 5

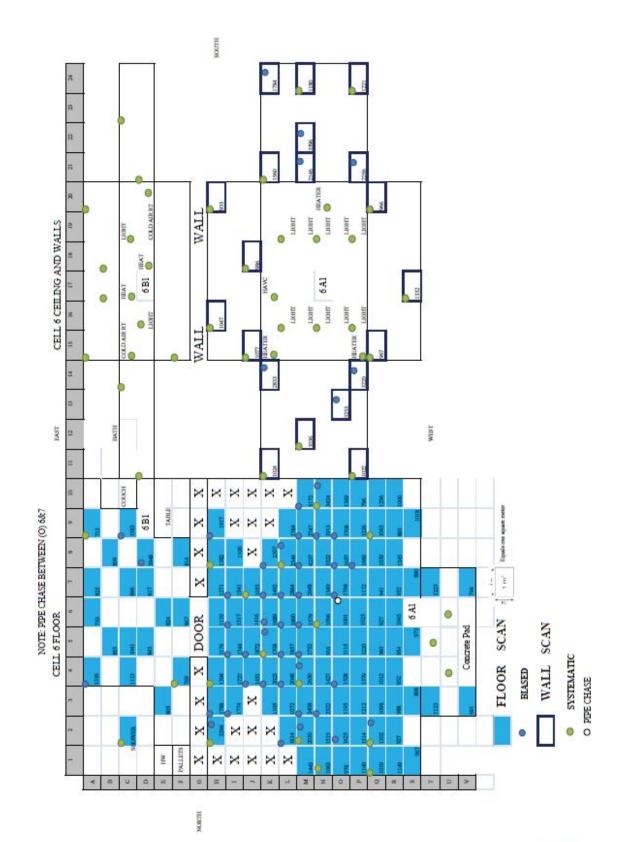


Figure 6. Drawing of Cell 6

5.2. Final Status Survey Plan for Soil under Cells 5 and 6

This section describes the survey methods and the survey deign. The contamination within the Building 181 is relatively light. It is not anticipated that the soil under Cells 5 and 6 will be contaminated. Thus, the entire area will be considered a MARSSIM Class 3 area. The area will be treated as a single Survey Unit.

A DCGL has been derived and the method is detailed in Attachment 2. A surrogate DCGL of 4.6 pCi/g for U-238 will be used. When the concentration of U-238 is less than the DCGL this assures that the TEDE will be less than 25 mrem/y when the amounts of U-234 and U-235 are considered.

5.2.1 Survey Methods

A number of field activities will be conducted as part of this effort. The principle activities include:

- Gamma Walk-Over Surveys (GWSs),
- Biased Sampling, and
- Systematic Sampling

Gamma Walkover Survey (GWS)

GWS data will be collected using a Field Instrument for Detecting Low Energy Radiation (FIDLER) because of the low energy gamma emissions from U-238 and daughters. The GWS will be conducted to provide complete, 100 percent coverage of exposed soil surfaces in the footprint of the excavated cells, with a data density of, on average, at least one measurement per square meter. All GWS data will be electronically logged. Coordinate quality on the x, y plane will include sub-meter accuracy. Areas that are inaccessible due to terrain or standing water will be clearly demarcated on a map.

The GWS will be performed with a global position system (GPS) capable of recording a survey measurement and a paired position approximately every second. The GPS will be capable of submeter accuracy (x, y data). The GWS will be used to determine if there are areas of gamma count rate different than background. If such locations are found, a decision will be made during the conduct of the survey to collect a biased sample. There will be no need to upgrade the Survey Unit if potential contamination is suspected because 100 percent of the Survey Unit is already planned to be scanned.

The GWS will be performed by a technician traversing areas on foot at a rate approximately 0.5 meters per second carrying a backpack mounted GPS and the detectors. Data will be presented graphically and in electronic table form. The data at a minimum will contain counts per minute (cpm), northing and easting (x, y), and dilution of precision (PDOP), date, and time.

The MDA for uranium at a scan speed of 0.5 m/s is 60 pCi/g (Reference: Phase 1 Decommissioning Plan for the West Valley Demonstration Project, Revision 1; May 2011; prepared by Argonne National Laboratory for the U.S. Department of Energy; approved by the US NRC). This MDA is considerably higher than the DCGL. Therefore, the gamma scan will serve as a qualitative evaluation of whether there are any significantly above-background gamma levels in the area when compared to the reference background GWS results. In this manner, gamma levels in excess of twice the reference area background levels will require a biased soil sample. The soil sample results

will be compared to the 4.6 pCi/g DCGL. The soil sample collection and analysis will be relied upon to evaluate the condition of the soil under the slab.

Sample Collection and Analysis

Samples will be collected using hand trowels or a hand auger. Samples will be collected in 15 cm depth increments from ground surface to 15 cm below ground surface. Samples will be mixed in a stainless-steel bowl and packaged in 500 or 1000 g plastic jars.

Systematic samples will be collected using a random start triangular grid. The purpose of systematic samples is to determine an unbiased average concentration to be compared to natural background determined by collecting samples in a background reference area. The spacing of systematic samples will be dependent on the number of samples required and the size of the Survey Unit. Previous experience when collecting samples shows that the variability in the data will be low as the soil concentration approaches background. Therefore, 18 samples will be collected; nine from the Survey Unit and nine from a background reference area (see below).

Biased samples may also be collected depending on the results of the GWS. The number of such biased samples, if any, will be determined by the AAR Site Radiation Safety Officer.

Samples will be sent to ARS DOD ELAP accredited laboratory in Port Allen, Louisiana. Chain of Custody will be documented on forms supplied by the laboratory. Samples will be in the custody of the sampler or stored in a locked location if left unattended.

Samples will be analyzed by alpha spectroscopy for U-238 and U-234. A comparison of the U-238 to U-234 ratio will prove useful to help determine whether any uranium detected in naturally occurring or depleted. If the uranium appears naturally occurring, this will help with an evaluation of whether low level concentrations are natural background.

5.2.2 Survey Design

The goal of the soil FSS is to demonstrate that the soil underneath Cells 5 and 6 is not different than natural background. This will be done by collecting an equal number of samples from the Survey Unit and from a background reference location. The sample analytical results will be compared using the Wilcoxon Rank Sum Test as discussed in MARSSIM.

Type 1 and Type 2 error rates are established at 0.05 for both. Given that the soil underneath the cells is not expected to be contaminated, then the variability in the data (standard deviation) is expected to be relatively low; approximately 0.1 pCi/g. Natural background for uranium typically ranges from 0.5 to 2 pCi/g with a typical average of 1.0 pCi/g. The difference between typical background of 1.0 pCi/g and the typical lower bound of background of 0.5 pCi/g results in a value of the relative shift (delta) of 0.5 pCi/g. The value of delta over sigma would then be 5. Given Type 1 and Type 2 error rates of 0.05, the number of samples required per MARSSIM Table 5.3 is 18. Nine samples are required in the Survey Unit and nine samples are required in the background reference area.

5.2.3 Background Reference Area

A location at Robins AFB will be selected in consultation with USAF Robins' personnel. The reference area will be at a location that has not been impacted by work with radioactive material. The soil type and geology of the reference area will be the same as that found underneath Building 181.

5.2.4 Decontamination Support and FSS Quality Assurance

Instruments will be calibrated according to ANSI N323A-1997. Survey instruments and methods specified in applicable AAR operating and technical procedures have been documented as to their ability to provide a 95% confidence level in detection of surface contamination at levels, which meet the requirements of FSS plan.

Instruments shall undergo daily quality control background and source checks prior use to assure they are operating within $\pm 20\%$ of their calibrated intrinsic efficiencies. All check sources will be traceable to the NIST. All instrument source and background check results will be reviewed by the project AAR Radiation Safety Office. All instrument calibration reports, source certificates, source/background checks will be retained as well as attached to the FSS final report. RCTs will verify that instruments have passed their daily source and background checks prior to their use. In addition, supporting instrument data is provided on each survey form.

QA duplicate static measurements, smears, and soil samples will be performed on ten percent of all FSS measurements. The QA duplicate measurements and smears will be performed by a different RCT using different an instrument. The instruments will be identical in model but have different serial numbers. QA soil samples will be collected and packaged by a different RCT. QA duplicate results shall show reasonable agreement with original results (i.e., within 20%).

All soil samples will be affiliated with a Chain of Custody for appropriate shipment to the ARS laboratory in Port Allen, LA for subsequent preparation and analysis. All soil sample analyses will be performed by ARS laboratory personnel in accordance with their applicable AAR operating and technical procedures.

During actual operations, the AAR Corporate RSO will also review FSS documentation during an unannounced site project assessment or as requested. In addition, the corporate RSO will also review and evaluate all FSS information in support of FSS Final Report generation.

6.0 References

ANL, 2001	User's Manual for RESRAD Version 6, Environmental Assessment Division, Argonne National Laboratory, ANL/EAD-4, July 2001.
ANL, 2003	User's Manual for RESRAD-Build Version 3, Environmental Assessment Division, Argonne National Laboratory, ANL/EAD/03-1, June 2003.
NRC, 2006	Consolidated Decommissioning Guidance, Decommissioning Process for Materials Licenses, NUREG-1757, Vol. 1, Rev 2, September 2006.

ATTACHMENT 2

Photograph Log

Geosyntec^D

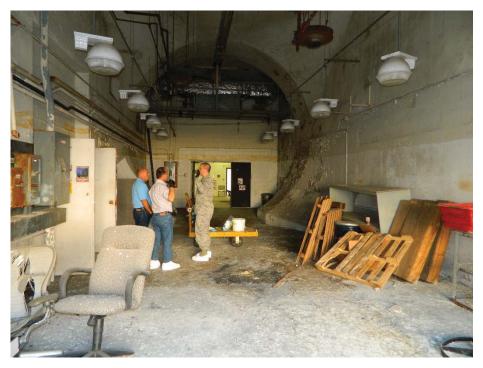
consultants

PHOTOGRAPH LOG

PROJECT NAME:	Final Status Survey Report for Building 181	PROJECT NO.: GW0082
CLIENT:	Robins Air Force Base, Georgia	FILE NAME: Building 181_Photolog.pptx



Photograph 1: View of Building 181 looking north/northwest.



Photograph 2: Room 6A1 of Cell 6 looking east toward doorway into Room 6B1. Doorway to Room 3A on left side.

Geosyntec consultants

PHOTOGRAPH LOG

PROJECT NAME: Final Status Survey Report for Building 181 PROJECT NO.: GW0082



Photograph 3: Paint peeling on wall inside Cell 6 (typical of conditions observed in other cells of Building 181).



Photograph 4: Room 6A1 following removal of lead-based paint.

Geosyntec^D

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PHOTOGRAPH LOG

PROJECT NAME: Final Status Survey Report for Building 187	PROJECT NO.: GW0082
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Photograph 5; Low-level radioactive waste (LLRW) storage shed outside Cell 5.



Photograph 6: Application of paint stripper in Cell 5.

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PHOTOGRAPH LOG

PROJECT NAME: Final Status Survey Report for Building 187	PROJECT NO.: GW0082
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Photograph 7: Arrangement of HVAC supply and return in Room 6B1.



Photograph 8: HVAC at east end of Room 6A1.

Geosyntec^D

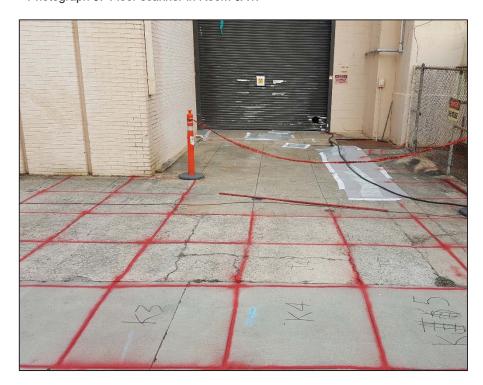
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PHOTOGRAPH LOG

PROJECT NAME: Final Status Survey Report for Building 181 PROJECT NO.: GW0082



Photograph 9: Floor scanner in Room 6A1.



Photograph 10: Expanded survey grid in the concrete apron area at the west entrance to Cell 6 (prior to decontamination).

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PROJECT NAME:	Final Status Survey Report for Building 181	PROJECT NO.: GW0082



Photograph 11: Static measurement with LM43-93 probe.



Photograph 12: Static measurement from a lift.

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PROJECT NAME: Final Status Survey Report for Building 181 PROJECT NO.: GW0082



Photograph 13: Static measurements in Cell 5.



Photograph 14: Floor scanning in Cell 5.

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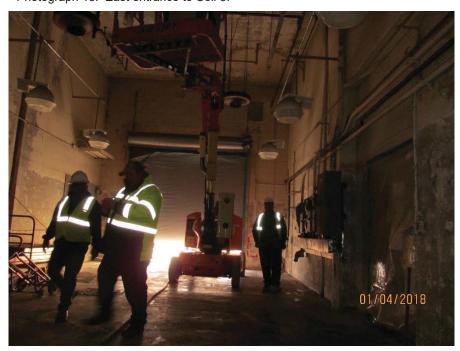
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PROJECT NAME:	Final Status Survey Report for Building 181	PROJECT NO.: GW0082
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Photograph 15: East entrance to Cell 5.

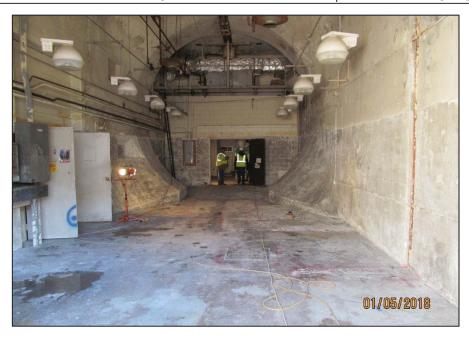


Photograph 16: Decontamination using a lift.

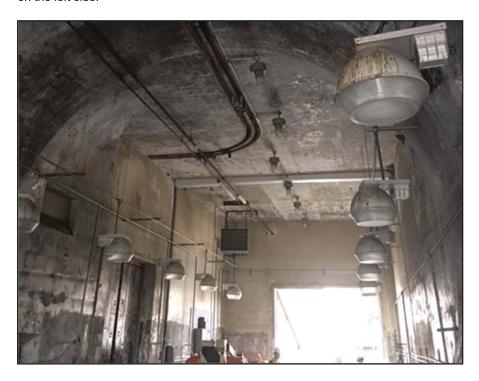
Geosyntec consultants

PHOTOGRAPH LOG

PROJECT NAME: Final Status Survey Report for Building 181 PROJECT NO.: GW0082



Photograph 17: Room 6A1 after decontamination. The doorway to Room 3A is on the left side.



Photograph 18: Cell 5 after decontamination.

Geosyntec consultants

PHOTOGRAPH LOG

PROJECT NAME:	Final Status Survey Report for Building 181	PROJECT NO.: GW0082
CLIENT:	Robins Air Force Base, Georgia	FILE NAME: Building 181_Photolog.pptx



Photograph 19: Powered ventilation stack lying on roof of Cell 6.



Photograph 20: Measurement of large area wipe (LAW) in Room 6A1.

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PROJECT NAME: Fina	al Status Survey Report for Building 181	PROJECT NO.: GW0082
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Photograph 21: Floor of Cell 5 covered with plastic during decontamination of walls.



Photograph 22: Shower in the bathroom of Room 6B1.

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PHOTOGRAPH LOG

PROJECT NAME:	Final Status Survey Report for Building 181	PROJECT NO.: GW0082
CLIENT:	Robins Air Force Base, Georgia	FILE NAME: Building 181 Photolog.pptx



Photograph 23: Coupons were cut from HVAC ducts in Cell 6 to assess potential internal contamination.



Photograph 24: Surveying the pipe chase at the east end of Cell 6.

Geosyntec^D

consultants

PHOTOGRAPH LOG

PROJECT NAME:	Final Status Survey Report for Building 181	PROJECT NO.: GW0082
CLIENT:	Robins Air Force Base, Georgia	FILE NAME: Building 181_Photolog.pptx



Photograph 25: East entrance to Room 6B1. Note, east exit of the pipe chase below the AC Unit.



Photograph 26: Electrical Vault outside the west entrance of Cell 6.

ATTACHMENT 3

Waste Disposal Certifications (Not Available As of Date of This Report)

ATTACHMENT 4

Building 181 Final Status Survey Results (Survey Sheets)

Survey Unit FC-1

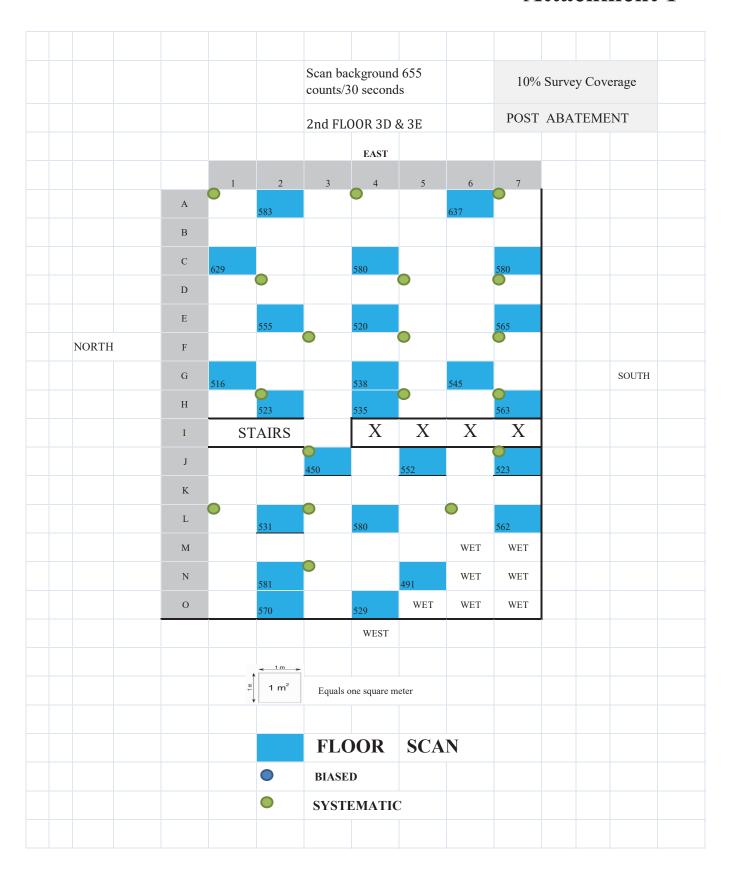
Second	ARS Aleut Remediation Robins AFB Building 181		_	#MM+	HWP# 02-181			ĕ	Room: Cell 4		Tage.	Survey Unit	Survey Ur	Survey Unit & Type: 1 m2 grids	m2 grids		Page of 1	- 19jett.	Page of 1 of 1	11	
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Survey Unit FC-2

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Comments		Surveyed By:	; <u>,</u>	Date:	=	Instrument	Ser	Serial #	Cal. Due	Probe	Area	Serial#	Cal. Due	α Eff.	β Eff.	α Bkg. β (cpm) (c	S C G Gpm) (t	Sample B Count C Time T	BKG Count Time (min)
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	Comments	ents	Survey	Surveyed By:	Date:		Instrument	8	Serial #	Cal. Due	Probe	Area	Serial #	Cal. Due	β Surface Eff.	β Bkg. β Source (counts Eff. per 30 s	β Bkg. (counts per 30 s)	β MDA dpm/ 100cm²	BKG Coun Time (min)	BKG Count Time (min)
			TIMOT	ТІМОТНУ БОИТТ	11/13/15	2	2221/43-37-1	(r)	308088	10/21/2016	43-47-1	100	PR149172	10/21/2016	0.5	0.3316	655	1473		0.5
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Arthur Desrosiers CHP

Signature:

Survey Unit FSS-1B

Controller Con	Robins AFB Building 181			HWP#	02-181		CEIL 5				Survey L	Jnit & Type: 5	Survey Unit & Type: Systematic grid			P	Page of 1 of 1	1.	
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Signature: Arthur Desrosiers CHP

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										FSS-1B	18				FSS scan			-	-	-	
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Signature	::	Artnur Desrosiers CHP	Srusiers	ŝ																	

	Robins AFB Building 181	lding 181		HWP#	P# 02-181	181		~	Room: CEL	L 5 LOWE	CELL 5 LOWER EAST WALL		Survey U	VALL Survey Unit & Type: 1 m2 grids	1 m2 grids			a	Page of 2 of 3	f3	
Company Comp										_	SS-1B				FSS scan						
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MANI- Inclusion Continue Mani- Inclusion	Col	mments	Surve	yed By:	: HINTED 12/2	Date:	트	strument		Serial #	Cal. Due	Probe	Area	Serial #		2 pi α e ff.	7		b Bkg. counts	(min)	
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Arthur Desrosiers CHP

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Arthur Desrosiers CHP

Signature:

Survey Unit FSS-3A

		#MM	02-181		CE	CELL 5 LIGHTS				Survey Ur	it & Type: 5	Survey Unit & Type: Systematic grid	_		Pe	Page of 1 of 1		
			FSS-3A	3A		OVER	HEAD HA	OVERHEAD HANGING LIGHTS				FSS systematics						
Commonte	Javarany		Date:	<u>*</u>	net riment		#	ei G	do	Area	7. 	ei d	, ic	oni Roff	α Bkg.	β Bkg.		Sample Count Time
surf. eff. = 25% alpha; 50% beta	Thon	nas Hun	Thomas Hunter 1-26-18		2929	190602	+	12/6/2018	43-10-1	100	PR199159		ì	1	2	1051	10	
BMDA (total) <= 1285 dpm total				23	2360/43-93	274959	+	11/17/2018	43-93	100	PR337817	4/17/2018	0.3314 #N/A	0.3662 #N/A	19	4515	10	
ווקט (בנד – א ניסטון אסואון	Review: CBP 1/26/18	1/26/:	81										A/N#	W/N#				
Smears		-	Direc	Direct Frisk			+						#N/A	#N/A				
Gross Counts	DPM/100cm ²	H	ross Coun	DPM/100cm ²	Jcm²		\dashv			' light fi	xtures; ta	Scan 7 light fixtures; take a static & smear at highest scan locations	& smea	r at high	st scan	ocations		
No. α β α α	30	-	α β	α	β	IIGHTC		Location #	# "							Droho	VUN	A MIDA
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Comments Surveyed By: Day Surveyed By: Carus	Date: r 12-20-17 r 12-20-17 CBP 12/21/17 CBP 12/21/17 Gross Counts α β α α β α α α α α α α α α α α α α α α	Instrument 2929 2360/43-89 2360/43-89 PPM/100cm² a B		FSS-3A			FSS scan			-			
Comments Surveyed By: Impo (total) <= 128 dpm total		Mda /					_	_		-	_	-	
Urf. eff. = 25% alpha; 50% beta Surveyed by: Thomas Hunt MNDA (total) <= 1205 dpm total Faviewed By: Thomas Hunt MNDA (total) <= 1205 dpm total SMDA (total) <= 1205 dpm total Reviewed By: Reviewed			-		-					α Bkg.	β Bkg.	BKG Count Time	Sample Count Time
MDA (total) <= 1285 dpm total		/WI	190602		43-10-1			17	7	counts 5	1074	10 10	(min) 3
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1 3.25 -1 3 4 4 5 4 <td></td> <td>12 -439</td> <td>N/A</td> <td>NUW V3</td> <td></td> <td>Б</td> <td>apm/100 cm⁻.</td> <td></td> <td></td> <td></td> <td>43-89</td> <td>/1</td> <td>414</td>		12 -439	N/A	NUW V3		Б	apm/100 cm ⁻ .				43-89	/1	414
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Survey Unit FSS-3B

	Robins AFB Building 181		HWP#	02-181		2	Room: Cell 5 Ceiling	iling FSS-3B		S	Survey Unit	Survey Unit & Type: Class 3	ass 3 FSS scan		Page of 1	P,	Page of 1 of 1	.1	
Throat Properties (2-20-2)	ments	Allivious		Date		- mem	100		e	Proper	6014	Serial ##	Cal Die	n c	2 ni R off	α Bkg.	β Bkg.	BKG Count Time	Sampl Count Time
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Signature: Arthur Desrosiers CHP

Surveyed By: Date: Surveyed By: Surveyed By: By: BMDA (loose) <= 129 dpm total Review. GBP 1/27/18		CELL 3		S	urvey Unit	Survey Unit & Type: 1 m2 grids	S			Page of 1 of 1	ot 1	
Comments Surveyed By: Date: MDA (total) <= 128% alpha; 50% beta	<u>.</u>		FSS-3B			FSS systematic	matic			-		
MDA (tocse) <= 128% alpha; 50% beta a Thomas Hunter 1/26/18 MDA (tocse) <= 129 dpm total a Thomas Hunter 1/26/18 Smears Gross Counts DPM/100cm² Gross Counts a B a a a B a a a B a a a B a a a B a		3								β Bkg.	BKG Count Time	Sample Count Time
MDA (total) <= 1285 dpm total Review. CBP 1/27/18 Review. C	1929 2929	190602	12/6/2018	43-10-1	100 I	PR199159 12/6/2018	7	0.6933 0.5749	m. counts	1051	10	(min) 1
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Signature: Arthur Desrosiers CHP

Survey Unit FSS-4

			HWP#	02-181	1			Room: CEL	L 6B1 INS	Room: CELL 6B1 INSIDE BATHROOM AREA	OM AREA	IROOM AREA Survey Unit	Unit & Type	Survey Unit & Type: 1 m2 grids				Page of 1 of 1	f 1	
					FSS 4									FSS scan						
Comments		uns	Surveved Bv:	sv: Date:		٤	Instrument		Serial#	Cal. Due	Probe	Area	Serial #	Cal. Due	2 pi a eff.	f. 2 bi B eff.	α Bkg.	β Bkg. counts	BKG Count Time (min)	Sample Count Time (min)
surf. eff. = 25% alpha; 50% beta	0% beta	Pat	ul Fletch	r 1/			2929		185266	12/6/2018	43-10-1	Н	PR194717	Н	-	-	-	972	10	
BMDA (total) <= 1285 dpm total BMDA (loose) <= 129 dpm total	pm total	Tho	mas Hu	inter 1/8/18		25	2360/43-93		274959	11/17/2018	43-93	100	PR293983	33 11/17/2018	.8 0.4367 8 0.3774	4	8 -	4702	10	1
		Rei	viewed	Reviewed CBP 1-9-18		í				111111111111111111111111111111111111111	Ш	H		-	Н		Ш			
Smears	rs				Direct Frisk	isk		43-37 Scan	can						#IN/H	Y/N#				
Gross Coun	DPM/100cm ²	cm²		Gross Counts	nts	DPM/100cm ²	0cm²	1 m²	2			Scan v	vith LM4.	Scan with LM43-37 - take a static and a smear at center of each grid elemen	a static a	nd a sm	ear at ce	inter of ea	ch grid	eleme
	ğ	β	,	+	β	α	8 2	30 Sec. Count	onut	Loca	Location #							-44	4 4 4 4	6
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0	5-	36			909	139	523	N/A		ď	FB 1									
0	-5	10		+	616	84	561	N/A		ď	FB 2									
25 0 321	-5	36	25	+	629	130	804	N/A			FB 3									
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Control Cont	Public Color Publ	ARS /	ARS Aleut Remediation	diation									Radiological Survey Form	Survey Fo	rm		8	Robins AFB Project: WR0082	Project: \	WR0082		
Second Control Contr	Since were Different Present Piece Prese	Robin	IS AFB Bu	ilding 181	I	WP# 0.	2-181			Room		LAB		Survey	Unit & Type:	1 M2 GRIDS			Pe	age of 1 of	1	
Control Cont	Control Cont										_	FSS-4			_	FSS scan	_		_	_	-	-
Note Continue Part Par	Authority Control Co		8	mments	Surveyed	By:	Date:		Instru	ment	Serial #				Serial #				α Bkg. counts			Sample Count Time (min)
Automotive Particle Particl	Manual Report Part	ns	·f. eff. = 25	5% alpha; 50% beta		as Hunter	1-22-18		29	29	190602				PR19915				4	940	10	
State Continue C	Secretary Secr	νg	IDA (total)) <= 1285 dpm total		Fletcher	1-22-18		2360,	43-93	274959	\vdash			PR33781.	H			7	4577	10	1
Secretary Constraint Cons	STATE STAT	ď	IIDA (100st	e) <= 129 apm total		PW: CBP	1-23-18										#\N/# #\N/A	#N/A #N/A				
State Continue C	Continue																#N/A	#N/A				
Constitution	Constitution			Smears		_	Ď	rect Frisk			13-37 Scan											
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	181	1	HWD#	02-181			R	Room: Cell 681 Floor	ululugicai	Kadiological Survey Form	rm Survey Uni	rm Survey Unit & Tyne: 1 m2 grids	m2 oride	Z S S S S S S S S S S S S S S S S S S S	70 77 27	NODIIIS AFB PTOJECE: WANDOZ	Page of 14 of 2	
									FSS-4		62.00		Cell 6B1			9		
Comments	nen ts	Surve	Surveyed By:	Da	Date:	<u> </u>	Instrument	Serial #	Cal. Due	Probe	Area	Serial #	Cal. Due 2 pi	2 pi α e ff. 2 pi	α l	α Bkg. βE	BKG Count β Bkg. Time counts (min)	BKG Sample Count Count Time Time (min) (min)
surf. eff. = 25% alpha; 50% beta	Ipha; 50% beta	T.	Thomas Hunter 1/17/18	er 1/17/18			2929	190602	-				1/6/2018			H		H
βMDA (total) <= 1285 dpm total	1285 dpm total		Paul Fletcher 1-17-18	r 1-17-18		25	2360/43-93	274959	\rightarrow	4	寸	PR293983 #	_			17 43	_	10
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	rs				Direct Frisk	risk		43-37 Scan	ľ		:	- 0	-		•			١.
Gross C	Gross Counts DPM/1	DPM/100cm ²		Gross Counts	ounts	DPM/100cm ²	0cm²	1m²	4 200	Kescan W	ith an Li	VI43-93 -	таке а сп	Rescan With an LIVI43-93 - take a direct frisk and a smear at nignest spots	and a si	mear at	nignest	pots
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	181	1	HWD#	02-181			R	Room: Cell 681 Floor	ululugicai	Kadiological Survey Form	rm Survey Uni	rm Survey Unit & Tyne: 1 m2 grids	m2 oride	Z S S S S S S S S S S S S S S S S S S S	70 77 27	NODIIIS AFB PTOJECE: WANDOZ	Page of 14 of 2	
									FSS-4		62.00		Cell 6B1			9		
Comments	nen ts	Surve	Surveyed By:	Da	Date:	<u> </u>	Instrument	Serial #	Cal. Due	Probe	Area	Serial #	Cal. Due 2 pi	2 pi α e ff. 2 pi	α l	α Bkg. βE	BKG Count β Bkg. Time counts (min)	BKG Sample Count Count Time Time (min) (min)
surf. eff. = 25% alpha; 50% beta	Ipha; 50% beta	T.	Thomas Hunter 1/17/18	er 1/17/18			2929	190602	-				1/6/2018			H		H
βMDA (total) <= 1285 dpm total	1285 dpm total		Paul Fletcher 1-17-18	r 1-17-18		25	2360/43-93	274959	\rightarrow	4	寸	PR293983 #	_			17 43	_	10
βMDA (loose) <	= 129 dpm total		o foo foo			23	2360/43-37	287606	#######	43-37	100	PR278379 #	#######	15	17	43 90	9031 1	10
		Keview: CBP 1/24/18	1/24/18											#N/A #N/A #N	#N/A #N/A			-
	rs				Direct Frisk	risk		43-37 Scan	ľ		:		-		•			١.
Gross C	Gross Counts DPM/1	DPM/100cm ²		Gross Counts	ounts	DPM/100cm ²	0cm²	1m²	4 200	Kescan W	ith an Li	VI43-93 -	таке а сп	Rescan With an LIVI43-93 - take a direct frisk and a smear at nignest spots	and a si	mear at	nignest	pots
1	99		1	d m	528	12	370	909	A1							Pre	Probe a MDA	DA B MDA
2																43-	43-10-1	13
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16 0	327 -2		16	3	484	12	200	687	C4						-			1
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Survey Unit FSS-5

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Arthur Desrosiers CHP

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Arthur Desrosiers CHP

Signature:

ARS Aleut Remediation				Radio	II Su	vey Form				obins AFE	Robins AFB Project: WR0082	WR0082		
Robins AFB Building 181	HWP# 02-181	Room:		CELL 6B1 INSIDE BATHROOM AREA		urvey Unit	& Type: SY	Survey Unit & Type: SYSTEMATIC SURVEYS	:VEYS		Ä	Page of 1 of 1	1	
			_	FSS-5		-	FS	FSS systematics	-		-	-	ŀ	
											α Bkg.	β Bkg.	BKG Count Time	Sample Count Time
Comments	Sur	Instrument	Serial #	Cal. Due	Probe		Serial #			2 piβeff.	counts	counts	(min)	(min)
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βMDA (loose) <= 129 dpm total		00-04/0007	0000	0102/11/11	3	t	2000	0102/11/11	#N/A	#N/A			2	1
	Reviewed By: CBP 1-24-18								#N/A	#N/A				
									#N/A	#N/A				
Gross Counts DP	DPM/100cm ² Gross Counts	DIRECT FIISK DPM/100cm²	43-37 Scan	Systematic points UW & LW inside the bathroom	points UV	/ & LW	nside the	bathroom						
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Signed: Arthur Desrosiers CHP



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Survey Unit FSS-6

Comments surf. eff. = 25% alpha; 50% beta	> I	HWP# 02-181	181		Ro	Room: Cell 6B1 FSS Ceiling	FSS Ceiling		Survey L	Init & Type: 0	Survey Unit & Type: CEILING AND VENTS	ENTS		Pag	Page of 1 of 1		
Comments surf. eff. = 25% alpha; 50% beta			FSS-6	9-						,	Ceiling survey FSS	S					
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Comments Surveyed By:	■ × 1:	ARS Aleut Remediation	ediation		<u>:</u>	:						Radic		vey Forr	u I	:	Š.	bins AFB	Robins AFB Project: WR0082	VR0082		
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	Sample Count Time	3	0.5					в МВА	299	730																													
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Page of 1 of 1	β Bkg.	866	9572			Directs		Probe	43-93	43-37	•																												
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	o i a o ft		0.3774	#N/A	#IN/A	Smears			as perform	on 1-25-18	accessible		L-25-18 at t	suit. ad on 1-11-	ent, except	was collect																							
2 grids	FSS scan		11/17/2018						of 13 and 13 w	he 43-93 probe	ation was not	be on 1-11-18	was taken on I	ignest stall re s were collects	the grid eleme	smear, which	can location.																						
Survey Unit & Type: 1 m2 grids	, in a second	+	PR293983						Note 1 The scan survey of I3 and I3 was performed	by hand using the 43-93 probe on 1-25-18	because the location was not accessible	to the 43-37 probe on 1-11-18.	I ne direct frisk was taken on 1-25-18 at the	Ocation of the ingliest scall result. All of the smears were collected on 1-11-18	at the center of the grid element, except for	the "E5 biased" smear, which was collected	at the highest scan location.																						
survey Uni	Area	100	100			RESCAN:						Ψ,				-	to																						
S	Prohe	43-10-1	43-37				# u																						pa										
6B1 NORTH WALL UPPER Survey Unit		12/6/2018	11/17/2018				Location #	A3	A5	B3	B4	B5	T 5	3 8	D3	D4	D5	E 2	2 2	EE	F4	F5	63	‡ F	H3	H4	HS	<u> </u>	E5 biased										
B1 NORTH W	Serial #	+	253275	\vdash	43-37 Scan	1 m²	30 Sec. Count	512	545	537	292	009	569	575	471	577	292	500	634	493	565	532	534	580	579	584	573	Note 1	N/A										
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Robins AFB Building 181	mon	surf. eff. = 25% alpha; 50% beta	BMDA (total) <= 1285 dpm total BMDA (loose) <= 129 dpm total		Sme	Gross Counts	В	345	339	249	309	303	300	381	267	276	321	330	285	261	357	270	303	309	324	303	315	315	110					\downarrow					
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Color Colo	ARS Aleut Remediation	iation									Radiolc	Radiological Survey Form	6				Robins AF	B Project	Robins AFB Project: WR0082		
Control Cont	Robins AFB Bui	lding 181			HWP#				2	oom: CELL 6B1 S	SOUTH W	'ALL UPPER		Unit & Typ	ne: 1 m2 gr	ids			Page of 1A	of 2	
Control Court Co							FSS-6								FSS resc	E .				BKG	Sample
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Arthur Desrosiers CHP

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Signature: Arthur Desrosiers CHP

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Signed: Arthur Desrosiers CHP

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Signature: Arthur Desrosiers CHP



Survey Unit FSS-7A

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Surf. eff. = 25% alpha; 50% beta David Davis 1-10-18 βMDA (total) <= 1295 dpm total David Davis 1-10-18 βMDA (total) <= 1295 dpm total David Davis 1-10-18 βMDA (total) <= 1295 dpm total David Davis 1-10-18 βMDA (total) <= 1295 dpm total David Davis 1-10-18 Reviewed: CBP 1/15/18 Reviewed: CBP 1/15/18 Reviewed: CBP 1/15/18 Direct Reviewed: CBP 1/15/18 Di	17A Instrument 2929 2360/43-99 2360/43-89 2360/43-89 2360/43-89 α β β β β β β β β β β β β β β β β β β	Serial # 190602 190602 274959 274959 190602 310179 43.37 Scan 1 m² 1 m	Cal. Due Probe Area Serial # Cal. Due 2 pi α e fit ######## 43-0.1 100 PR199159 ######## 0.6933 ######## 13.00 PR29383 ###################################	Area Serial 100 PR19 100 PR29 100 PR29 100 PR19 125 PR39	Area Serial# Cal. Due is 100 PR199193 #################################		α Bkg. counts 5 8 8 27 4 4 12	BKG. Tim Counts (min 998 11 4398 11 1135 10 1135 10 4328 11 4328 11 4328 11 2329 α 43-37 α 43-37 α 43-37 α 43-39 α 43-39 α 43-39 α 43-89 α	DA A DA A DA A DA DA DA DA DA DA DA DA D	Sample Count Time (min) 3 3 1 1 1 1 1 779 290 771 84 368
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Survey Unit FSS-7B

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Arthur Desrosiers CHP



Survey Unit FSS-8

Comments surf. eff. = 25% alpha; 50% beta ßMDA (total) <= 1285 dpm total		# 100	02-181			Room: 6A1EA	ST AND	WEST LOWE	6A1 EAST AND WEST LOWER WALLS Survey Unit	Survey Un	Survey Unit & Type: 1 m2 grids	m2 grids			_	Page of 1 of 1	1	
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surf. eff. = 25% alpha; 50% beta BMDA (total) <= 1285 dpm total	Surveyed By:	D.	Date		Instrument		Serial#	Cal. Due	Probe	Area	Serial #	Cal. Due	2 ni a e ff.	2 ni 8 eff	α Bkg.	β Bkg.	BKG Count Time (min)	Sample Count Time
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		2	HWP# 02	02-181		R	Room: CELL 6	5 A1 SOU	CELL 6 A1 SOUTH LOWER WALL	VALL	Survey U	Survey Unit & Type: 1 m2 grids	1 m2 grids			4	Page of 1 of 1	1	
								ш	FSS-8				FSS scan						
																α Bkg.	β Bkg.	BKG Count Time	Sample Count Time
Comments surf. eff. = 25% alpha: 50% beta	S	Surveyed By: Paul Fletcher	r 1-1	Date: 1-11-18	Ĕ	Instrument 2929	Se 19	Serial # 190602	Cal. Due 12/6/2018	Probe 43-10-1	Area 100	Serial # PR199159	Cal. Due 12/6/2018	2 pi α e ff. 0.6933	2 pi β eff. 0.5749	counts	counts 1064	(min) 10	(min)
βMDA (total) <= 1285 dpm total		1/	l ò l		23	2360/43-93	27	\vdash	11/17/2018	43-93	100	PR293983	\vdash	0.4367	Ш		4539	10	1
βMDA (loose) <= 129 dpm total		pawai	Reviewed By: CRD 1/18/18	18/18	23	2360/43-37	25	253275	11/17/2018	43-37	100	PR278380	11/17/2018	0.3774 #N/A	#N/A	23	8988	10	0.5
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Gross Counts	DPM/100cm ²	7	Gross	Gross Counts	DPM/100cm ²	Jcm²	1 m²		300	an with L	.M43-37	- take a c	Scan with LIVI43-37 - take a direct static and a smear at center of grid elemetns	and a si	mear at	center o	grid elei	netns	
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Robi	1s AFB Bu	Robins AFB Building 181		HWP#		02-181		Room:	1: Cell 6 A WALLS		Survey Uni	Survey U	Survey Unit & Type: 1 m2 grids	m2 grids			Page of 1	Page of 1 of 1	of 1	
)								ADDITIONAL STATICS				FSS-8				•		
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SL	rf. eff. = 2	surf. eff. = 25% alpha; 50% beta	ก็	Camille Par	Camille Patrick 3/1/18	7/18	Í	2929	190602	12/6/2018	43-10-1	100	PR199159	12/6/2018	0.6933	0.5749		37	1	
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Signature: Arthur Desrosiers CHP

Survey Unit FSS-9

Serial # Cal. Due	Comparison Com	Surveyed By: Pate: Room: 6A1 UPPER EAST WALL	L Survey Unit & Type: 1 m2 grids Date of 1 c	Page of 1 of 1	
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Mathematics Mathematics	Control Cont	MANA (cutation Carrow Countries) Sample Carrow Countries Sample		α Bkg.	BKG Count Time
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Mark Mark	Control Cont	March Construction Constructio	190602 12/6/2018	100 PRISSISS 12/6/2018 0.0933 0.5/49 2	10
Control Cont	Continue Continue	Secretary Control	253275 11/17/2018	100 PR293983 4/11/2018 0.4367 0.5194 16 10 PR278380 11/17/2018 0.3774 0.4203 53	10
Second County County County County Cou	Constraint Con	Streams		A/N# A/N#	2
Continue Symptom Continue	Signature Sign	Constraint Con			
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0 234 -1 5 6 8 374 KB 462 AA 1 239 1 -13 7 N/R N/R N/R 557 B4 1 261 1 -33 8 4 300 13 -206 643 E4 1 233 1 -64 9 3 520 13 202 643 E4 1 233 1 -64 9 3 520 13 202 E4 1 -19 10 NR N/R N/R N/R N/R 12 14 <td< td=""><td>0 2244 -1 -5 6 8 374 597 A47 1 254 -1 -5 6 8 374 N/R N/R 897 B44 1 253 -1 -5 9 3 520 -208 643 E4 1 233 -1 -6 9 3 520 -208 643 E4 1 233 -1 -1 10 10 R 331 -202 643 E4 1 233 -1 -1 10 N/R N/R N/R 568 D4 1 23 -1 -1 11 N/R N/R</td></td<> <td>0 2244 -1 -5 6 8 374 59 -700 4622 A44 1 259 -1 -5 6 8 374 N/R N/R 897 B44 1 251 1 -33 8 30 -20 643 E4 1 233 1 -19 10 8 391 -20 643 E4 1 233 1 -19 10 8 391 -20 643 E4 1 233 1 -29 643 E4 E4 1 233 1 -20 20 B3 E4 1 233 1 N/R N/R N/R N/R D4 1</td> <td>-108 446</td> <td></td> <td>1001</td>	0 2244 -1 -5 6 8 374 597 A47 1 254 -1 -5 6 8 374 N/R N/R 897 B44 1 253 -1 -5 9 3 520 -208 643 E4 1 233 -1 -6 9 3 520 -208 643 E4 1 233 -1 -1 10 10 R 331 -202 643 E4 1 233 -1 -1 10 N/R N/R N/R 568 D4 1 23 -1 -1 11 N/R	0 2244 -1 -5 6 8 374 59 -700 4622 A44 1 259 -1 -5 6 8 374 N/R N/R 897 B44 1 251 1 -33 8 30 -20 643 E4 1 233 1 -19 10 8 391 -20 643 E4 1 233 1 -19 10 8 391 -20 643 E4 1 233 1 -29 643 E4 E4 1 233 1 -20 20 B3 E4 1 233 1 N/R N/R N/R N/R D4 1	-108 446		1001
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		#MD#	HWP# 02-181			Room: 6A1	1		Survey Unit 8	Survey Un	it & Type: S	Survey Unit & Type: Systematic grid	-		Page of 1 of	Page of 1 of 1		
			FSS	FSS-9 Ceiling							ı.	FSS ceiling scans	S		_		03.0	
Comments	Surveyed By:	Š	Date:		Instrument		Serial #	Cal Die	d d d d	Δ	Sorial #	Cal Due	2 ni a eff	2 ni 8 eff	α Bkg.	β Bkg.	BKG Count Time (min)	Sample Count Time (min)
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10	DPM/100cm ²	1	Gross Counts		DPM/100cm ²	1 m²	12	Scan 1	mz Judgn	nental Ic	cations -	Scan 1m2 judgmental locations - take a direct frisk and a smear at highest spot per grid	ect trisk	and a sn	near at h	ighest spo	ot per gr	g
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Page of 1 of 1			β Bkg.	counts	1042	100					Probe	43-10-1	43-93			•	1					San Partie	Second Second					•					No. of Street, or other Persons			A	T	+		The state of the s		900	The state of the s		-	1	THE PERSON NAMED IN
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6A1)			Serial #	190602	21433			43-37 Scan	30 Sec. Count	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A																							
Room: 6A1				ıt	60	20		ç	43	30.5																																					
				Instrument	2929	2300/43			74.002	DPINI/ 100cm		1 -426						7 -459						404																							L
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HWP# 02-181				ķ	Thomas Hunter 1-24-18		Review: CBP 1/24/18		Č	Gross		2			n -			m					2																								
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Signature: Arthur Desrosiers CHP

Robins AFB	Robins AFB Building 181		-	HWP#	02-181			Room: CELL	6A1 UPPI	CELL 6A1 UPPER NORTH WALL		Survey Un	Survey Unit & Type: 1 m2 grids	m2 grids				Page of 1 of 1	1	
					FS	FSS-9								FSS scan			-			
				: -	ć				1	3	4			3	1 1		α Bkg.	β Bkg.	BKG Count Time	Sample Count Time
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Arthur Desrosiers CHP

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6A1 East Upper Wall			Serial #	190602	310179				Grid	20	C4 P4	E4	F4																												
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Reviewed: Arthur Desrosiers CHP



Controlled Con	Surveyed By: 10% beta Camille Patri pm total Review: AE 15 15 15 15 15 15 15 15 15 15 15 15 15	الذة ال					()	Rescan of	grids					
Control Cont	Comments Surveyed By: Urf. eff. = 25% alpha; 50% beta Camille Patri MDA (total) <= 1285 dpm total Review: AE Smears Smears Camille Patri Smears Smears Smears Camille Patri Smears Smears Smears Camille Patri	Date: /31/18												
According Continue Comments	./31/18										β Bkg.		Sample Count Time	
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Second Registration Second Registration	Sobins AFB BL	Robins AFB Building 181		HWP#		02-181			Room:		CELL 6A1 UPPER SOUTH WALL	4 WALL	Survey L	Survey Unit & Type: 1 m2 grids	1 m2 grids			Põ	Page of 1 of 1	1	
Control Cont														Post	LBP abatement	survey					
March Composition Control Contro																				BKG Count	Sample Count
	Ū	omments	Survey	ed By:		Date:	=	nstrume	int	Serial #	Cal. Due	Probe		Serial #				α Bkg. counts	β Bkg. counts	Time (min)	Time (min)
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Survey Unit FSS-10

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Arthur Desrosiers CHP

Survey Unit FSS-11

Comments Surf. eff. = 25% alpha; 50% beta BMDA (total) <= 1285 dpm total BMDA (loose) <= 129 dpm total Blased Smears Gross Counts Gross Counts DPM/100cm²	¥	ı							Nadiological 3di vey 101111					-	ייסטווא ייסלקין אורסססד	1	
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TOT SUIT OF THE TOTAL	181		HWP#	# 02-181				Room: 3A	3A FLOOR			Survey U	Survey Unit & Type: 1 m2 grids	1 m2 grids			_	Page of 1 of 1	of 1	
					FSS-11				1	FSS-11				FSS floor scan						
Comments	v	Survey	Surveved Bv:		Date:	_	Instrument		Serial #	Cal. Due	Probe	Area	Serial #		2 pj a e ff.	f. 2 biß eff.	α Bkg.	β Bkg.	BKG Count Time (min)	Sample Count Time (min)
surf. eff. = 25% alpha; 50% beta	a; 50% beta		David D	David Davis 1-3-18			2929		190602	12/6/2018	43-10-1	100	PR199159	Н	\mathbb{H}			П	10	
BMDA (total) <= 1285 dpm total BMDA (loose) <= 129 dpm total	S dpm total	4	aul Fle	Paul Fletcher 1-3-18	8	,7	2360/43-89		310164	4/17/2018	43-89	125	PR337817	4/17/2018	0.3314	5 0.3562	7 1	4651	10	0.5
		Re	viewed	Reviewed: CBP 1/8/18	18	2	2360/43-93		274959	11/17/2018	43-93	100	PR293983	+	\perp		,,	4320	10	
			 -												#N/A	#N/A				
Sm Gross Counts	Smears ts DPM/100cm ²	00cm²		Gross Counts	Direct Frisk ounts D	Frisk DPM/100cm ²	00cm²	43-37 Scan 1 m²		Complete scan and a	scan and	a 1 min	ute re-co	1 minute re-count of each grid over MDA	grid ove	er MDA				
No. α β			H	α	β	α	β	30 Sec. Count		Location #	# uo									
1		-54		2	400	8	-123		80	FA2	2							Probe	α MDA	В
	e-	-33		2	422	3	-39		7	FA3	33		Note: direct	Note: direct frisk was performed with the LM43-93	ormed with	:he LM43-93		2929	15	83
0		-82	\perp	9	481	39	189		7	FA4	4		probe					43-89	57	338
4 0 303 5 1 300		-3/	4 7	7 8	41/	17	84-	409		FB1	1 2							43-37	8/	988
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1		2		2	460	m	108		80	FB4	4									
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9 2 372	1	43	9	8	485	58	204		0	FC2	2									
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3		-45		9	492	39	231		6	FF2	2									
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No. column Column	Instrument Serial # 2929 190602 2929 190602 2920 190602 2920 190602 2920 2920 2920 2920 2920 2920 2920	Probe 43-10-1 43-89 43-89 43-89 43-89 43-89 53-8 53-8 54 53-8 54 53-8 54 53-8 54 53-8 54 53-8 54 53-8 54 53-8 54 53-8 54 54 54 55-8 55-8 55-8 55-8 55-8 55-	Serial # PR199159 PR337815 PR3378 PR3378 PR3378 PR3378 PR3378 PR3378 PR3378 PR3378 PR3378 PR3378 PR337	2 pi a e ff. 2 0.6933 0.3126 #N/A #N/A #N/A	α B/g. counts 1 16 16	BKG S Count Time (min) 10 10 α MDA 24 75
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Survey Unit FSS-12

Companies Comp	Robins AFB Building 181	11		HWP# 02-181			Room:	Roof over Cells 5 and 6	ells 5 and 6	6 Survey Unit	Survey Un	Survey Unit & Type: Systematic grid	stematic grid			Ь	Page of 2 of 2	f 2	
March Marc					FSS-				nears Only				FSS-12						
Cut Cut																		BKG	Sample
Muth math	Comments		Surveyed		te:	Instrum	ient	Serial #	Cal. Due	Probe	Area	Serial #	Cal. Due	2 pi a e ff.		α Bkg. counts	β Bkg. counts	Time (min)	Time (min)
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Continue Continue	BMDA (total) <= 1285 RMDA (loose) <= 129	dpm total												A/N#	#N/A #N/A				
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1 11 c 1 c	Smc Gross Counts)cm²	Gross Count	Direct Fr	isk DPM/100cm ²	4	1-37 Scan	Smears										
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Arthur Desrosiers CHP

02-181 RC	8	<u>R</u>		Room: Roof over o	Roof over cells 5 and 6		Survey Un	Survey Unit & Type: 1 m2 grids FSS LM 43-93 scan	Yype: 1 m2 grids FSS LM 43-93 scan and statics	tatics		<u></u>	Page of 1 of 1	BKG Sample Count
111	Date:	 	Instrument	Serial #		Probe	Area	-				α Bkg. counts	β Bkg. counts	Count Time (min)
2	Paul Fletcher 12/14/17	25	2929	190602	12/6/2018	43-10-1	100	PR199159	12/6/2018	0.6933	0.3662	1 2	122 499	1 1
										#N/A	#N/A			
Review: CBP 12/19/17										#N/A */\/*	#N/A #N/A			
	Direct Frisk	Frisk		43-37 Scan						V /> #	C/NI#			
_	Gross Counts	DPM/100cm ²	0cm²	1 m²	93-93 used to scan all acessible areas.	d to scan a	all acessi	ble areas.		-	-	_	-	-
8	β 300	α 27	1030	30 Sec. Count	Location #	ation #							Drobo	VUM
		-36	-1049	N/A		77							2929	44
	10 305		-1060	N/A	Σ	M2							43-93	162
	5 294	0 48	-1120	N/A	× 2	K3	27							
		9 0	-1065	N/A	¥	K4	The second second	1	The last of the la					
		-36	-1103	N/A	_	14	1	はたため				4		
	1 292		-1131	N/A	M	M4						1		
			9/1-	N/A	S	C2				* 1	1			
	8 304	36	-1065	N/A	O L	2 2	Ż	W.			7			
	9 293		-328	N/A	<u>.</u>	62						100		
			-1049	N/A	9	G4	×							
	7 318		686-	N/A	13	3			Line S					
	11 344		-847	N/A	J1	1								
	7 317	24	-994	N/A	JS	J5 D2						4.		
		,,	-841	N/A	- ~	R5								
			-634	N/A	R5 drain	drain								
		72	-1212	N/A	O2 AC unit	C unit			1			ne.		
	6 231	12	-1464	N/A	P3 AC unit	P3 AC unit						te de		
			-1425	N/A	Q2 AC unit	Cunit								
	9 286	48	-1163	N/A	Q3 AC unit	C unit								
			-1202	N/A	L3 vent stack	t stack					Man -			
			-1136	N/A	L3 ven	L3 vent stack								
	32 328	326	1001	N/A	L3 ven	L3 vent stack	2							
	17 277		-1212	A/N	L3 vent stack	t stack					-			
								Note: the smear MDA is too high. The smear survey was repeated	MDA is too h	igh. The sm	ear survey w	vas repeate	pe	
								and recorded separately. The initial smear data are presented here	parately. The	initial smea	r data are pı	resented he	ere	
								in order to present a complete record. The 43-93 was used for	ent a complete	e record. Th	e 43-93 was	nsed for		
								scans due to the location of the survey. The statics and smears	location of th	າe survey. Tł	ne statics an	d smears		
								were taken at the location of the highest scan reading.	ne location of	the highest s	can reading			
ı														

Arthur Desrosiers CHP

Survey Unit FSS-13

Second Biochest Second Bio	Since of the control of the contro	ARS Aleut Remediation Robins AFB Building 181	ding 181		HWP#	# 02-181			RC	Room: 6A1			Survey Unit	urvey Unit	t & Type: Sy	Survey Unit & Type: Systematic grid		Page of 1	a d	Page of 1 of 1	f1	
Control Cont	Control Cont						FSS-13				PRE DEC	ON HVAC				FSS						
Commontion Com	Control Cont																				BKG Count	Sample Count
March Marc	MANY MANY	ځ	ıments	Surveya	Pd Bv.	Dat	<u>.</u>	Š	trument	Seria		Cal Due	Prohe	Area	Serial #	Cal Due		2 ni R eff.	α Bkg.	β Bkg.	Time (min)	Time (min)
MANA Local Control	Constraint Con	surf. eff. = 255	6 alpha; 50% beta	The	omas H	unter 1-24-18			2929	1906		2/6/2018	43-10-1	100	PR199159	12/6/2018		0.5749	1	1042	10	1
Secretary Part Pa	Constraint Con	BMDA (total)	<= 1285 dpm total	Pē	aul Flet	tcher 1-24-18		23	60/43-93	3101	+	/17/2018	43-89	125	PR337815	4/17/2018	0.3126 #N/A	0.3249 #N/A	16	3999	10	1
Constraints Constraints	Simple S	associated and	ייי באלי מאווי נסומו	Re	view:	CBP 1/29/18											#N/A	#N/A				
1	Continue Continue																#N/A	#N/A				
Column C	1	Gross Co	nears	/100cm²		Gross Count	Direct Fr	isk DPM/100)cm²	43-37 Scan 1 m²		Scan	HVAC equ	ipment	with LM	43-89; tak	e statics,	smears	or LAW	s as appl	opriate	
1 1 1 1 2 2 2 2 2 2	1 1 1 1 1 1 1 1 1 1			β		α	_	σ	β	30 Sec. Count		Location	#1									
1 1 2 2 2 2 2 2 2 2	1 1 1 1 2 2 2 2 2 2	1			1		16	9-	572	N/A		HEATER	1							Probe	α MDA	βМDА
1 1 2 1 2 2 2 2 2 2	10 10 10 10 10 10 10 10	2			2		35	14	999	N/A		HEATER	1							43-10-1	24	133
11	10 10 10 10 10 10 10 10	m '			e .		116	9 ;	572	A/N		HEATER	2							43-89	75	354
110 1	10 11 12 13 14 15 15 15 15 15 15 15	4			4	+	35	14	999	N/A		HEATER	7									
10 10 10 10 10 10 10 10	100 110 1 20 392 16 339 N/A 45CREN 101 11 20 9 18 66 188 1310 N/A HVACIN O/H chase 102 104 1.1 1.1 1.1 1.2 1.1 2.5 1.1 2.5 1.1 2.5 1.1 2.5 1.1 2.5 1.1 2.5 1.1 2.5 1.1 2.5 2.4 N/A HVACIN O/H chase 101 1.1 1.1 1.1 1.1 2.4 1.6 6.48 4.5 1.2 1.2 N/A HVACIN O/H chase 101 1.1 1.1 2.4 1.6 6.48 4.5 1.2 1.2 N/A HVACIN O/H chase 101 1.1 2.4 1.6 6.48 4.5 1.2 1.2 N/A HVACIN O/H chase 101 1.1 2.4 1.6 6.48 4.5 1.2 1.2 N/A HVACIN O/H chase 101 1.1 2.4 1.6 6.48 4.5 1.2 1.2 N/A HVACIN O/H chase 102 1.1 2.4	2			9 0		172	45	3802	N/A		FAN ON HE		PACE HEAT	FRS REMOVE	D AND DISPOS	ED AS LLRW					
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0 110 -1, 2 10 18 666 188 1331 N/A HVAC in O/H chase HVAC decontaminated 2 152 11 2 2 260 35 247 N/A HVAC in O/H chase 0 1 13 13 2 2 267 N/A HVAC in O/H chase 0 1 13 13 2 2 267 N/A HVAC in O/H chase 0 1 13 13 2 2 267 N/A HVAC in O/H chase 0 1 13 13 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	0 110 -1, 20 9 18 666 186 11310 N/A HVAC.In.O/H chase PVAC decontaminated 2 150 -1, 10 10 622 88 1231 N/A HVAC.In.O/H chase PVAC.In.O/H ch	8			∞		41	-16	202	N/A		4" COND	UIT									
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Arthur Desrosiers CHP

Serial # Cal Due			HWP#	02-181			Room:	m: Cell 6B1				Survey U	nit & Type: C	Survey Unit & Type: CEILING AND VENTS	ENTS			Page of 1 of 1	f 1	
Continue Continue					FSS-13				FSS-13	3				HVAC						
Company Comp																			BKG Count	Sample Count
Auto-	Comments	Surveve	d Bv:	۵	ate:	Insti	ument	Serial #		je Pi	Probe	Area	Serial #	Cal. Due	2 pi a e ff.	2 piβeff.	α Bkg. counts	β Bkg. counts	Time (min)	Time (min)
Mary Mary Carlo surf. eff. = 25% alpha; 50% beta	1	om Hui	ntr 1-3-18		2	929	19060		318	43-10-1	100	PR199159	12/6/2018		0.5749		1041	10	3	
	BMDA (total) <= 1285 dpm total	Põ	ul Fletc	ther 1-3-18		236(0/43-89	31017	\dashv	018	43-89	100	PR337815	4/17/2018			24	4540	10	1
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11	10		10		345	-25	-537	N/A	W. e	and of N. du	ct vertical							4		
12	11		11		282	-14	-847	N/A	W. en	nd of N. duct	t horizontal									
13	12		12		264	-14	-936	N/A	ر	upper wall d	uct I/S	600								
14	13	1	13	1	204	-14	-1231	N/A		ower wall d	uct I/S									
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Arthur Desrosiers CHP

Comments surf. eff. = 25% alpha; 50% beta βMDA (total) <= 1285 dpm total βMDA (loose) <= 129 dpm total		HWP# 02-181	UZ-181			ν V O	Room: 6B1			Survey U	Survey Unit & Type: 1 mz grids	m2 grids			_	Page of 1 of 1	-	
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Comments surf. eff. = 25% alpha; 50% beta βMDA (total) <= 1285 dpm total βMDA (loose) <= 129 dpm total																	BKG Count	Sample Count
surf. eff. = 25% alpha; 50% beta BMDA (total) <= 1285 dpm total BMDA (loose) <= 129 dpm total	Surveyed By:	By:	ă	Date:	Insti	Instrument	Serial #	Cal. Due	Probe	Area	Serial #	Cal. Due	2 pi α e ff.	2 piβeff.	α Bkg. counts	β Bkg. counts	Time (min)	Time (min)
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Smears				Direct Frisk	ķ		43-37 Scan			'								
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Arthur Desrosiers CHP

Content of the cont	Comments Surveyed By: Date: Instrument Secial Cal. Due Probe Area	survey Offic & Type: EQUIPMENT	Page of 1 of 1
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		neaters were scanned with a 45-33. A direct frisk	TISK the
		highest scan reading.	
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Second Decision 1,12,13	Simple S	Robins AFB Building 181	H	HWP# 02-181	1		HVA	HVAC CELL 6A1			Survey Un	Survey Unit & Type: HVAC	/AC			4	Page of 1 of 1	1	
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	Robins AFB Building 181	1	HWP# 02-181				Room: Cell 6B1	6B1			Survey	Survey Unit & Type: CEILING AND VENTS	EILING AND V	ENTS			Page of 1 of 1	of 1	
Strong border Strong borde				FS	S-13				FSS-13				LAWS HVAC						
National Part																		BKG	Sample Count
	Comments	Surveyed	By:	Date:		Instrument		erial #	Cal. Due	Probe	Area	Serial #	Cal. Due	2 pi α e ff		α Bkg. counts	β Bkg. counts	Time (min)	Time (min)
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Column C	LAWS			Dir	ect Frisk		43-37 Sc	;an											
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Arthur Desrosiers CHP

Second S	Robins AFB	Robins AFB Building 181			HWP#	02-181			Room:	Room: Cell 6A1		Survey Unit	Survey U.	nit & Type: C	Survey Unit & Type: Coupon Samples from HVAC	s from HVA	VAC Page of 1	ď	Page of 1 of 1	1	
Control Cont											HVAC				FSS-13						
The continue of the continue		Comments		Survey	yed By:	Date		tool	ment	Serial #	Cal. Die	Probe	Δrea	Serial #	Cal. Due	2 ni a e ff.	2 ni B eff.	α Bkg.	β Bkg.		ample Count Time
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Constraint Con	BMDA (t	otal) <= 1285 o	ipm total		1/29/	2018		236	0/43-89	310170	4/17/2018	43-89	100	PR337820	4/17/2018	0.3283 #N/A	0.4149 #N/A	10	3834	10	
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Arthur Desrosiers CHP

Survey Unit FSS-14A

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erization	Sample locations listed		7	12/6/2018	+									NW corner																												
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nit & Type	8		Serial #	PR199159										Soil samp		11	111				*									1			Town or the last									
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ding 181			Comments	surt. eff. = 25% alpha; 50% beta BMDA (total) <= 1285 dpm total	βMDA (loose) <= 129 dpm total			Smears	β	93	109	118	114	120	106	95	89	96	128	88	107																					
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Arthur Desrosiers CHP

Signature:

Comments Surveyed By: surf. eff. = 25% alpha; 50% beta BMDA (tose) <= 128 dpm total BMDA (loose) <= 129 dpm total Review: AED 3-16-18 Smears Gross Counts DPM/100cm² G				ROL	Room: Outside Pad West of Cell 6	west of Cell 6		Survey Un	it & lype: 51	Survey Unit & Type: SYSTEMATICS			-	Page of 1 of 1	-	
St. Review					FSS-:	FSS-14A AND 14B			A	Additional data						
Review //100cm²	3	9	<u> </u>	***************************************	, co.	910	dodo	7,000	0. 2. 4.	ond F5	n i a off	Ho Bin C	α Bkg.	β Bkg.	BKG Count Time	Sample Count Time
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Survey Unit FSS-14B

Robins A	Robins AFB Building 181	1		HWP#	02-18			RC	Room: Outside	Cell 6 V	Outside Cell 6 West side Pad		Survey Un	Survey Unit & Type: 1 m2 grids	m2 grids			Pa	Page of 1 of 1	1	
					1	14 - B Survey unit	y unit			CLA	CLASS 3			Post	Post Decon FSS Survey	/ey					
																		α Bkg.	ß Bkg.	BKG Count Time	Sample Count Time
surf. et	Comments surf. eff. = 25% albha: 50% beta	50% beta	Surve	yed By	Surveyed By: Tom Hunter 1/29/18	Date:		Instrument 2929	Serial #		Cal. Due	Probe 43-10-1	Area 100	Serial # PR199159	Cal. Due 12/6/2018	2 pi α e ff. 0.6933	2 pi ß eff. 0.5749			(min)	(min)
BMDA	BMDA (total) <= 1285 dpm total	dpm total						2360/43-89	310170	++	4/17/2018	43-89	125	PR337820	4/17/2018	0.3283 #N/A	0.4149 #N/A	4	5015	10	
TO NO.	C7T (acool)	abili cotal	æ	Review: CBP	: CBP 1/29/18	8				H						#N/A	#N/A				
				F						+						#N/A	#N/A				
	Smears Gross Counts		DPM/100cm ²		Gross Counts	Direct Frisk ounts D	Frisk DPM/100cm ²	00cm²			Grids s	canned 1	0% with	า 43-89 pr	Grids scanned 10% with 43-89 probe; direct frisk and a smear at hot spot of each grid	t frisk an	d a smea	r at hot	spot of e	ach gri	75
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Arthur Desrosiers CHP

Signature:

Survey Unit FSS-QC

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Reviewed: Arthur Desrosiers CHP



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				OC.	QC of FSS - 14A									PSS-QC					BKG	Sample
																	i	i		Count
Comments	ents	Surveyed Bv:	Bv:	Date:		Inst	Instrument	Serial #		Cal. Due	Probe	Area	Serial #	Cal. Due	2 pi a e ff.	f. 2 piß eff.	α Bkg. counts	β Bkg. counts		Time (min)
surf. eff. = 25% alpha; 50% beta	pha; 50% beta	Christi	ne Hunte	Christine Hunter 1/29/18			2929	190602	\vdash	12/6/2018	43-10-1	100	PR199159	Н			\sqcup	866	10	1
βMDA (total) <= 1285 dpm total BMDA (loose) <= 129 dpm total	1285 dpm total					236	2360/43-93	234834	+	12/20/2018	43-93	100	PR312654	4/17/2018	0.4398 #N/A	8 0.4675 #N/A	9	3868	10	1
		Review: CBP 1/29/18	31/59/18	_											#N/A	#N/A				
	Smears		L		Direct Frisk		-		-						#N/A	#N/A				
Gross Counts	_	DPM/100cm ²	g	Gross Counts	_	DPM/100cm ²	:m²													
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Michigan Continue Nature Figal Section Continue Nature	MANA March	Comments		Survey			Date:		trument	Serial #		Probe			Cal. Due	2 ni a e ff.		α Bkg.	β Bkg.		Sample Count Time	
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Countrier Series 12/4/2018 Gald Ga						02-181		2	Dom: ROOF	OVERC	LISSAND6		Survey Un	nit & Type: O	C 10% VERIFIC	TION SUF	VEY	_	Page of 1 of 1	1	
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ATTACHMENT 5

Instrument Certifications and Daily Source Checks

Instrument Certifications

	\[\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		
Setting:	670 V	AT (120
FT % ERROR	AF 250:	250.1	% I
0.00%	AF 2500:	2501	% I
0.00%			
0.00%	AF 25K:	25.02 K	%
0.00%	AF 250K:	250.1 K	%
0.00%		Is the As	s Fo
0.00%			
0.00%			
0.00%		x.1 or x1	Sca
0.00%		x1 or x10	Sca
0.00%			
0.00%	x1	0 or x100	SCa
0.00%	x100	or x1000	Sca

120 mV pha: fficiences Alpha Back A-B XTLK ground: 2.97% 4.46% Pu-239: 3905 7.03% Tc-99: 22 2.31% Th-230: 6113 2.74% SrY-90: N/A ncy from "AF" in the AL E Efficiencies in t 5164.0 Are th 5163 Average: bration and the B-A Xtalk is <1% and the A-B Xtalk is <1 ortional probes = 1/8" from surface unless otherwise sp Source 2. Th-230

etponits

Setting:	825 v	AT	(120
FT % ERROR	AF 250:	251	%
0.00%			
0.00%	AF 2500:	2501	%
0.00%	AF 25K:	25.01 K	%
0.00%	AF 250K:	250.1 K	%
0.00%		Is the A	s Fo
0.00%			
0.00%			
0.00%		x.1 or x1	Sca
0.00%		x1 or x10	Sc
0.00%			
0.00%	x1(0 or x100	Sca
0.00%	x100	or x1000	Sca

cience	S A-B XTLK	Back	Alpha
55 3/583/25A3	9.07%	ground:	0
07%	9.0170	Pu-239:	4092
30%		Tc-99:	26
79%		Th-230:	5697
62%		SrY-90:	N/A
cy from			the AL Ef
4154	Average:	4126.0	Are the
ration and rtional pro	the B-A Xtalk is bes = 1/8" from s	<1% and the A- urface unless o	B Xtalk is <10 therwise spe
q	Source 2:	Pu-239	

120 mV

pomis

ha:

	AF V		
Setting:	790 v	AT (120
			•15.5
FT % ERROR	AF 250:	250.1	%
0.00%	AF 2500:	2501	%
0.00%	AF 2500.	2301	/0
0.00%	AF 25K:	25.01 K	%
0.00%	AF 250K:	250.1 K	%
0.00%		Is the As	Fo
0.00%			
0.00%			
0.00%		x.1 or x1	Sc
0.00%		x1 or x10	Sc
0.00%			
0.00%	- x1	0 or x100	Sc
0.00%	x100	or x1000	Sc

V			
pha:	120 mV		
ficience 5.57% 1.62% 3.37% 6.88%	<u>S</u> <u>A-B XTLK</u> 7.75%	Back ground: Pu-239: Tc-99: Th-230: SrY-90:	Alpha 1 4348 14 6403 N/A
ncy from		"AF" in t	
5736	Average:	5824.3	Are th
	the B-A Xtalk is bes = 1/8" from st		
99	Source 2:	Th-230	

ctpomits

V Setting:	650 v	AT (12
EFT % ERROR	AF 250:	251 %
0.00%	AE 2500.	
0.00%	AF 2500:	
0.00%	AF 25K:	25.01 K %
0.00%	AF 250K:	250.1 K %
0.00%		Is the As Fo
0.00%		
0.00%		
0.00%		x.1 or x1 Sc
0.00%		c1 or x10 Sc
0.00%		
0.00%	x10	or x100 Sc
0.00%	x100	or x1000 Sc

			A
٧			
pha:	120 mV		
ficience 4.50% 1.71% 2.15% 5.38%	<u>S</u> <u>A-B XTLK</u> 4.97%	Back ground: Pu-239: Tc-99: Th-230:	Alpha 0 4165 17 6070
ncy from		SrY-90: "AF" in the Efficience	
5786	Average:	5727.7	Are the
oration and ortional pro	the B-A Xtalk is bes = 1/8" from st	1% and the A-E	3 Xtalk is <1 herwise spe
99	Source 2:	Th-230	

HV Se	tting:	800 V	AT	(12
LEFT	% ERROR	AF 250:	250	9
4F	0.00%	AF 2500:	2500	9/
4F	0.00%			
AF	0.00%	AF 25K:	25 K	%
AF	0.00%	AF 250K:	250 K	9
٩F	0.00%		Is the A	e F
AF	0.00%			
ÀF.	0.00%			
AF	0.00%		x.1 or x1	S
٩F	0.00%		1 or x10	S
AF.	0.00%			
AF	0.00%	x10	or x100	S
NF.	0.00%	x100	or x1000	S

V Alpha: 120 mV Efficiences Alpha Back A-B XTLK ground: 0.00% #Div/0! Pu-239: 4968 0.00% Tc-99: 11 0.00% Th-230: 5810 0.00% SrY-90: N/A ency from "AF" in the AL I Efficiencies in t 4989 Average: 4984.0 V Are th libration and the B-A Xtalk is <1% and the A-B Xtalk is < portional probes = 1/8" from surface unless otherwise sp -99 Source 2: Th-230

IV Se	tting:	775 V	AT	(12
LEFT	% ERROR	AF 250:	250	9/
AF .	0.00%			
AF .	0.00%	AF 2500:	2500	9/
١F	0.00%	AF 25K:	25 K	%
\F	0.00%	AF 250K:	250 K	%
٩F	0.00%		Is the A	s F
\F	0.00%			
\F	0.00%			
\F	0.00%		x.1 or x1	Se
٨F	0.00%		1 or x10	SI
\F	0.00%			
۱F	0.00%	x10	or x100	S
\F	0.00%	x100	or x1000	S
		F-2 .		

V			A
Ipha: Ifficiences A- 17.59% 7.07% 19.35% ency from	120 mV B XTLK 10.47%	Back ground: Pu-239: Tc-99: Th-230: SrY-90: "AF" in the Efficience	
3894		3911.0 🗸	
portional probet	s = 1/8" from su Source 2:	rface unless of	perwise sp



Safety and Ecology to achieve mentour 1 sec-15-418 Rev 2

2800 Solway Road Knoxville, TN 37931 Calibration Certificate

Page 1 of 1 4/17/2017

Calibration Certificate for 2360, Serial # 310164, Bar Code # 01508, Property # ARS13 Technician: Carl Hall Date: 04/17/17 Date Last Cal. Expires: 05/05/16 Location: 999999, Reason For Calibration: Due for Calibration EQUIPMENT USED DURING CALIBRATION MODEL: 500-2 SERIAL #: 132896 CAL DUE: 06/20/17 MODEL: SERIAL #: AS FOUND DATA Geotropism: SAT AS LEFT Instrument Condition: SAT AS FOUND Instrument Condition: SAT AS LEFT Mechanical Zero: 0 New Batteries? Battery Check: SAT AS FOUND Mechanical Zero: 0 HIGH VOLTAGE AS FOUND HV AS LEFT HV WINDOW SETTINGS AS FOUND AS LEFT (+/- 10% tolerance) 500 V: 503 V AF V BT (4 mV +/- .4 mV): AF mV 4 mV 1000 V: 999 V AF v 40 mV AF mV BW (40 mV +/- 4 mV): 1500 V: 1496 V AF v AT (120 mV +/- 10 mV): 120 mV AF mV AF HV Setting: 800 V AL HV Setting: 800 V RATE METER DIGITAL SCALER SCALE RATE CPM AS FOUND % ERROR AS LEFT % ERROR AF 250: 250 % ERR: 0.00% AL 250: AF % ERR: 0.00% 0.00% AF 0.00% 0.00% AF 0.00% AF 2500: 2500 % ERR: 0.00% AL 2500: AF % ERR: 0.00% 250 0.00% AF 25K: 25 K % ERR: 0.00% AL 25K: AF K % ERR: 0.00% 400 1000 0.00% 400 0.00% AF 250K: 250 K % ERR: 0.00% AL 250K: AF K % ERR: 0.00% 0.00% 0.00% 0.00% 1000 0.00% ☑ Is the As Found Data Within 20% of the Set Point? 4000 4000 0.00% 0.00%
REPRODUCIBILITY 0.00% 10K 10 25K 0.00% x.1 or x1 Scale: 250 250 250 40K 40 0.00% AF 0.00% x1 or x10 Scale: 2500 2500 2500 100 0.00% 0.00% 25 K x10 or x100 Scale: 25 K 25 K 250 0.00% 250 K 250 K x100 or x1000 Scale: 250 K 400K 400 0.00% 0.00% Are the Individual Counts Within 10% of the Average? Audio Response: SAT ☑ Is the As Found Data Within 20% of the Set Point? Overload Light: SAT Low Battery (2.2V): SAT Comments: Married as a set with: Model: 43-89 Serial #: PR337817 ♥ Does Instrument Meet Final Acceptance Criteria? ✓ Calibration Sticker Attached? Date Instrument is Due For Next Calibration: 04/17/18 2 Printed Name: Carl Hall **MANAGEM**



Safety and Ecology Corporation SEC PROCEDURE

SEC-19-420 Pau 2

2800 Solway Road, Knoxville, TN 37931

Page 1 of 1 4/17/2017

Calibration Certificate

Calibration Certificate for 43-89, Serial # PR337817, Bar Code # 01505, Property # ARS14

Location: 999999,

Date Last Cal. Expires: 05/05/16

Technician: Carl Hall

EQUIPMENT USED DURING CALIBRATION MODEL: 2360

Reason For Calibration: Due and Repair 360 SERIAL #: 310164

CAL DUE 04/17/18

NIST TRACEABLE SOURCES USED			SOURCE	ISOTOPE	ACTIVITY	217 11,528 cpm	ASSAY DATE 1/3/2017
Efficiencies from last calibration		5744-06	Sr-90	16430 dpm			
Pu:	20.04	%	5746-06	To-99	31900 dpm	20,000 cpm	1/3/2017
Tc:	12.81	%	5747-06	Pu-239	25797 dpm	13,098 cpm	1/3/2017
Th:	17.24	%	5748-06	Th-230	34899 dpm	17,699 cpm	1/3/2017
SrY:	26.14	%					

AS FO	UND DA				Condition: n Setpoint	SAT 5
		orine)		HV: 8	00 V	
Thresho	ld Beta:	4	- 40	mV	Alpha:	120 mV
Back	Alpha		Beta	AF 41	T Efficienc	
ground:	0	CPM	0	CPM		A-B XTLK
Pu-239:	0	CPM	0	CPM	0.00%	#Div/0!
Tc-99:	0	CPM	0	CPM	0.00%	
Th-230:	0	CPM	N/A		0.00%	
SrY-90:	N/A		0	СРМ	0.00%	

Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

			HV: 8	000	V	
Back	Alpha		Beta	AL4	π Efficien	cies
ground:	1	CPM	179	CPM		A-B XTLK
Pu-239:	4945	CPM	668	CPM	19.17%	9.89%
Tc-99:	8	CPM	4199	CPM	12.60%	
Th-230:	5867	CPM	N/A		16.81%	
SrY-90:	N/A		4400	CPM	25.69%	

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility: Isotope: Sr-90 4437 4382 4416 Average: 4411.7 🗹 Are the individual counts within 10% of the average?

If the As Found data (even after reposit) is within 10% of the last calibration and the 8-A Xtalk is <1% and the A B Xtalk is <10%, then the technician may NIA the Plateau Data and go directly to Comments. Geometry of source - Rush to surface, except pas proportional probes > 165 from surface unless otherwise specified.

PLATEAU DATA		1: Tc-99 onse (CPM)	Source 2: Respons	Th-230 se (CPM)	Backgrou	nd (CPM)	Net A to B	
	Ach. I	B ch. Net Eff.	Ach. B	ch. Net Eff.	A ch.	B ch.	Xtalk: <10%	
N/A			79 191414	7 7 7			N/A	
							N/A	
		The state of the s					N/A	
		W. T.		100			N/A	
		-					N/A	
				D 000			N/A	12420000
				Pu-239	To		<u>Th-230</u>	SrY-90
		2 Pi Effici	encies:	37.75%	20.1	0%	33.14%	36.62%
Comments: Married as a s Replaced damaged mylar.	set with:	Model: 2360		Serial #: 3	10164		Bar Code f	1: 01508

☑ Does Instrument Meet Final Acceptance Criteria?

Performed by:

Reviewed by:_

Date: 4.0-17

Printed Name:

Carl Hall

MINNIN

0 10,000 CPM:

10,021

CPM

)%, the technician may place AF in AS LEFT sec

PLY CA	100	ATIC	M
FIVA	-11-7.VA		

AS FOUND

Vernier Setting:

2.86

HV Setpoints:

700 V

500 V Reading:

504 V

1000 V Reading:

1010 V

1500 V Reading:

1501 V

Max HV (1500 V +):

ERR: 0.03%

AL 250: AF

%

ERR: 0.04%

AL 2500: AF

%

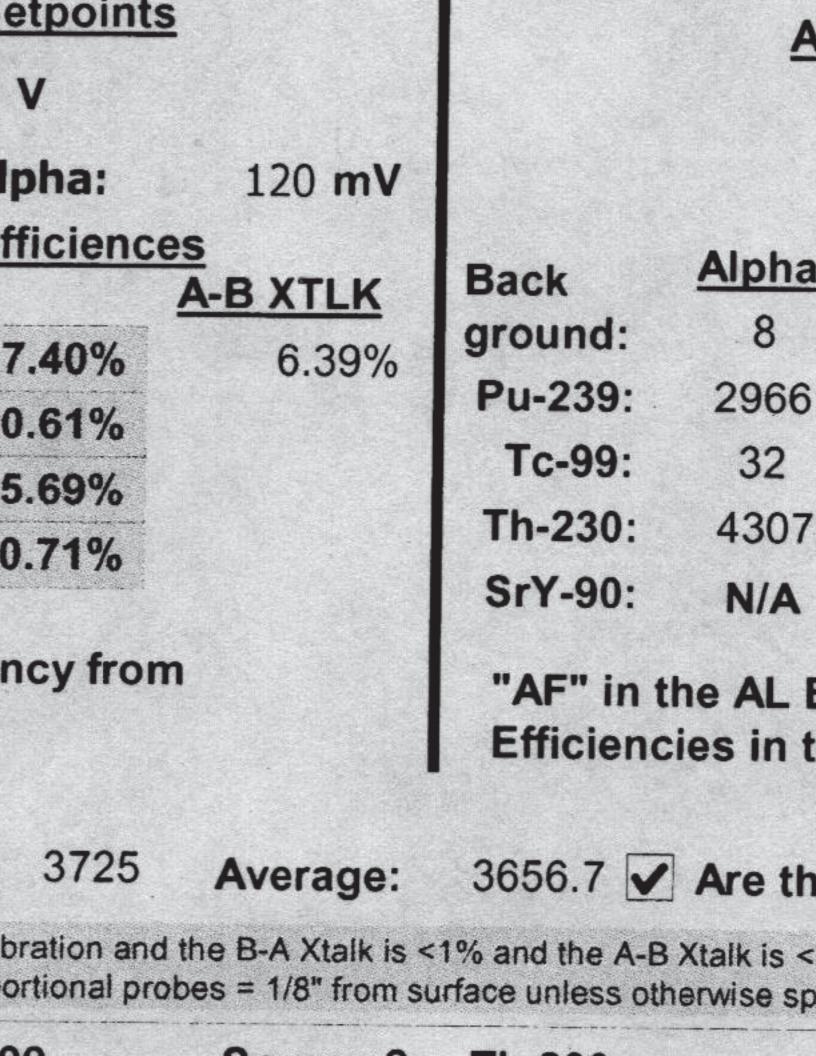
AS LE 4 - 50 mV ta: 175 mV Alpha: Alph fficiencies Back A-B XTLK ground: 3.1% Pu-239: 5.25% 599 1.79% Tc-99: 12 **B-AXTLK** 5.17% 963 Th-230: 0.2%).26% SrY-90: N/A "AF" in th ency from the last cal.? Efficienci 6133 Average: 6153.7 Are the ration and the B-A Xtalk is <1% and the A-B Xtalk is <1 r probes are in contact with surface unless otherwise sp Source 2: Th-230

Resnance (CPM)

Racke

Inresnoia

	A1 V	
Setting:	1825 V	AT (120
T % ERRO	R AF 250:	250.1 % E
0.00%	AF 2500:	2501 % E
0.00%		
0.00%	AF 25K:	25.02 K %
0.00%	AF 250K:	250.1 K % I
0.00%		Is the As Fo
0.00%		
0.00%		
0.00%		x.1 or x1 Sca
0.00%		x1 or x10 Sca
0.00%		
0.00%	X 1	0 or x100 Sca
0.00%	x100	or x1000 Sca



Setting: 1	700 v	AT	(120
FT % ERROR	AF 250:	251	%
0.00%	AF 2500:		%
0.00%			
0.00%	AF 25K:	25.01 K	%
0.00%	AF 250K:	250.1 K	%
0.00%		Is the A	s Fo
0.00%			
0.00%			
0.00%		x.1 or x1	Sc
0.00%		x1 or x10	Sc
0.00%			
0.00%	x1(or x100	Sca
0.00%	x100	or x1000	Sca

V			
lpha:	120 mV		
fficience	es		
	A-B XTLK	Back	Alpha
0.52%	7.51%	ground:	5
5.11%		Pu-239:	3493
9.14%		Tc-99:	17
9.44%		Th-230:	5250
9.44 /0		SrY-90:	N/A
ncy from		"AF" in t	he AL E
4876	Average:	4967.7	Are th
bration and ortional pro	the B-A Xtalk is < 'bes = 1/8" from su	1% and the A-B	Xtalk is <
99	Source 2:	Th-230	

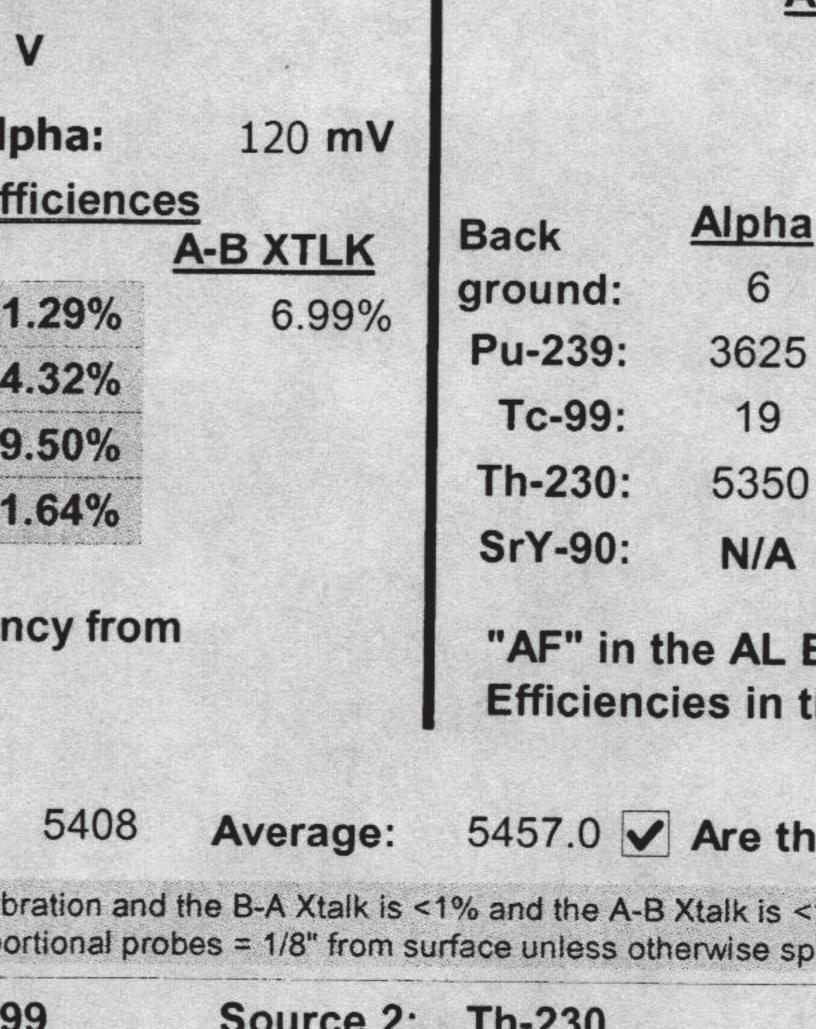
.

V Se	tting: 1	700 v	AŢ	(12
				je je
EFT	% ERROR	AF 250:	251	%
F	0.00%	AE 2500.	2501	%
F	0.00%	AF 2500:	2501	
F	0.00%	AF 25K:	25.01 K	%
F	0.00%	AF 250K:	250.1 K	%
F	0.00%		Is the A	s F
F	0.00%			.
F	0.00%			
	0.00%		x.1 or x1	Sc
=	0.00%		x1 or x10	S
F	0.00%		**	
-	0.00%	x1(0 or x100	So
	0.00%	x100	or x1000	Sc

V			
lpha:	120 mV		
fficience 20.13% 23.71% 8.16% 29.92%	<u>A-B XTLK</u> 7.07%	Back ground: Pu-239: Tc-99: Th-230:	Alpha 6 3428 22 4982
ncy fror		SrY-90: "AF" in the Efficience	
5039	Average:	5089.3	Are th
ibration and portional pro	the B-A Xtalk is < obes = 1/8" from su	1% and the A-B	Xtalk is <
99	Source 2:	Th-230	

Æ

	/\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \				
Setting:	1725 v	AT (120			
FT % ERROR	AF 250:	251 %			
0.00%					
0.00%	AF 2500:				
0.00%	AF 25K:	25.01 K %			
0.00%	AF 250K:	250.1 K %			
0.00%		Is the As Fo			
0.00%					
0.00%					
0.00%		x.1 or x1 Sc			
0.00%		x1 or x10 Sc			
0.00%					
0.00%	- x1	0 or x100 Sc			
0.00%	x100	or x1000 Sc			



ctponits

Daily Source Checks

ATTACHMENT W (SEC-RP-F-059) DESKTOP ALPHA/BETA COUNTING INSTRUMENT (95% CL) RESPONSE/DAILY TEST SHEET (Use for Model 2929, 3030 or MPC 2000)

Meter # 185244 Probe # PRISULT

PART	1:	A Service Service		INIT	IAL REFERI	Probe # PRIG	The Country of the Co	N-78-07-1112/2		
SET UP DA	ATE: \-S	-18	LOCATION	Building		T			.J.,	
	18526	The A		29-29	7 181		HV. Vernier: 700 / 2.9 BY: K Giu			
	R SERIAL #:			MODEL: 43-	10 1		19-19	EFF: a: (69.92" B:55.14%	
VIII - TOTAL STREET	STRUMENT.		DETECTOR	(cpm)	-10-1		04-19	CF: α:	1.43 8: 1,81	
		u ot.pl	Chet	(Cpili)		ALPHA MDC:		(dpm)		
		nute count): 1.		(total c	numte)				1412-256 85344.526	
α5 SOUR	CE CNTS (cpi	n): :1. 49	ilel		529	β BKG COUNT (1 1- min 3. -		90	(cpm)	
β5 SOURC	CE CNTS (cpr	n): :18	الولو		8354	3. 8449		ي پ	5. 4739	
α BACKGR	OUND:	0.8	(cpm)	α BKG RANGE		0-5 cpm	4. 0 3 7	9	5. 8440	
β BACKGR		90	(cpm)	β BKG RANGE:	7	2 т	0 108			
	AVERAGE:	4611.4			IGE (± 20% AVG.)		то то	55	(cpm) (cpm)	
PART 2	Charles and the same of the same	8451	(cpm)	β SOURCE RAN	IGE (± 20% AVG.) RESPONSI	AND DESCRIPTION OF THE PARTY OF	в то	10,10	-militarium attenua	
1 DATE	2 TIME	3 CAL DUE	4 HV (Volts)	BAC	5 KGROUND	6	7	8	Aksarija a produce postavani	
-8-18	(Enter Date) Verni		Vernier Vernier	α	(CPM)	α SOURCE RESPONSE (Gross CPM)	β SOURCE RESPONSE (Gross CPM)	S/U/ Number	9 SIGNATURE	
)	0700	01-14-19	700	0.1	102	4648	8325	8	16.00 1.0	
1-9-18	0830		700	0.1	101	4699	8449	8	16: 1 1 1 C	
-10-18	U700		700	U.I	95	4703	8358	8	16's a line	
-11-18	OTIO		700	1	85	4897	8611	8	Winherly Duck	
-15-18	0730		700	1	107	4712	8436	S	Mentely Derche	
16-18	טטט		700	0.1	96	4619	8619	5	Vamburey Surley	
-17-18	0730		700	0.1	84	4553		5	Mundred Such	
~18-18	טטרט		700	0.1	108	4626	7488		Kindely Side	
-27-18	0800		700	1	98	4444	8630	8	binkey Sides	
-23-18	0700		700	0.1	85	4507			Oal A Oan	
-24-18	0700		700	0.1	95	4696	8632	5	Onla Un	
	- MINE AND AND AND AND AND AND AND AND AND AND				94	557	8536	5	Ould In	
-25-18	0700		790		7 -1	I man V				
			700	(0.)		4648			0 0	
-26-18	0700		700	0.)	89	4573	8693	S	OnlA On	
-26-18	0700			0,)					0 0	

ATTACHMENT W (SEC-RP-F-059) DESKTOP ALPHA/BETA COUNTING INSTRUMENT (95% CL) RESPONSE/DAILY TEST SHEET (Use for Model 2929, 3030 or MPC 2000)

Meter	# 1906	02				Probe # 19915	ς			
PART 1:				INITIA	L REFERE	NCE RESPONSE TE	ST			
SET UP DAT	TE: 12-17	L-17	LOCATION:	Building	181	HV .' Vernier: 700	HV. Vernier: 700 12.86 BY: K Guider			
THE PERSON NAMED IN COLUMN 1	19060		1	29 29		CAL. DUE: 12-6	-18	69	1337. 57.497.	
DETECTOR	SERIAL #: \	99189	DETECTOR MC	DDEL: 43-1	0-1	CAL. DUE: 12 - (and the second	44 B: 1.74	
ALPHA INST	TRUMENT. L	×		(cpm)		ALPHA MDC:		(dpm)		
GEOMETRY	: Cent	u of pl	anchet			SOURCE (S) TYPE: 8, 4-	96 74-230	ID#: 8234	t10-526 82344-526	
α BKG COU	NT.(1 10-min	ute count): 1		(total cou	ints)	β BKG COUNT (1 1- minute	count): 1\	2.90	(cpm)	
α5 SOURC	E CNTS (cpn	n): :1	1403	2_4		3. 4611				
β5 SOURC		n): :1	314	_28	304	3. 8263	48467		_58393	
α BACKGRO		0.5	(cpm) a	BKG RANGE:		0 - 5 cpm				
β BACKGRO		4454		BKG RANGE:	Min The sangates Con.	75. 2.2	131.4	C 21	(cpm)	
B SOURCE		8347.2			GE (± 20% AVG.) GE (± 20% AVG.)	: 3563.2 : 6647.76	TO TO		(cpm)	
PART 2:	e16264 F	do w			RESPONSE			10,61	<u> (срм)</u>	
1 DATE	2 TIME	3 CAL DUE (Enter Date)	4 HV (Volts)/ Vernier		5 GROUND CPM) B	6 a SOURCE RESPONSE (Gross CPM)	7 β SOURCE RESPONSE (Gross CPM)	8 S/U/ Number	9 SIGNATURE	
12-12-17	0930	12-6-18	750	0.1	108	4357	8343	2	Windred Dines	
12-13-17	0718)	700	0.1	88	4392	8518	S	the last Dinge	
12-14-17	U730		700	0.1	122	4517	8268	S	Hambely Sile	
12-18-17	0715		700	1	107	4477	1048	3	Vainley Sid	
12-19-17	0718		700	0.1	108	4517	8351	2	Wanted Side	
12-20-17	0710		700	0.1	110	4483	8338	S	bully Sinds	
12-21-17	0112		700	0.1	99	4397	४३९।	1	Voultaly Sinh	
1-2-18	0940		100	1	110	4402	8 You	2	Winley Diele	
1-3-18	0730		700	0.1	107	4860	% ३६७	2	Vanluey Side	
1-4-18	0730		700	0.1	114	4415	8306	2	Hailed Dil	
1-2-18	ر130		700	0.1	109	4338	8381	2	Kirley Did	
1-8-18	UTUD		700	0.1	114	4500	8122	2	Willey Diels	
1-9-18	0730		700	0.1	99	4438	8288	2	Willy Sid	
1-10-18	0700		700	0.1	119	4470	8230	2	History Sides	
	0700	1	700	0.1	117	4349	8313	2	Willy Dile	
RCT Sup	ervisor	or Designee	Signature	C	lank		a	Date:	3-14-18	

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ATTACHMENT W (SEC-RP-F-059) DESKTOP ALPHA/BETA COUNTING INSTRUMENT (95% CL) RESPONSE/DAILY TEST SHEET (Use for Model 2929, 3030 or MPC 2000)

PART	the state of the s	<u> </u>		Juli-	IAI SEES	Probe # 19919	Park Comment of the C	w remembers	and the second s
By a Mark to the						NCE RESPONSE 1	EST		
SET UP DA	12-1	2-17	LOCATION:	Buildin	181 25	HV.' Vernier: 700	L Guider		
	19060		MODEL:	2929	<u> </u>	CAL. DUE: 12 - 4 - 18 EFF: a: 49.33% B: 57			
		199159	DETECTOR	MODEL: 43	1-01-	CAL. DUE: 12-6	1977 Marco		1.44 B: 1.74
	STRUMENT. L			(cpm)		ALPHA MDC:		(dpm)	
		er of p				SOURCE (S) TYPE: 54	-490/Th-230	ID#: 87	1344-556 B 2341B-55
WW.	UNT (1 10-mir		5	(total c	To be seen	β BKG COUNT (1 1- minu		109.	
	CE CNTS (cpr	100	403		4417	3. 4011	4. 4438)	_5. 4401
Mark at the control of the control	CE CNTS (cpn	LONG THEFTON	314	2	4304	_3. <u> </u>	4. 846	2	5. 8393
BACKGR		109.5		α BKG RANGE		0 - 5 cpm			
SOURCE	AVERAGE:	4484		B BKG RANGE:	NGE (± 20% AVG.)				(cpm)
11 - Na. 14 . 22	AVERAGE:	8347.7			NGE (± 20% AVG.)		TO TO		(cpm)
PART 2	(中央等/2010年)		3000		RESPONSE	NAME OF THE OWNER, WHEN PERSON AND THE PERSON AND T		100	16.67 (cpm)
DATE	TIME	CAL DUE (Enter Date)	4 HV (Volts)/ Vernier	ВΑС	5 KGROUND (CPM) β	6	7 β SOURCE RESPONSE (Gross CPM)	8 S/U/ Number	9 SIGNATURE
18	0700	12-6-18	ZOO	0,1	105	4323	8384	3	16. 0 0 h i 0
me to	0750		700	0.1	94	4377	8327	5	Winkey Single
-17-16	0730		700	0.1	88	4405	838Ce	8	Vinley Dis
Name of the last of	0700		700	1	102	4389	8164	5	Winhal Suida
-2Z-18	0800		700		103	4361	8287	S	Ould In
-23-18	0700		700	0.1	113	4293	8331	5	Oaldil
	0700		700	0.1	98	4410 .	8213	5	Oul A Un
	0700		7.00	0.1	101	4532	8273	2	Ould On
-26-18	0700		700	0.1	94	4356	8409	S	Ola Om
10		4	-	1	109	4441	8242	2.2.07	Ould On
-29-18	0700		700		101	1 (711	0777	1	
-29-18	0703 9860		700	1	92			5	A
-29-18 -30-18	9860			1		4488	8385	5	Out A Va
-29-18	9860		700	0	92	4488		S	A
-29-18 -30-18	9860		700	0	92	4488	8385	S	Out A Va

ATTACHMENT L (SEC-RP-F-048) Attachment 1 DUAL-USE ALPHA/BETA CONTAMINATION INSTRUMENT (95% CL) RESPONSE/DAILY TEST SHEET

(Use for Model 2224-1 or 2360 with 43-68, 43-89 or 43-93 probe) (NOTE: Used with 1-minute beta background count time)

Meter #	234	834					Probe #	312654			
.RT 1:					INITIAL R	EFERE	NCE RESP	ONSE TEST			
SET UP DATE	:12-11-	·IT	LOCATIO	ON: Bluil	iding 18	,	HV / C.S. THR:	/ a:	β:	ву:	Guide
SERIAL #: 2	3483	4	MODEL:	236	000		CAL. DUE: \	CAL. DUE: 10-20-2018 EFF: a: 20.96 % 8:32.43			
PROBE SERIA	L#: 317	1654	PROBE I	MODEL:	1393		CAL. DUE: \	0-20-201	8		4,77 B: 3.08
ALPHA INSTR	l. L _C :		0	(cpm)			ALPHA MDC:		(dpm/100cm ²)		
GEOMETRY:	f-day.	flat	Surfa	ندد			SOURCE (S) TY	PE: 5, 90 T	n 230	ID#:82	344-526 82341A-526
2 5-MINUTE B	KG CNT (co	ounts): a: 1		2,		TOTAL	L COUNTS (cour	nts):	OR 1 10-MIN	UTE BKG	CNT (counts): 11/3955
1 (1-MINUTE)	BKG COU	NT (cpm): β: 1	1					77/18			
5 (1-MINUTE)	SOURCE C	NTS (cpm):	o: 1	2265	2_	2416	3.	2370	4. 23	45	5. 2261
						The second second	CACHELLA PROPERTY.	The second second		Carlo Marie Control	5. 7028
α BKG COUNT	TRATE:	1.1	(0)	om) a Bi	KG RANGE:		0 TO 5 (cpm)				
β BKG COUNT	RATE:	395.5			(G RANGE:		The state of the s		то Н	14.1	(cpm)
α SOURCE AV	/ERAGE:	2331.4	(q	pm) αSC	DURCE RANGE (± 20% AVG): 18	12.00	то 2-	197.1	رcpm)
β SOURCE AV	/ERAGE:	7030.4	r (q	pm) 8 SC	DURCE RANGE (± 20% AVG): 5C	024.32	то 84	36.4	(cpm)
PART 2:						SPONS	E TEST				
1 DATE	2 TIME	CAL DUE (Enter Date)	BATT. (S/U)	5 H.V. (Volts)	6 THRESHLD α/β (S/U)		7 KGROUND β	8 a SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE (Gross CPM)	10 S/U/ Number	11 SIGNATURE
12-12-17	0734	10-20-18	5	5		١	396	2380	881F	1 -0.550(350)	Kinhe & Dud
12-13-17	0712		S	S		0.1	385	2410	Le734		Kinhely Suide
					8						8
	-	-				2					
			1				1-1	\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-\-	0 V		
		1	11			0 (+1	,			
	1	1/e	1	U	1 / / /		1				
			-			-	-				
	-		LA	Λ_	<u> </u>	+					
			1//	//	D 1	11	,				
		V									
			1	L	10						
BCT Supe	ervisor	or Design	ee Sigr	ature: _	Your	ril				Date: _	3-14-16

ATTACHMENT L (SEC-RP-F-048)

	# 234	834	***********************				Probe #	PR3126	54		20000000 70000000785 128 00000000000
RT.1:							NCE RES	PONSE TEST	in the second second		arter
SET UP DATE			LOCATI	ON: Bu	ilding 19	81	HV / C.S. THR	:670 /#17	0 p.4-40	BY:	K Guider
SERIAL #: 7			MODEL:		360		CAL. DUE:	12-20-18		EFF: oz	43.98% B. 46.75%
PROBE SERI	NEARNOLL ACCOUNTS	2684	PROBE	MODEL:	43-93		CAL. DUE:	12-20-	18		2.27 B: 2.14
ALPHA INSTI				(cpm)			ALPHA MDC:		(dpm/100cm ²)		
GEOMETRY:							SOURCE (S) T	YPE: 76-290	S14-00	ID#: 87	25-H828 025-AIFE
2 5-MINUTE E	C#3			2		TOTA	L COUNTS (co	unts):	OR 1 10-Mil	NUTE BKG	CNT (counts): 8 3827
1 (1-MINUTE) BKG COU	NT (cpm): β: 1	3	88							
5 (1-MINUTE)	SOURCE	CNTS (cpm): c	z: 1 ?	2418	2	24	448 a.	2420	4. 2	470	5. 2420
5 (1-MINUTE) SOURCE CNTS (cpm): β:1. 6997 2 7118 3. 7004 4. 7060 5. 7081											
α BKG COUNT RATE: (), % (cpm) α BKG RANGE: 0 TO 5 (cpm)											
B BKG COUN	T RATE:	401.	(cp	om) BB	KG RANGE:	**************************************	320.8		то	481.	2 (2002)
α SOURCE A	VERAGE:	2438.2	(c)	pm) as	OURCE RANGE	(±20% AVG	i): \Q	48.16	Marin and All and Appear to the African	2922	(cpan)
PART 2:	VERAGE:	7082	(c)	pm) BS	OURCE RANGE	(±20% AVG): 5	641.la		8462	(cpm)
1	2	3	I 4	5		ESPONS	AND THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NAMED I	The second second			(Guil)
DATE	TIME	CAL DUE (Enter Date)	BATT. (S/U)	H.V. (Volts)	THRESHLD		GROUND	8 α SOURCE RESPONSE	9 β SOURCE RESPONSE	10 S/U/ Number	11 SIGNATURE
1-3-18	080	12-20-18	5.	S	S	2	429	(Gross CPM)	(Gross CPM)	5	
1-4-18	0930		S	S	S	1	421	2443	6949	S	Mundrely Bush
1-2-18	0730		- S	S	·S	2	385	2340	7009	S	Marrhof Bush
1-8-18	0630		5	S	S	1	410	2474	6909	S	Wenley Such
L2-18	0630		S	S	S	2	397	2484	6836	S	Willes Suda
1-10-14	0630		S	_S_	S	1	424	2412	١٩١٦	S	this of him
1-11-18	0630		8	8.	5	0.1	409	2477	7013	3	Windely Sinder
1-15-18	Olezo		2	S	S	1	409	2317	6870	S	Winted Did
-16-18	0640		8	S	8	0.1	422	2428	4771	S	11:00
-17-18	טעט		S	S	S	0.1	412	2407	7153	5	Bunkely Sude
-18-18	०७५६		S	S	S	0.1	375	2384	7008	8	
-23-18	1520		5	2	S	0.8	383	2405	7006	2	Wald da
-24-18	0700		S	S	5	0.5	367	2423	6839	2	Oald On
-25-18	0700	1	S	S	S	0.4	405	2329	7056	5	0.1AD
T Supe	rvisor o	or Designee	Signa	ature:	Olom	lo)					Swir en
\			~	_	Aut. V					Date: _	3-14-18

ATTACHMENT L (SEC-RP-F-048) Attachment 1 DUAL-USE ALPHA/BETA CONTAMINATION INSTRUMENT (95% CL) RESPONSE/DAILY TEST SHEET (Use for Model 2224-1 or 2360 with 43-68, 43-89 or 43-93 probe) (NOTE: Used with 1-minute beta background count time)

	77	40	2 L1
Meter #	2)	70	27

Probe# PR 312654

ET UP DATE:	1-2-	18		LOCATIO	N: BL	06 181	ŀ	IV / C.S. THR:	l ac	β:	BY:	C. All the street makes to the street and the stree	
ERIAL #: 7	34 8	734		MODEL:	23	60		AL. DUE:			EFF: oc	В:	
OBE SERIAL	#:			PROBE M	ODEL:			CAL, DUE: CF: a: B:					
PHA INSTR.	L _c :				_ (cpm)			ALPHA MDC: _		(dpm/100cm ²)	V		
OMETRY:							9	SOURCE (S) TY	PE:	a a superior and a su	ID #:		
-MINUTE BK	G CNT (co	unts): a: 1	1		2		_ TOTAL	COUNTS (cour	nts):	OR 1 10-MI	NUTE BKG	CNT (counts) :	
(1-MINUTE) E	KG COUN	T (cpm):	B: 1.							A	THE PARTY OF THE P		
(1-MINUTE) S				to the state of									
		2 4				2		3		4		5	
1-MINUTE) S		VTS (cpm): β:	1	_	2		3		4		5	
SKG COUNT			10.5%	(ср	m) a B	KG RANGE:		0 TO 5 (cpm)					
SKG COUNT				(срі		KG RANGE:	V DOSMIN'S	то				(cpm)	
α SOURCE AVERAGE: (cpm) α SOURCE RANGE (± 20% AVG.): TO β SOURCE AVERAGE: (cpm) β SOURCE RANGE (± 20% AVG.): TO PART 2: RESPONSE TEST										(cpm)			
DAIDT A STATE OF THE STATE OF T								STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET, STREET,		то		(cpm)	
1 DATE	2	3		4	5	6 1		7	8	9	10	I	
	TIME	(Enter D		BATT. (S/U)	H.V. (Volts)	THRESHLD a/β (S/U)	BACK	GROUND B	α SOURCE RESPONSE (Gross CPM)	β SOURCE RESPONSE (Gross CPM)	S/U/ Number	11 SIGNATURE	
1-26-18	0700	12-20	7-18	5	5	5	- [396	2178	7104	5	Oald On	
1-29-18	0700			S	S	S	l	384	2273	7097	5	0.110	
1-30-18	0800			5	. 5	S	.5	367	2410	6966	5	Old O.	
												02.71.02	
		\vdash						 			+		
			R		5								

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**************************************											+		
		1								-	-		
		-											
								15					
								- 43					

ATTACHMENT L (SEC-RP-F-048) DUAL-USE ALPHA/BETA CONTAMINATION INSTRUMENT (95% CL) RESTATACHMENT SHEET

(Use for Model 2224-1 or 2360 with 43-68, 43-89 or 43-93 probe)
(NOTE: Used with 1-minute beta background count time)

Meter	# 253	248			(1.072.1	obed with I		244541			
.RT 1:					INITIAL	REFERE		PONSE TEST			
SET UP DATE	:12-1	1-201	1 LOCAT	TION: Bui	Iding 18	(HV / C.S. THR	:825 10:12	0 B: 4-40	BY: 1	Kbrieler
SERIAL #: 2	5324	ષ્ઠ	MODE	: 236	0			11-17-201		170-774	20.79% B: 26.62%
PROBE SERI	AL #: 24	4541			4393			11-17-201			4.81 B: 3.7ce
ALPHA INST	R. L _c :			(cpm)						TCF: 0:	в: 5.10
GEOMETRY:	fla	it Su	rece							ID#: 93	344-256/853418-256
2 5-MINUTE E				2.		TOTAL	COUNTS (co	unts):	OR 1 10-MIN	UTF BKG	CNT (counts): 9/2466
1 (1-MINUTE)	BKG COU	NT (cpm):	β: 1	238						To Table	orr (counts). 11 - 140
5 (1-MINUTE)	SOURCE	CNTS (cpm)	: α:1	2217	2	224	3.	2194	4. 22		5. 2199
										31	5. 5600
α BKG COUN				100	KG RANGE:		0 TO 5 (cpm				
β ВКG COUN	RATE:	246.1	٠ (pm) βB	KG RANGE:	19	97.28		то	295.	97
α SOURCE A	/ERAGE:	2224	? (cpm) αS	OURCE RANGE	(± 20% AVG.): 178	30,08	VACAA BELLEVILLE	2671	7
β SOURCE AV	ERAGE:	5548	4 (OURCE RANGE			138.72		.58.	170
PART 2:				1 6 6		SPONS			HEADERT !	000.	(cpm)
DATE	TIME	CAL. DU (Enter Da	ate) (S/U)	5 H.V. (Volts)	6 THRESHLD α/β (S/U)	ВАСК	7 GROUND β	8 α SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE (Gross CPM)	10 S/U/ Number	11 SIGNATURE
12-12-17	0734	11-17-	18 5	5	S	120	236	2654	5678		bus sin
12-13-17	0715		8	S	S	0.1	235	2213	5598		Generally Sinder
12-19-17	0100		S	S	S	3	239	1936	5674		
12-18-17	0750		5	S	5	0	243	2223	5626		Kimberly Sinds
									8		Transaction of the state of the
			1						\		
	Λ	Ahs	A	0	<		\		250		
		1	300			()	$\supset Q $	200.			
						1	1		*		
	The sales of the s		1	10				MA	(1)		1
		-	1					1 100			
		-				()	1				
j		V	1		1	X			Live and Market		

Date: _ 3_14-18

Supervisor or Designee Signature:

ATTACHMENT L (SEC-RP-F-048)

Meter	# 253	548						Probe #	PR2445	541			
.RT 1:						INITIAL I	REFERE	NCE RES	PONSE TEST		Page 3	Press, applications	
SET UP DAT	E: 1-2-	18		LOCATI	ON: BU	alding 19	18	HV / C.S. THR	:825 10: V	20 B: 4-40	BY:	K & wich	
SERIAL #: 2	5324	8		MODEL:	234	0			1-17-18			40.99% B: 30	2 00%
PROBE SERI	IAL #: PR	24454	+1	PROBE	MODEL:	4393			11-17-18	•		2,44 в: 2	
ALPHA INSTI					(cpm)			ALPHA MDC:		(dpm/100cm ²)			
GEOMETRY:	flat	Surf	ج ر و					SOURCE (S) T	YPE: Th -230	151-90	18:# al	1341A-826 823	44-826
2 5-MINUTE E	BKG CNT (c	ounts): α:	1		2.		TOTA	L COUNTS (co	unts):	OR 1 10-MII	NUTE BKG	CNT (counts) : 1 20	40
1 (1-MINUTE) BKG COU	NT (cpm):	β: 1	2	208								
5 (1-MINUTE) SOURCE	CNTS (cpn	n): a	e 1 2	480	2	260	3.	2614	4. 2(295	5. 2882	
5 (1-MINUTE) SOURCE (CNTS (cpn	n): β	:1\	4982	<u> </u>	475	<u>(م</u> 3.	5088	4. \$0	sus	5. 4940	ę
α BKG COUN	IT RATE:	1.0		(cr	om) α E	BKG RANGE:		0 TO 5 (cpm)				
β BKG COUN	T RATE:	191	5	(cp	om) βB	KG RANGE:		152.8		то	229	.2	(cpm)
α SOURCE A				(c)	pm) αS	OURCE RANGE	(± 20% AVG	.): 2	103.52	то	3185	7.28	(cpm)
β SOURCE AV	VERAGE:	4984	4.4	(c)	om) βS	OURCE RANGE	(± 20% AVG): 39	763.52	то	594	2.28	(cpm)
PART 2:	2	3	alle, di	4	5		SPONS					Maria Salaka Tiron B	
DATE	TIME	CAL D (Enter D		BATT. (S/U)	H.V. (Volts)	6 THRESHLD α/β (S/U)	ВАСН	7 (GROUND B	8 α SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE (Gross CPM)	10 S/U/ Number	11 SIGNATUR	IE
1-3-18	0830	11-1	7-18	5	S	S	0.1	194	2711	4893	S	Vainley b	0.
1-4-18	0930			5	2	2	0.1	228	2685	4944	S	balos (Dude
1-2-18	0815			S	5	2	0.1	205	2633	4800	5	Winded !	Luier
1-8-18	Cleto			8	S	S	0.1	200	2741	4788	5	Your or	NO.
1-9-12	0630			S	S	S	0.1	219	2678	5074	S	Winhal I	Sinch
1-10-18	Ve45		- 1	5	S	S	١.ن	211	2788	5186	5	0 -	inla
1-11-18	0630			S	8	8		277	2642	5029	S	Vainly Si	ما
	Deso			S	S	S	0.1	198	2668	5045	S	0	eigles
1-16-18	0690			8	S	S	2	208	2678	4934	S	Binhaly F	wiles
1-17-18	5700			8	S	5	١. ن	229	2680	5074	2	Winhal D	mela
1-18-18	Viers			8	2	S	0.1	242	21615	5048	8	Winluh Din	d.
The Arthresis	1315			5	5	5	0	190	24.85	Ball	8	Car O Pour	me
1-29-18	0800		_	5	5	S		195	2421	4696	5	Oul A Va	
		1					0						
Supe	ervisor c	r Desi	gnee	Signa	ature:	\bigcirc	Keron	ch			Date:	3-110-1X	RESTAURANCE TO THE

ATTACHMENT R (SEC-RP-F-054) FLOOR MONITOR INSTRUMENT RESPONSE/DAILY TEST SHEET (Use for Model 12, 2221, 2224, 2224-1 or Model 2360 with 43-37 probe)

Meter# 253275 Probe # PP278380 PART 1: INITIAL REFERENCE RESPONSE TEST SET UP DATE: 12-19-17 Building 181 HV / C.S. THR: SERIAL #: 253278 2360 MODEL: 11-17-18 CAL DUE: EFF: # NIA 37.74 B: NIA 42. US PROBE SERIAL # 278380 PROBE MODEL: 43-37 81-17-11 CF. # NIA 2.45 B: NIA 2.38 SOURCE(S) TYPE Th - 230 | SVY- 90 10#82341A-526 (82344-826 5 (1-MINUTE) BACKGROUND COUNTS (cpm): c=1. 0.1 5 (1-MINUTE) BACKGROUND COUNTS (cpm): 930 948 959 954 5 (1-MINUTE) SOURCE CNTS (cpm): ez 1_ 1330 1295 1292 1333 1327 5 (1-minute) SOURCE CNTS (cpm): 8:1. SUUT 4811 4844 4937 4889 BACKGROUND AVG 3.42 0 TO 10 (cpm) BACKGROUND AVG 953.2 762,56 BEKG RANGE (± 20% AVG.): TO 1143,84 (cpm) SOURCE AVERAGE: 1315,4 a Source Range (± 20% AVG.) : 1052.32 1578,48 TO (cpm) SOURCE AVERAGE: 4897.6 B SOURCE RANGE (± 20% AVG.): 3918.08 5877:12 PART 2: (cpm) RESPONSE TEST CAL DUE 5 H.V. DATE TIME BATT. THRESHLD 11 SIGNATURE BACKGROUND (Enter Date) ∝ SOURCE B SOURCE (S/U or ±2% for 2221) SHILL (Volts) RESPONSE RESPONSE (Gross CPM) 12-12-17 0730 5427 11-17-18 3,9 1311 t054.7 12-20-17 10730 5 S 1348 5 3.3 1051.2 5419 122417/0730 S 5 S 1324 2.2 991.1 5352 1-8-18 1800 5 S 2.1 957.2 1297 5381 W1-18 1800 S 5 1285 5269 2.6 995 1-15-18 0800 2 5 S 6.1 876,4 1168 4606 1-16-18 0800 5 5 5 5.3 1148 886.8 4367 1-17-18 0800 5 5 5 860.7 1161 4748 RCT Supervisor or Designee Signature: Date:

ATTACHMENT L (SEC-RP-F-048)

DUAL-USE ALPHA/BETA CONTAMINATION INSTRUMENT (95% CL) RESPONSE/DAILY TEST SHEET (Use for Model 2224-1 or 2360 with 43-68, 43-89 or 43-93 probe)

(NOTE: Used with 1-minute beta background count time)

Meter #	268	411		- AN - 200 M			Probe #	DK2860	127		AND AND AND AND AND AND AND AND AND AND
.RT 1:			9.2av.		INITIAL F	REFERE	NCE RES	PONSE TEST			
SET UP DATE	1-2-	18	LOCATION	ON: Bui	Iding 1	81	HV/C.S. THR	: 790 /012	ω β:4.40	ву:	K Guich
SERIAL #: 2	6847	<u> </u>	MODEL:				CAL. DUE:	12-19-18	91	EFF: a:	46.06% B. 52.66%
PROBE SERIA	L#: 289	3427	PROBE	MODEL:	43-93		CAL. DUE:	12-19-18		1	2.17 B: 1.9
ALPHA INSTR				(cpm)		***************************************	ALPHA MDC:		(dpm/100cm ²)		
GEOMETRY:	fist	Sufce					SOURCE (S) T	TYPE: Th-230	0181490	ID#: 82	3418-526 82344-520
2 5-MINUTE BI	KG CNT (co	ounts): a: 1		2.		TOTAL	COUNTS (co	unts):	OR 1 10-MIN	UTE BKG	CNT (counts): 914919
1 (1-MINUTE)	BKG COUN	IT (cpm): β: 1		192							
5 (1-MINUTE)	SOURCE C	NTS ₍ (cpm): 0	e 1	2570	2	288	43.	2581	4. 24	404	5. 2894
5 (1-MINUTE)	SOURCE C	NT\$ (cpm): β	i: 1	784	٦ _{2.}	787	73 3.	1908	4. 1	934	5. 1929
α BKG COUNT	RATE:	0.9	(cı	om) a E	BKG RANGE:		0 TO 5 (cpm)		Vieta de la composición del composición de la composición de la composición del composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la composición de la comp	
β BKG COUNT	RATE:	480	(ct	m) β B	KG RANGE:		384		то	57	(cpm)
α SOURCE AV	ERAGE:	2586.6	10-10-0	pm) αS	OURCE RANGE	(± 20% AVG): 2	069.28	то	3103.	
β SOURCE AV	ERAGE:	7897.	<i>γ</i> (c)	om) BS	OURCE RANGE (± 20% AVG.): (80.818a	то с	777	The state of the s
PART 2:	2	3				SPONS	E TEST				
DATE	TIME	CAL. DUE (Enter Date)	BATT. (S/U)	H.V. (Valts)	6 THRESHLD α/β (S/U)	ВАСК	7 GROUND 8	8 α SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE (Gross CPM)	10 S/U/ Number	11 SIGNATURE
1-3-18	0800	12-19-18	5	S	5	0.1	516	2700	4772	S	This a Dia
1-4-18	אורט		S	S	S	0.1	461	2705	7737 W	S	Henda Duela
1-2-18	८४७०		S	3	5	0.1	499	2663	7924	S	Winley Dish
1-8-18	دوما		S	5	5	0.1	496	2581	7696	S	Vinency Sines
1-9-18	८७३०		5	S	5	0.1	516	2680	1944	S	Wieles Diel
1-10-18	0630		S	S	5	1	493	2581	1884	5	Wild Did
1-11-18	0630		S	S	S	1	472	2605	1984	১	Winder Sinds
1-14-10	Vers		S	2	8	2	477	2589	8102	S	Bialed Suids
t-14-18	0630		2	8	2	0-1	487	2642	7697	ک	Kinhay Sinda
1-17-18	ULBU		S	S	S	0.1	521	2601	7946	8	Minhey Sinde
1-18-18	0630		S	S	5	I	484	2424	8035	S	N . 9
1-22-18	0800		S	S	S	1,4	486	2570	8123	S	Oald da
1-23-18	0700		S	S	S	1.7	495	2398	7789	S	Ould On
1-24-18	0701	1	2	2	5	.7	497	2428	7908	S	Ould On
CT Supe	rvisor o	r Designe	e Signa	ature:	No	anil	(**************************************			3-14-18

ATTACHMENT L (SEC-RP-F-048)

SET UP DATE	I: `		LOCATIO	ON:			HV / C.S. THR:	/œ	8 -	BY:	
SERIAL #:		2	MODEL:					74	β:	DY:	
ROBE SERI	AL#:		PROBE				CAL. DUE:			EFF: oc	β:
LPHA INSTI	R. L _c :			(cpm			ALPHA MDC:		(d	CF: 0:	<u>В</u> :
EOMETRY:							SOURCE (S) T	VDE-	(dpm/100cm ²)	10.1	erupu satus 1979 - Timoria de Carlos de Carlos de Carlos de Carlos de Carlos de Carlos de Carlos de Carlos de Carlos de Car
5-MINUTE B	KG CNT (c	ounts): a: 1		,	2		COUNTS (cou			ID#:	1
	N.	NT (cpm): β:	1			LIOTAL	COOM 5 (COO	nts):	OR 1 10-MII	NUTE BKG	CNT (counts) :
(1-MINUTE)	SOURCE	CNTS ₁ (cpm):	œ1		2		3.		4		-
(1-MINUTE)	SOURCE	CNT\$ (cpm):	β: 1		2		3.		4		5
BKG COUN	T RATE:		(cp	om) a	BKG RANGE:		0 TO 5 (cpm)				5
BKG COUN	T RATE:		(ср		BKG RANGE:		3 10 3 (cpiii)		то		
SOURCE A	/ERAGE:		(cr		SOURCE RANGE (±20% AVG.)) -		то		(cpm)
SOURCE AV	/ERAGE:		(cp	1	SOURCE RANGE (**************************************			(cpn
ART 2:			*******	7.7	The second secon	SPONSI	AND DESCRIPTION OF THE PERSON		TO		(сри
DATE	TIME	CAL DUE (Enter Date)	BATT. (S/U)	5 H.V. (Volts)	1 wp	BACK	7 GROUND	8 α SOURCE RESPONSE	9 β SOURCE RESPONSE	10 S/W Number	11 SIGNATURE
-29-18	0800	12-19-18	5	5	(s/u)	j	497	(Gross CPM) 2633	(Gross CPM)	C	000
1-30-18	0800	2	S	S	S	.4	466	2649	AND AND AND AND	2	Oak A Van
					1	• (100	2011	7991	5	Wald Um
				AND COLUMN							
								IL CONTROL OF THE PROPERTY OF			
									3)		
		-									
							10				1095
						To .					
								(2)			
					-				2		
					2						E 8
								7			3
		V	1		+			and the second second		1	

ATTACHMENT L (SEC-RP-F-048)

Meter :	# L 14	989	SASTISTIC D	N aller de			Probe #	PR29398	13		48
RT 1:					INITIAL	REFERE	NCE RESI	ONSE TEST			
SET UP DATE	= 12-1	1-17	LOCATI	ON: Bi	Iding 18	1	HV/C.S. THR:	680 100 1	lo B:4-40	BY:	Chile-
SERIAL #: 2			MODEL		1360			11-17-18	. 1 10		43.67% B. 51.94%
PROBE SERI	- 31 - A1	3983	PROBE	MODEL:	48-93			11-17-18		77.0	2.29 B 1.93
ALPHA INSTI				(cpm)			ALPHA MDC:		(dpm/100cm ²)	15.1	μ (
		Surfce					SOURCE (S) T	YPE: 514-90)	Th-270	ID#: %2	344-526 82341A-526
	El	counts): a: 1	-	2		TOTA	L COUNTS (cou	nts):	OR 1 10-MI		CNT (counts): 6/4625
1 (1-MINUTE) BKG COU	NT (cpm): B:	1	173							
5 (1-MINUTE)	SOURCE	CNTS (cpm):	er 1	1278	2	240	3.	2460	4 2	424	5. 2397
5 (1-MINUTE)	SOURCE	CNT\$ (cpm):	β: 1	785	0 2	772	۵.	7748	4. 780		5. 7679
α BKG COUN	T RATE:	0.6	(9	pm) a	BKG RANGE:	S Well	0 TO 5 (cpm)		4		5. (01)
BKG COUN	T RATE:	462.5	(q		BKG RANGE:	3-	70		то	828	
SOURCE AT	VERAGE:	2411.2	(0	pm) as	SOURCE RANGE			18,94		2893	11 (cpin)
SOURCE AV	/ERAGE:	7755.	8 (9		OURCE RANGE	20		L8. FD-		1311.7	(cpin)
PART 2:	2	3	4			CHARLES OF THE PARTY OF THE PAR	E TEST				(cpm)
DATE	TIME	CAL DUE (Enter Date)	BATT.	H.V. (Valts)	6 THRESHLD 邮 (S/U)		7 KGROUND	8 α SOURCE RESPONSE	9 β SOURCE RESPONSE	10 S/U/ Number	11 SIGNATURE
12-12.17	0133	11-17-18	5.	S	S	. /	1441	(Gross CPM)	(Gross CPM)	S	N- NO
12-13-17	0715		5	S	3	2	467	2489	7746	S	Wintely Ducken
1214-17	งางง		5	3	3	5	499	2490	7733	S	Minhely Buch
2-18-17	טטט	9	S	S	S	1	488	2477	7748	5	Winted Sinds
2-19-17	5715		5	S	S	1	476	2409	7900	3	Winhey Janke
12-20-17	บาผง		S	S	S	3	467	2530	7123	8	Bully Sude
12-21-17	งาเม		S	2	S	0.1	426	2518	7883		Bushey Sichen
-2-18	0900		S	S	S	0.1	430	2423	7595	3	Wainley Sinch
-3-18	0800		2	3	S	1	420	2339	7675	5	Would Sule
-4-18	שזור	24 100	S	2	S	1	464	2448	7792	S	Wesley Lande
-8-18	U800		2	3	S	0,1	470	2443	7671	5	Harrier Sole
-8-18	0640		S	S	S	2	442	2390	7518	5	Minhay Sunday
1-9-LY	0630		S	S	S	0.1	418	2468	7692		Wantely Such
-10-18	0630	1	S	S	S	2	470	2388	7787	2	Mulerly Dide
CT Supe	rvisor (or Designe	e Sien	oh	1	7		(###			Hulesh Dishes
			~ Olyile	ature;	your	XL_				Date: _	3-14-18

ATTACHMENT L (SEC-RP-F-048)

Meter #	1214	420	<u> </u>	42° Marian De				Probe #	PR2930	83		
AT 1:				· C. U.S. S.			THE RESERVE AND A STATE OF THE SHAPE	NCE RESI	PONSE TEST			
SET UP DATE	= 12-11	-17		LOCATI	ON: Bui	Iding 18	1	HV / C.S. THR:	680 10 13	N 8:4-40	BY:	Kbuider
SERIAL #: Z	7495	59		MODEL:		الون	- 1	CAL. DUE:	11-17-18		FFF: m	43.67% \$ 51.94%
PROBE SERI		983	lio	PROBE	MODEL:	43-93		CAL DUE:	11-17-18			2.29 B: 1.93
ALPHA INSTE					(cpm)			ALPHA MDC:		(dpm/100cm ²)		
GEOMETRY:		***************************************				27		SOURCE (S) T	YPE: Th-230	5,4-90	ID#:82	341 A-526 82344 - 526
5-MINUTE B					2_		TOTAL	COUNTS (cou	ints):	OR 1 10-MIN	UTE BKG	CNT (counts): 4 4628
(1-MINUTE)	BKG COU	VT (cpm)	: β: 1		175							
(1-MINUTE)	SOURCE	NTS (cp	m): 0	E1	1278	2	2497	3.	2460	4. 2.4	124	5_
(1-MINUTE)	SOURCE	NT\$ (cp	m): B	:1	1820	2	772	3	7748	478	162	5. 7079
BKG COUN	T RATE:	0.0	-	(0	om) a B	KG RANGE:		0 TO 5 (cpm)				
BKG COUNT		46		(9	om) BBI	(G RANGE:	3-	10		то	228	(cpm)
SOURCE AV	1000	241			pm) a Sc	OURCE RANGE	(±20% AVG.	192	8.96	то	2893	(cpm) +4.
PART 2:	ERAGE:	77	87.	g (d	om) BSC	OURCE RANGE	And the second second second	THE RESIDENCE OF THE PARTY OF T	17.84	то	9311	.7 (cpm)
1 DATE	2 TIME	CAL.		4 BATT.	5	6	SPONS	7	8	9	10	
		(Enter		(S/U)	H.V. (Volts)	THRESHLD	BACK	GROUND B	α SOURCE RESPONSE	β SOURCE RESPONSE	S/U/ Number	SIGNATURE
-11-18	0630	11-1-	7-18	5	S	S	0.1		(Gross CPM)	(Gross CPM)	-	
1-12.18		1		S		WEST-COMM	0.1	480	2423	7745	2	Bumbaly Sudia
					S	5	1	429	2494	7701	8	Minhey Direl
-1ce-18	0638			S	8	S	0.1	460	2494	7456	8	Minhah Singres
-17-18	0630			8	S	5	1	438	2389	7705	8	16: 0 ° 1.0
-18-18	bleso			8	S	5	-	444	2480	7799	5	Tuntey Scrole
-22-18	0800			5	5	S	i	451	Company of the Compan			Munday Side
-23-18	0700			5	5		L L		2406	7764	S	Dalfila
		7				2		460	2451	7842	2	Oal A O_
-24-18				5	S	S	1	477	2424	7746	S	Oals In
-25-18	0700			5	S	5	1	440	2384	7819	2	ValA U -
26-18	0700			S	5	S	1	433	2366	7697	S	
-29-18	0800			5	S		1			7.0		Och Om
30-18		-		-		S		455	2484	7734	S	Dalf On
35-10	7 0 -0	-		S	2	S		456	2657	7599	S	Oal A On
		1	,									
OT 0	rvisor o	_				11/	n					3-14-16

ATTACHMENT R (SEC-RP-F-054) FLOOR MONITOR INSTRUMENT RESPONSE/DAILY TEST SHEET (Use for Model 12, 2221, 2224, 2224-1 or Model 2360 with 43-37 probe)

Meter # 287606 Probe # 71278379 PART 1: INITIAL REFERENCE RESPONSE TEST SET UP DATE: 12-19-17 LOCATION: Building 181 HV / C.S. THR: BY-B: SERIAL#: 287404 MODEL: 2360 11-17-18 CAL DUE: EFF: CE NIA 38,45 B: NIA 45.17 PROBE SERIAL # 278379 PROBE MODEL: 43-93 CAL DUE: 81-17-18 CF. E NIA 2. 4 B: NIA 2.21 GEOMETRY: Glat Surfac SOURCE(S) TYPE Th-230 SIY-90 10 - 526 AL STO 1858 - 250 5 (1-MINUTE) BACKGROUND COUNTS (cpm): 2 5 (1-MINUTE) BACKGROUND COUNTS (cpm): Pc.1. 1009 1007 PIUL 1073 1040 1495 5 (1-MINUTE) SOURCE CNTS (cpm): c 1_ 1884 1594 1579 1574 5 (1-minute) SOURCE CNTS (cpm): B: 1. 5242 5234 5191 5089 5267 a BACKGROUND AVG: ■ BKG RANGE: 0 TO 18 (cpm) 1028.6 BACKGROUND AVG: 1234.32 B BKG RANGE (± 20% AVG.): 822.88 TO (cpm) 1559.4 SOURCE AVERAGE: SOURCE RANGE (±20% AVG.): 1247.68 1871-52 TO (cpm) 5204.6 SOURCE AVERAGE: 4163,68 4245.52 m (cpm) PART 2: RESPONSE TEST CAL DUE BATT. DATE TIME THRESHIR BACKGROUND a SOURCE **B SOURCE** SIUI SIGNATURE (Enter Date) (S/U or ±2% for (Volts) RESPONSE RESPONSE 22211 12-19-17/0730 11-17-18 5 5 2.5 959.9 1390 3480 Can 12.20-17 S 0730 S 5 4.1 1368 5514 960,4 1-3-18 1221-0 USGO 5 5 S 3.1 1349 5 873.3 5499 1-4-18 9 WYU S S 5 2.4 860,1 1361 8473 S 1-10-18 0800 S S 1054 5474 5 2.7 1357 1-11-18 5 U8W S 5 1.7 1047.6 1344 5483 S 0800 3 4967 4.3 5 < 903.1 1340 RCT Supervisor or Designee Signature: Date: 3-14-18

ATTACHMENT L (SEC-RP-F-048)

-9,764,00,84%	310	167		en gare	Company Control		Probe #	PR3378	17			
.RT 1:					INITI	AL REFE	RENCE RES	PONSE TEST				
SET UP DATE	12-11	1-17	LOCATI	ION: T	Buildin	1812	HV / C.S. THR	:800 10:17	LO 8:4-40	BY:	V Guide	
SERIAL #: 3			MODEL	. 2	360	0		4-17-18		EFF.	33,14% B: 36.6	2'/
PROBE SERIA	AL #: 33	7817	PROBE	MODE	L: 43.0	25		4-17-18			3.02 B: 2.73	
ALPHA INSTR				(cp	m)		ALPHA MDC:		(dpm/100cm ²)	jer: a:	3.0 = B: C.1.	,
GEOMETRY:	flat	Surface	2				SOURCE (S) T	Th- 230		ID#: 37	2344-526 82341A	82
5-MINUTE B	KG CNT (c	ounts): a: 1			_2	T			0.		CNT (counts): 489	
(1-MINUTE)	BKG COU	NT (cpm): β:	4	198					011 10 Hill	NOTE DAG	CNT (counts): Set 4 0.	=
(1-MINUTE)	SOURCE	CNTS (cpm):	z 1	20	81	2. 2	J92 3.	2099	4. 2	400	52112	
(1-MINUTE)	SOURCE	CNTS (cpm): j	3: 1	رون	21	2. le	188_3.	433 م		2239	5. 6195	8
BKG COUNT	RATE:	0.le	(c)	pm)	α BKG RANG	E:	0 TO 5 (cpm)				
BKG COUNT	RATE:	489.0	(c)	pm)	β BKG RANGE	i:	391.2		то	586	.8	pm)
SOURCE AV	ERAGE:	2071.4	' (c	pm)	a SOURCE RA	NGE (± 20%	AVG.): \Q	57.25	то	2485.	C 2.	20
SOURCE AV	ERAGE:	6235.	2 (0)	pm)	β SOURCE RA	NGE (± 20% /	AVG.):	988:16		7482	24	cpm)
PART 2:						A Company of Control o	NSE TEST					cpm)
DATE	TIME	GAL DUE (Enter Date)	BATT. (S/U)	H.\ (Vol	/. THRES		7 ACKGROUND a B	8 α SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE	10 S/U/ Number	11 SIGNATURE	
2-12-19	0733	4-17-18	5	S		1	473	2018	(Gross CPM)	5	Mand of No	
12-13-17	0718		S	S	5	2	488	2034	6296	5	Will a Di	-0
2-14-17	0700		S	5	5	5	461	1994	6213	5	this a his	
2-18-17	5700		5	5	5	٥.	1 424	2477	6238	5	William J	0
2-19-17	5715		5	5	S	2	496	2013	6348	5	This is a single	0
2-20-17	0700		S	S	S	1	USG	2019	6187	5	Vanley Sure	0
2-21-17	0700		S	S		1	444	2084	6216	5	bully De	<u>dh</u>
-2-18	0900		5	5		U,		1880	6374	5	World Dried	
-3-18	กเร		5	8			470	1988	6474		Vauly Die	^
-4-18	U730		S	5				1848		3	Meeled De	ol.
-8-18	0730		S	S	2000	2			6243	5	Buly Du	للم
8-18	U650		S	5	-		470	1946	6427	S	bully bind	da
-9-18	0450		S	S	5	0.1		1960	5981	8	buly And	_
	0648		5	5		0.1		1990	6261	2	Windy Sind	
1		4			3	7 3	466	1889	4072	S	Will Sind	-
Super	rvisor o	r Designe	e Signa	ature	:_ <u>U</u>	Kaon				Date: _	3-16-18	

ATTACHMENT L (SEC-RP-F-048)

SOURCE AVERAGE 1071. 4 (epm) SOURCE RANGE (270% AVG). 1657.25 TO 2445.92 (epm) SOURCE RANGE (270% AVG). 14988.16 TO 1482.24 (epm) TO 14	Meter #	310	164						Probe #	PR33781	17			
CAL DUE 4-17-17 PROBE REPORT 33111/ PROBE REPORT 2310 CAL DUE 4-17-17 PROBE REPORT 23111/ PROBE REPORT 23111/ PROBE REPORT 23111/ PROBE REPORT 23111/ PROBE REPORT COUNTY	.RT 1:					INI	TIAL	REFERE						
CAL DUE 4-17-17 PROBE REPORT 33111/ PROBE REPORT 2310 CAL DUE 4-17-17 PROBE REPORT 23111/ PROBE REPORT 23111/ PROBE REPORT 23111/ PROBE REPORT 23111/ PROBE REPORT COUNTY	SET UP DATE	12-11	-17	LOCATI	ION: T	Buildi	nel	9.1	HV / C.S. THR:	900 /a17	0 8:4-40	BY:	V (-	1
PROBE SERIAL : 337 % 7 PROBE MODEL					: 2	360	9				OF T- TO			
ALPHA MDC: (GPMT 100mT) ALPHA MDC: (GPMT 100mT) ALPHA MDC: (GPMT 100mT) ALPHA MDC: (GPMT 100mT) SOURCE (B) TYPE: Th. 230 5.4 - 90 D+ 873-W-526 D2341A-7 DATE CHAMUTE BKG CNIT (GOUNTS): (E) W 990 ALPHA MDC: (GPMT 100mT) TOTAL COUNTS (GPMT) S. 1 144 TO CHAMUTE BKG CNIT (GOUNTS): (E) W 990 ALPHA MDC: (GPMT) SOURCE (CNTS (GPMT) CS W 990 ALPHA MDC: (GPMT) SOURCE (CNTS (GPMT) CS W 990 ALPHA MDC: (GPMT) SOURCE (CNTS (GPMT) CS W 990 ALPHA MDC: (GPMT) SOURCE (CNTS (GPMT) CS W 990 ALPHA MDC: (GPMT) SOURCE (CNTS (GPMT) CS W 990 ALPHA MDC: (GPMT) CS	PROBE SERIA	L#: 33	7817	PROBE			284	NOT THE OWNER OF THE OWNER OWN			-	Carrier Street		
SOURCE AVERAGE SOURCE RANGE (2007) SOU	ALPHA INSTR	. L _c :			///	700	-/				(dnm/100am²)	CF: α:	3.02	в: 2.15
1. MANUTE BKG COUNT (counts): 2	GEOMETRY:	flat	Surface	2								ID #. (2)	1344 50	In so wa See
(-MANUTE) BING COUNT (COMP)						2.	TC X W. T							•
CLANNITE SOURCE CNTS (cpm) E1	1 (1-MINUTE)	BKG COU	NT (cpm): β: 1	4	18				2 000/110 (000	intoj.	OR 1 10-INI	NUTE BKG	CNI (counts):_	Ce14810
CHAINIVITE SOURCE CINTS (CPMP) P. 1. GLOT1 2 GLYS 3 GLYS 4 GLOS 5 GLYS 6 GLYS	5 (1-MINUTE)	SOURCE	CNTS (cpm): c	z 1	20	81	2	209	2 3	2059	. 7	15C24		2.12
BEG COUNT RATE: O. C. (pm) a BKG RANGE: 0.TO 5 (pm) DEG COUNT RATE: U. S. 9. 0 (pm) B BKG RANGE: 3 C. 2 TO 5 S C. 8 (pm) SOURCE AVERAGE: 7071. V. (pm) B BKG RANGE: 3 C. 2 TO 2445. 9.2 (pm) SOURCE AVERAGE: 7071. V. (pm) B BKG RANGE: 3 C. 2 TO 2445. 9.2 (pm) SOURCE AVERAGE: 7071. V. (pm) B BKG RANGE: 3 C. 2 TO 7482. 24 (pm) SOURCE AVERAGE: C. 2735. 2 (pm) B BKG RANGE: 3 C. 2 TO 7482. 24 (pm) SOURCE RAVERAGE: C. 2735. 2 (pm) B BKG RANGE: 2 C. 2 C. 2 C. 2 C. 2 C. 2 C. 2 C. 2	5 (1-MINUTE)	SOURCE	NTS (cpm): β	3: 1.	رون	21	0.10							
DENG COUNT RATE: 489.0 (cpm) B BKG RANGE: 391.2 10			8	-							4		5	Q113
SOURCE AVERAGE 7071.4 (opm) a SOURCE RANGE (= 20% AVG); (a 57.25) to 2445.92 (opm) p SOURCE RANGE (= 20% AVG); (a 57.25) to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7482.24 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7488.224 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7488.224 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7488.224 (opm) p SOURCE RANGE (= 20% AVG); 4988:116 to 7488.224 (opm) 4988.224 (op	B BKG COUNT	RATE:	489.0	1000				3			TO	501	8	
SOURCE AVERAGE C235.2 (opm) SOURCE RANGE (20% AVG.): 4984:16	SOURCE AV	ERAGE:	2071.4	(c)						51.25				(cpm)
PART 2: DATE TIME CAL DUE BATT H.V. (ORIS) THRESHLD BACKGROUND BACKGROUND CGROSS CPM) CGROSS CPM CGROSS CHANCE CGROSS COMP CGROSS CHANCE CGROSS COMP CGROSS CHANCE CGROSS COMP CGROSS CHANCE CGROSS COMP CGROSS CHANCE CGROSS CANCE CGROSS COMP CGROSS CHANCE CGROSS COMP CGROSS CHANCE CGROSS CHANCE CGROSS CHANCE CGROSS CANCE CGROSS COMP CGROSS CHANC	SOURCE AVE	ERAGE:	6235.	7	1				20		Alvinos de como de la	Real Water Commen		(cpm)
DATE TIME CAL DUE BATT. H.V. (SUI) PHYS THESHID BACKGROUND RESPONSE (Gross CPM) (Gross CP	PART 2:						Mark World		THE RESERVE OF THE PERSON NAMED AND ADDRESS OF THE PERSON NAME		10	1702		(cpm)
2-12-13 0733 4-17-18 3 S S I 473 2015 16427 5 Kindley Dinder 12-13-17 0715 S S S Z 485 2034 16296 5 Kindley Dinder 2-14-17 0710 S S S S J 461 1994 16213 5 Kindley Dinder 2-14-17 0710 S S S S O.1 424 2477 16235 5 Kindley Dinder 2-19-17 0710 S S S S J 496 2013 16348 5 Kindley Dinder 2-19-17 0710 S S S S J 496 2013 16348 5 Kindley Dinder 2-20-17 0710 S S S J 496 2019 16187 5 Kindley Dinder 2-21-18 0900 S S S J 444 2084 16216 5 Kindley Dinder 2-2-18 0900 S S S J 496 1880 16374 5 Kindley Dinder 3-18 0715 S S S J 470 1985 16474 5 Kindley Dinder 3-18 0730 S S S J 470 1946 16473 5 Kindley Dinder 3-18 0730 S S S J 470 1946 16473 5 Kindley Dinder 3-18 0450 S S S J 471 1960 5981 5 Kindley Dinder 3-18 0450 S S S J 441 1989 16072 5 Kindley Dinder 3-18 0450 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 0450 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 0450 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 0450 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 04550 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 04550 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 04550 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 04550 S S S J 3 466 1889 16072 5 Kindley Dinder 3-18 04550 S S S J 3 466 1889 16072 5 Kindley Dinder	DATE	TIME	CAL. DUE	BATT.	H.1	ts) THR	ESHLD α/β		GROUND	a SOURCE RESPONSE	β SOURCE RESPONSE	S/U/	SI	
12-13-17 0715 S S S 2 458 2034 6296 5 Kimberly Dind 2-14-17 0700 S S S S O.1 424 2477 6235 5 Kimberly Dind 2-14-17 0716 S S S S O.1 424 2477 6235 5 Kimberly Dind 2-14-17 0716 S S S S O.1 424 2477 6235 5 Kimberly Dind 2-14-17 0716 S S S S 1 456 2079 6187 5 Kimberly Dind 2-12-17 0700 S S S I 444 2084 6216 5 Kimberly Dind 2-2-18 0800 S S S I 444 2084 6216 5 Kimberly Dind 2-18 0800 S S S O.1 486 1880 6374 8 Kimberly Dind 2-1-18 0730 S S S O.1 486 1880 6374 8 Kimberly Dind 2-1-18 0730 S S S O.1 486 1886 6474 8 Kimberly Dind 2-1-18 0730 S S S O.1 486 1848 6243 8 Kimberly Dind 2-1-18 0730 S S S O.1 486 1848 6243 8 Kimberly Dind 2-1-18 0730 S S S O.1 476 1848 6243 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S S O.1 471 1960 5981 8 Kimberly Dind 2-1-18 0750 S S S S S S S S S S S S S S S S S S	12-12-13	0733	4-17-18	5.	S			1			20 60 2 505	5	16. 1 s	N 0
2-14-17 0700 S S S S S O.1 424 2477 6235 S Knowledge Dick 2-18-17 6700 S S S S O.1 424 2477 6235 S Knowledge Dick 2-19-17 5715 S S S S 2 4916 2013 6348 S Knowledge Dick 2-20-17 0700 S S S S I 456 2079 6187 S Knowledge Dick 2-21-17 0700 S S S S I 444 2084 6216 S Knowledge Dick 2-21-18 0900 S S S S O.1 486 1880 6374 S Knowledge Dick 2-3-18 0715 S S S I 470 1985 6474 S Knowledge Dick 2-3-18 0730 S S S S O.1 485 1845 6243 S Knowledge Dick 2-6-18 050 S S S O.1 471 1960 5981 S Knowledge Dick 2-9-18 0650 S S S O.1 491 1990 6261 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S 3 466 1889 6072 S Knowledge Dick 2-10-18 0645 V S S S S S S S S S S S S S S S S S S	12-13-17	0718		S	S	3	Š	2	488	2034	10296		Vanie	Die
2-18-17 (5700 S S S O.1 424 2477 (235 S Knowly Dind) 2-19-17 (5715 S S S S 2 4912 2013 (2348 S Knowly Dind) 2-20-17 (5700 S S S I 456 2019 (2187 S Knowly Dind) 2-21-17 (5700 S S S I 444 2084 (2216 S Knowly Dind) 2-2-18 (5900 S S S O.1 426 1880 (2374 S Knowly Dind) 2-3-18 (5715 S S S I 470 1985 (4774 S Knowly Dind) 2-4-18 (5730 S S S O.1 485 1845 (2243 S Knowly Dind) 2-8-18 (550 S S S O.1 471 1990 (5701 S Knowly Dind) 2-9-18 (550 S S S O.1 471 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S O.1 491 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S S O.1 491 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S S O.1 491 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S S O.1 491 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S S O.1 491 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S S O.1 491 1990 (5701 S Knowly Dind) 2-10-18 (550 S S S S S S S S S S S S S S S S S S	12-14-17	0740		5	5	3 3	3	5	461	1994			16:10	J Succession
2-20-17 0700 S S S S I USG 2079 6187 S Windy Direct 2-21-17 0700 S S S S I U44 2084 6216 S Windy Direct 2-218 0900 S S S S 0.1 426 1880 6374 S Windy Direct 2-3-18 0715 S S S I U70 1988 6474 S Windy Direct 2-4-18 0730 S S S S 0.1 488 1848 6243 S Windy Direct 2-8-18 0720 S S S S 2 U70 1946 6471 S Windy Direct 2-8-18 050 S S S O.1 471 1960 5981 S Windy Direct 2-18 0650 S S S O.1 491 1990 6261 S Windy Direct 2-10-18 0665 S S S O.1 491 1990 6261 S Windy Direct 2-10-18 0665 S S S S S S S S S S S S S S S S S S	12-18-17	(2)00		5	5	. <	<u>S</u>	0.1	424	2477	6238		bilil	Diel.
2-70-17 0700 S S S S I 456 2079 6187 S Willy Died 21-17 0700 S S S S I 444 2084 6216 S Willy Died 2-18 0900 S S S S O.1 486 1880 6374 S Willy Died 3-3-18 0715 S S S I 470 1988 6474 S Willy Died 3-5-18 0730 S S S S O.1 485 1845 6243 S Willy Died 3-8-18 0730 S S S S 2 470 1946 6471 S Willy Died 3-8-18 050 S S S S O.1 471 1960 5981 S Willy Died 3-9-18 0650 S S S S O.1 471 1960 5981 S Willy Died 3-9-18 0650 S S S S O.1 491 1990 6261 S Willy Died 3-10-18 0645 S S S S S S S S S S S S S S S S S S S	12-19-17	७२१४		5	S		É	2	496	2013	6348		Th' 10	1
1-21-17 0700 8 8 8 1 444 2084 6216 5 While Direct of the control o	2-20-17	0700		S	S		S	1		2019	(0187		Vanie	J Duren
-2-18 0900	2-21-17	0700		8	S	, (3	t				-	11	y Birds
-3-18 0715	-2-18	0900		5	S	5	2	٥,١					,]
-4-18 0730 S S S O.1 485 1845 6243 S Willy Diele -5-18 0730 S S S S 2 470 1946 6471 S Willy Diele -6-18 0650 S S S S O.1 471 1960 5981 S Willy Diele -10-18 0645 V S S S S 3 466 1889 6072 S Willy Diele -10-18 0645 V S S S 3 466 1889 6072 S Willy Diele	-3-18	מזוצ		5	8	5		1) hall
-8-18 0730 S S S 2 470 1946 6477 S Willy Sinds -8-18 0650 S S S 0.1 471 1990 6761 S Willy Sinds -9-18 0650 S S S 0.1 491 1990 6761 S Willy Sinds -10-18 0645 V S S S S 3 466 1889 6072 S Willy Sinds	-4-18	0730			S			0.1		enw e			Marin o	y Jamel
-8-18 0650 S S S O.1 471 1960 5981 S Winling Sindle Supervisor or Designer Signature. -8-18 0650 S S S S S S S S S S S S S S S S S S S	-8-18	0730		S	S	5							Vandel	1 Such
-9-18 0650 5 5 5 0.1 491 1990 6261 5 Windy Sindy	-18-18	U650		S	5						EU.		Vandul	Jamala 1
-10-18 0645 \$ 5 5 5 3 466 1889 6072 5 Will Dish	-9-18	0450		S									Mulul	of Sunda
CT Supervisor or Designed Signature	-10-18	2400	1	5	S	3								2 c
Date: 3-16-18	Super	visor o	r Designee	Signa	ature	:(Va				0,016	Date:		Sudo

ATTACHMENT L (SEC-RP-F-048)

110 72032	#3101	10	The Company	THE COURSE	A PROPERTY AND ADDRESS.	5.3.2.5cm	Probe #	PR3378	20		
RT 1:			100,000	OMASS SEE			ENCE RES	PONSE TEST			andre de la companya de la companya de la companya de la companya de la companya de la companya de la companya
SET UP DAT			LOCA	TION: B	ilding 18	51	HV / C.S. THR	: 800 /es/	20 B: 4.40	BY:	K Guider
SERIAL #: 3			MODE		360	me ven	CAL. DUE:	4-17-1	Š	FEE:	32.83 1. B. 41.49.
PROBE SERI		7820	PROB	E MODEL:	43.89		CAL. DUE:	4-17-1			3.05 B: 2.41
ALPHA INST				(cpm)			ALPHA MDC:		(dpm/100cm ²)		д. С. Т.
GEOMETRY:							SOURCE (S)	TYPE: Th-230	814-90	ID#: 8	2344-526 82341113-572
2 5-MINUTE E	The second second second			2		TOTA	L COUNTS (co	unts):	OR 1 10-MI	NUTE BKG	CNT (counts): 8/5410
1 (1-MINUTE) BKG COU	NT (cpm):	β: 1	50G							
5 (1-MINUTE) SOURCE	CNTS (cpm)	c: 1	2006	<u> </u>	204	٦3.	2086	4 2	رکون	5. 2080
5 (1-MINUTE) SOURCE	CNT\$ (cpm):	: β: 1	670	2 2.	رون	35 3	1780		830	
α BKG COUN	IT RATE:	0.8		(cpm) a	BKG RANGE:	19	0 TO 5 (cpm			030	
BKG COUN	T RATE:	543.	٥ (BKG RANGE:		434.	:	то	(e51.1	
a SOURCE A	VERAGE:	200	2	(cpm) a	SOURCE RANGE	(±20% AVG			то		Cpm C
B SOURCE AT	VERAGE:	676	۵.8	1	SOURCE RANGE		18-38-3-37	413,44		8120	ССРИ
PART 2:	2	3			THE RESERVE OF THE PARTY OF THE	ESPONS				* 43	(сри
DATE	TIME	CAL DU (Enter Da			6 THRESHLD	BAC	7 (GROUND	8 α SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE	10 S/U/ Number	11 SIGNATURE
15-15-17	0.31	4-17-1	18 5	. 5	5	2	309	2012	(Gross CPM)	3	11 . 0 . 0 . 0
15-13-13	3110		S	5	S	0.1	241	2001	7120	5	Montely Sud
12-14-17	07.60		S	S	5	3	499	2004	نو۹۱۱	5	Kunliely Bush
12-18-17	6700		S	5	S	0.1	527	2097	6727	5	Winley Such
2-19-17	5715		8	8	5	2	281	2027	6878	5	Menticaly Durch
2-20-17	0700		2	5	S	2	467	2002	1850	5	This a him
2-21-17	บางง		8	2	S	2	490	2004	6982	5	Winder Dinder
-2-18	5900	15 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8	8	8	1	510	1917	7018	S	
3-18	21.12		2	S	8	1	811	1869	6862	S	Hindrey Durch
81-4.	U800		8	S	S	0.1	428	1856	6882	8	Miles Suide
-2-18	0750		8	8	S	0,1	514	1929	(e761	3	Winley Sinder
81-8-	U630		8	S	S	4	531	1881	6698	S	161 () compre
-9-18			5	8	8	0*1	808	1890	6840	5	Villey Backs
1			6	-					0,70		Mundely Suda
-10-18	U045	V	5	2	5	0.1	546	2028	6938	5	Winley Sinda

ATTACHMENT L (SEC-RP-F-048)

Meter #	3101	70					20.50	Probe #	PR337 87	20		8
RT 1:				121. - Cites 2.		INITIAL I	REFERE		PONSE TEST			
SET UP DATE	12-11	-18		LOCATI	ION: B	wilding 18	()	HV / C.S. THR	: Sris > 1 a= \ ?	U B:4-40	BY:	V (
SERIAL #: 3	10170		Š	MODEL		360			4-17-18	7,440		K Guider 32,83% B.41.49%
PROBE SERIA	AL#: 33	782	0	PROBE					4-17-18		1	Mary Services
ALPHA INSTR					(cpr	n)	***	ALPHA MDC:		(dpm/100cm ²)	TCF: @:	3.05 B: 2,41
GEOMETRY:	flet	Sur	tace					SOURCE (S) T	YPE: Th-2301	S.Y-90	ID#: 80°	44-526 82341A-521
2 5-MINUTE B	KG CNT (co	ounts): c	£ 1			2			ints):			CNT (counts): \$\5410
1 (1-MINUTE)	BKG COU	NT (cpm)): B: 1	L	500	٩				3		
5 (1-MINUTE)	SOURCE	NTS/(cp	om): 0	= 1.	200	ی 7ء	204	٦ 3.	20086	. 7	<u></u>	2.55
(1-MINUTE)						102 2	in the Political					5. 2080
x BKG COUN		0.5	11.1				603	33	1780	4. (2830	5. <u>673</u> 4
BKG COUNT			3.0			α BKG RANGE:		0 TO 5 (cpm))			
x SOURCE AV	10000		162	5000		B BKG RANGE:		34.4	10	то	681.	
SOURCE AV	RADOLES .		ر وال	•	1	SOURCE RANGE		-W-9	249.le	то	2474	(сріп)
PART 2:			40.	9 (6	pm)	SOURCE RANGE	±20% AVG	A DESCRIPTION OF THE PERSON NAMED IN	113.44	TO	8150	-1 (cpm)
1 DATE	2 TIME		DUE	BATT.	5 H,V	6		7	8	9	10	
		(Enter	Date)	(S/U)	(Volt		BACK	GROUND B	α SOURCE RESPONSE (Gross CPM)	β SOURCE RESPONSE (Gross CPM)	S/U/ Number	11 SIGNATURE
1-11-18	0630	4-1	7-18	5	8	S	2	570	1967	6946	3	W
1-18-18	Octo	- 1	2	S	3	S	(یرن	520			3	Mindely Buch
1-16-18	5700			8	5	S	1	1	1851	4786		Venlag Sude
							1	491	1959	6618	5	Henley Side
1-17-18	0700			5	S	S	0.1	510	1916	7024	2	Hinley Disles
	0645			8	2	S	1	517	1850	6949	8	Winhuly Dishes
1-26-18				S	S	S	. [521	1957	6792	S	OUNU_
1-29-18	0700			S	S	5	. 1	514	2012	6869	5	Odd Um
							-					-5(1, 0.4
eroedya-eestavas												
	Of								8			=
	-								2000			
		1				1 1						*
			,					241	* ***			5

ATTACHMENT L (SEC-RP-F-048)

11 5.43	# 31W	179	Service Control	10 t 10+2		of Managha Resent	Probe #	PR3378	-12		2
RT 1:		A Maria			INITIAL	REFERE	NCE RES	PONSE TEST			
SET UP DATE	12-1	1-17	LOCAT	ION: B	ullaing 1	81	HV / C.S. THR	: 778 /#1	200 B:4-40	BY:	70.1
SERIAL #: 3	10179	1	MODEL		SLED		CAL. DUE:	4-17-19	7	-1	Guder
PROBE SERI		1818	PROBE	MODEL:	43-89		CAL. DUE:	4-17-1		CF: 00	31,26% \$32.49%
ALPHA INSTI				(cpm)			ALPHA MDC:		(dpm/100cm ²)	[CF: @:	3.2 B: 3.08
		Surfa	رو				SOURCE (S) T	YPE: SVY-90		ID#:5	2344-526 823418-
2 5-MINUTE B	KG CNT (c	ounts): a: 1		2		TOTA	L COUNTS (co				i CNT (counts):
1 (1-MINUTE)	BKG COU	NT (cpm): β:	1	488					E1	National Association of the Control	
5 (1-MINUTE)	SOURCE	CNTS _(cpm) :	œ1	205	2 2	1965		1983	. 10	148	1070
5 (1-MINUTE)	SOURCE (:NT\$ (cpm):	B: 1.	١١٥١١		6180				V TO THE REAL PROPERTY.	5. 1979
α BKG COUN		0.9				010		6119	4. (0	522	5_ 5984
B BKG COUNT	RATE:	465.9			BKG RANGE:	27	0 TO 5 (cpm))			
a SOURCE AV		1985,	1		SOURCE RANGE	1114		· · · · ·	G G G G G G G G G G G G G G G G G G G	559.0	(GPRII)
SOURCE AV	ERAGE:	6103.8			SOURCE RANGE			883.04		2382	(cpin)
PART 2:					The second of th	ESPONS	CONTRACTOR AND ADDRESS OF THE PARTY OF	0 0 3.04	то	7324	. 8 (cpm)
DATE	7 TIME	3 CAL DUE (Enter Date)	BATT. (S/U)	5 H.V. (Volts)	6 THRESHLD α/β		7 GROUND	8 α SOURCE RESPONSE	9 β SOURCE RESPONSE	10 S/U/ Number	11 SIGNATURE
12-12-17	O733	4-17-11	5.	3	(S/U)	ο.1	469	(Gross CPM)	(Gross CPM)		
12-13.17	0718		5	5	S		448	1907	6246	5	Mules Deid
2-14-17	いつい		5	5	5	0.1	464	1989	6086	2	Whenhay Sinh
2-18-17	७२७०		3	5	S	2	450	2017	(2007)	5	Merchy Davids
2-19-17	0715		S	S	5	0.1	473	2046	ieles	5	Hunley Durch
2-20-17	ONO		S	5	5	١	492	2099	5689	S	Marily Duck
221-17	SOLO		S	S	5	١	448	1983	Lever	5	Menhely Dinols
-2-18	U900		2	S	2	2	483	1894	6231	5	bunkal Sil
	0730		Š	S	5	0.1	446	1889	Lelau	5	Henday Durch
	0730		5	S	S	0.1	462	1879	6027	5	This a him
	0120		5	S	8	0.1	397	1923	5922	S	Winds I Dides
	0640		3	S	5	1	434	1838	5708	S	Muchel Doub
	0620		S	S	S	0.1	452	1982	59.47	S	Wall & Duisla
	0642	1	2	S	S	0.1	504	2000	5987	S	Warhal Did
Super	visor o	r Designe	e Signa	ature: _	()=	trik				Date	D
į.										Date:	3-14-18

ATTACHMENT L (SEC-RP-F-048)

SET UP DATE	= 12-1	I-\7	LOCAT	ION: R	milding 18	1	HV / C.S. THR	:775 /=12	ν β:4-40	BY: dx	1 G : 10 -
SERIAL #: 3	1017	9	MODEL	: 2	360			4-17-18	0 19-90		1 Credo 1
PROBE SERI	AL#: 33	7815	PROBE		: 43-89		CAL. DUE:	4-17-18			31.26% B: 32.49%
ALPHA INSTI				(cpn	n)		ALPHA MDC:	The state of the s	(dpm/100cm ²)	CF: @:	3,2 B: 3,08
		Surfa	ce				SOURCE (S) T	YPE: 5,47-90	Th-230	ID#: %	2-844-250 B5341B-8
5-MINUTE B	KG CNT (co	ounts): a: 1			2			ınts):			CNT (counts): 9 4309
(1-MINUTE)	BKG COU	IT (cpm): β:	i	455	5				X		
(1-MINUTE)	SOURCE	NTS (cpm):	a: 1 7	205	2 2	1962	3.	1983	4. 19	148	5. 1979
(1-MINUTE)	SOURCE	NT\$ (cpm):	B: 1	60	\\ 2.	6180		6119		255	
BKG COUN	T RATE:	0.9	(0	pm)	a BKG RANGE:	Non-Alleria de	0 TO 5 (cpm				5. 3984
BKG COUN		465.9		pm) p	BKG RANGE:	3	72.72	V	то	559.	()\$
SOURCE AV	/ERAGE:	4.2891	(c	pm) o	SOURCE RANGE	WARE THE SAME TO SAME THE	15 7-15	8.32		2382	18 Jepin
	/ERAGE:	6103.8	(0	pm) p	SOURCE RANGE (± 20% AVG.		883.04		7324	56
PART 2:	2	3	4			SPONS	E TEST	7120			(cpin
DATE	TIME	CAL DUE (Enter Date)	BATT. (S/U)	H.V. (Volts		BACK	7 GROUND B	8 a SOURCE RESPONSE (Gross CPM)	9 β SOURCE RESPONSE (Gross CPM)	10 S/U/ Number	11 SIGNATURE
511-18	0630	4-17-18	5	5	5	0.1	484	1919	5884	5	Winds & Sine
81-18	0640		S	8	S	\	484	1859	5991	S	birly Die
i-16-18	Ulego	-	S	S	S	2	473	1798	5945	S	bill A Dio
1218	0630		8	2	S	4	452	1848	5901	8	Binbery Rides
0	0630		5	5	S	1	484	1833	5893	5	0
-22-18	0800		S	2	S	. [474	1874	5941	5	DA Var
-23-18	0700		S	5	S	1	472	1958	5795	S	Cal A Ven
-24-18	0700		S	S	5	.5	468	1936	5814	S	Walk On
25-18	0700		S	S	5	Ī	470	1945	5800	S	Walk On
26-18	0700		5	5	-5	+	433		000	7	0.00
26-18	0700		S	S	5		472	197/	Carr	C	(OA ()
31-18			5	5		4		1936	5927	2	Oct All
				_	1	4	453	1849	5553	S	Cacalornia
	1	1 1			1						

ATTACHMENT 6

Laboratory Analytical Report for Sediment Samples

2609 North River Road, Port Allen, Louisiana 70767 (800) 401-4277 -- FAX (225) 381-2996



ARS International, LLC

Laboratory Analysis Report

ARS1-18-00307

Prepared for:

ARS Aleut Remediation, LLC

Steve Shirley 802 E. Martintown Road, Suite 214 North Augusta, SC 29841

sshirley@aar-Ilc.com; jhampel@aar-Ilc.com

Phone: 803-442-7661

Project Manager Review

Notes: ARS International, LLC assumes no liability for the use or the interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

Contact Person: Questions regarding this analytical report should be addressed to:

Project Manager
ProjectManagers@amrad.com

Phone: 225.381.2991 Fax: 225.381.2996

LELAP Cert# 01949

Notes (Case Narrative):

General Comments:

- 1.0) Soil and Sludge analysis are reported on a wet basis or an as received basis unless otherwise indicated.
- 2.0) Modified analysis procedures are procedures that are modified to meet the certain specifications. An example may be the use of a water method to analyze a solid matrix due to the lack of an officially recognized procedure for the analysis of the solid matrix.

 Modified analyses are indicated by the subsequent addition of "m" to the procedure number (i.e. 900.0M).

Radiochemistry Comments:

- 1.0) All MDA/MDC values are calculated on a sample specific basis.
- 2.0) Data in this report are within the limits of uncertainty specified in the reference method unless otherwise specified.
- 3.0) Total activity is actually total gamma activity and is determined utilizing the prominent gamma emitters from the naturally occurring radioactive decay chains and other prominent radioactive nuclides. Total activity may be lower than the actual total activity due to the extent of secular equilibrium achieved in the various decay chains at the time of analysis. The total activity is not representative of nuclides that emit solely alpha or beta particles.
- 4.0) Ra-228 is determined via secular equilibrium with its daughter, Actinium 228 (Gamma Spectroscopy only).
- 5.0) U-238 is determined via secular equilibrium with its daughter, Thorium 234 (Gamma Spectroscopy only).
- 6.0) All gamma spectroscopy was performed utilizing high purity germanium detectors (**HPGe**).
- 7.0) ARS makes every attempt to match sample density to calibrated density; however, in some cases, it is not practical or possible to do so and data results may be affected (Gamma Spectroscopy only).
- 8.0) Gamma spectroscopy results are calculated values based on the ORTEC® GammaVision ENV32 Analysis Engine.
- 9.0) ACLASS DOD and ISO 17025 certification applies only to the following analytes and methods: Gross Alpha and Gross Beta (EPA 900, SM7110B&C, SW846 9310); Radium 226 (EPA 903, EPA 903.1, SM 7500 Ra-B, SW846 9315); Radium 228 (EPA 904, SM 7500 Ra-B SW846 9320); Iodine-131(EPA 901.1); Uranium by ICPMS (EPA 200.8); Strontium 89/90 (EPA 905, Eichrom SRW01, HASL 300 Sr-03-RC); Tritium (EPA 906, EPA 906M); Gamma Emitters (EPA 901.1, SM7120B, HASL 300 Ga-01-R); Americium-241, Curium 242/244, Plutonium 239/240 and 241, Thorium 228/230/232, Uranium 234/233 and 238 (Eichrom ACW03 VBS); Lead 210 (HASL 300 Pb-01-RC, Eichrom OTW01); Polonium 210 (HASL 300 Po-01-RC, HASL 300 Po-02-RC); Technetium-99 (Eichrom TCW02, Eichrom TCS01M).

Definitions:

CRDL Contract Required Detection Limit
CSU Combined Standard Uncertainty

DLC Decision Level Concentration (ANSI N42.23) or critical level

DUP Duplicate Original Method Duplicate

LCS/LCSD Laboratory Control Sample/Laboratory Control Sample Duplicate

MDA Minimum Detectable Activity

MDC (Minimum Detectable Concentration) minimum concentration of the analyte that ARS can detect utilizing the specific analysis

MBL Method Blank

MS/MSD Matrix Spike/Matrix Spike Duplicate

N/A Not Applicable
NP Not Provided
NR Not Referenced
LOD Limit of Detection
LOQ Limit of Quantitation

MCL Maximum Contaminant Level

Data Qualifiers:

B The analyte is found in both the associated method blank and the sample. This flag indicates probable blank contamination.

D Sample analysis accomplished through dilution.

J The reported result is an estimated value above the limit of detection but outside of quantitation range (e.g., matrix interference

was observed).

Q One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).

U Activity is below the MDC, MDA, MDL, or LOD

N The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are

tentatively identified.

* LCS/LCSD or MS/MSD fails RPD criteria.

S Spike

SC Subcontracted out to another qualified laboratory

H Holding time exceeded
E Exceeds MCL

E Exceeds MCL

** Reporting Limit is higher than MCL; Target cannot be detected



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-18-00307

Client Sample ID: CELL 6A1 I/S TRENCH

Sample Collection Date: 01/30/18

Sample Matrix: Soil/Solid/Sludge

Percent Solids: N/A

Request or PO Number: NA

ARS Sample ID: ARS1-18-00307-001

Date Received: 02/01/18 **Report Date:** 02/08/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/- 2 s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
U-234	4.155	0.671	0.102	0.034	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	82%
U-235	0.254	0.123	0.065	0.013	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	82%
U-238	28.850	3.678	0.169	0.068	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	82%
Be-7	0.324	0.547	0.924	0.462	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Bi-212	0.207	0.528	0.927	0.464	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Bi-214	0.526	0.199	0.267	0.134	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
K-40	3.147	1.118	0.982	0.491	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Pb-210	1.293	1.538	2.160	1.080	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Pb-214	0.582	0.200	0.274	0.137	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Ra-226	11.934	2.574	2.410	1.205	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Ra-228	0.689	0.320	0.421	0.211	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Sc-46	-0.015	0.070	0.121	0.061	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Th-228	1.128	0.227	0.211	0.106	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
TI-208	0.361	0.112	0.137	0.069	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
U-235	0.683	0.476	0.749	0.375	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
U-238	27.512	3.414	2.920	1.460	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Total NORM Gamma	48.949	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A
Total NORM Activity	160.550	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:21	ECAMP	N/A

Notes: American Radiation Services, Inc. assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.



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1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-18-00307

Client Sample ID: CELL 6B1 E. end UTILITY

Sample Collection Date: 01/29/18

Sample Matrix: Soil/Solid/Sludge

Percent Solids: N/A

Request or PO Number: NA

ARS Sample ID: ARS1-18-00307-002

Date Received: 02/01/18 **Report Date:** 02/08/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/- 2 s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
U-234	0.420	0.193	0.202	0.080	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	68%
U-235	0.028	0.066	0.132	0.041	NP	U	pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	68%
U-238	1.201	0.320	0.197	0.077	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	68%
Be-7	0.228	0.466	0.797	0.399	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Bi-212	2.513	0.680	0.485	0.243	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Bi-214	1.497	0.259	0.163	0.082	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
K-40	0.483	0.777	1.320	0.660	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Pb-210	2.395	1.440	1.790	0.895	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Pb-214	1.611	0.309	0.216	0.108	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Ra-226	4.391	2.242	2.380	1.190	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Ra-228	3.005	0.376	0.176	0.088	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Sc-46	0.000	0.055	0.101	0.051	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Th-228	3.047	0.306	0.162	0.081	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
TI-208	1.062	0.172	0.111	0.056	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
U-235	0.300	0.435	0.721	0.361	NP	U	pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
U-238	3.282	1.099	2.090	1.045	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Total NORM Gamma	28.619	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A
Total NORM Activity	60.196	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/05/18 13:22	ECAMP	N/A

Notes: American Radiation Services, Inc. assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-18-00307

Client Sample ID: NE ELECT. VAULT

Sample Collection Date: 01/29/18

Sample Matrix: Soil/Solid/Sludge

Percent Solids: N/A

Request or PO Number: NA

ARS Sample ID: ARS1-18-00307-003

Date Received: 02/01/18 **Report Date:** 02/08/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/- 2 s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
U-234	0.489	0.187	0.109	0.033	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	68%
U-235	0.055	0.063	0.050	0.000	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	68%
U-238	1.084	0.290	0.094	0.025	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	68%
Be-7	0.003	0.334	0.621	0.311	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Bi-212	0.263	0.381	0.636	0.318	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Bi-214	0.548	0.157	0.174	0.087	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
K-40	3.377	1.001	0.829	0.415	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Pb-210	0.576	0.874	1.570	0.785	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Pb-214	0.597	0.146	0.180	0.090	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Ra-226	3.420	1.564	1.730	0.865	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Ra-228	0.666	0.250	0.333	0.167	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Sc-46	-3.367E-4	0.013	0.098	0.049	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Th-228	0.723	0.157	0.163	0.082	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
TI-208	0.290	0.087	0.083	0.042	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
U-235	0.143	0.230	0.392	0.196	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
U-238	1.110	0.993	1.660	0.830	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Total NORM Gamma	11.870	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A
Total NORM Activity	25.493	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:49	ECAMP	N/A

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2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-18-00307

Client Sample ID: NW ELECT. VAULT

Sample Collection Date: 01/29/18

Sample Matrix: Soil/Solid/Sludge

Percent Solids: N/A

Request or PO Number: NA

ARS Sample ID: ARS1-18-00307-004

Date Received: 02/01/18 **Report Date:** 02/08/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/- 2 s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
U-234	0.436	0.166	0.085	0.023	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	73%
U-235	0.042	0.058	0.089	0.022	NP	U	pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	73%
U-238	1.624	0.361	0.114	0.037	NP		pCi/g	ARS-026/Eichrom ACW-03	02/07/18 16:26	SCAUSEY	73%
Be-7	-0.018	2.449	0.591	0.296	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Bi-212	0.172	0.348	0.610	0.305	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Bi-214	0.434	0.161	0.170	0.085	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
K-40	1.487	0.720	0.828	0.414	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Pb-210	2.854	1.105	1.170	0.585	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Pb-214	0.358	0.113	0.168	0.084	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Ra-226	1.960	1.036	1.190	0.595	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Ra-228	0.809	0.205	0.110	0.055	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Sc-46	-0.013	0.042	0.077	0.038	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Th-228	0.683	0.136	0.112	0.056	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
TI-208	0.091	0.054	0.076	0.038	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
U-235	0.114	0.259	0.441	0.221	NP	U	pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
U-238	3.310	0.889	1.130	0.565	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Total NORM Gamma	12.462	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A
Total NORM Activity	33.913	N/A	N/A	N/A	NP		pCi/g	ARS-007/EPA 901.1M	02/06/18 6:50	ECAMP	N/A

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QC Results per Analytical Batch

Analytical Batch	A1K31+3L3-(4)272
SDG	ARS1-18-00307
Analysis	Gamma Spec (Solid)
Analysis Test Method	ARS-007/EPA 901.1M
Analysis Code	GAM-A-SO
Report Units	pCi/g

Acceptable QC Performance Ranges									
QC Sample Type	Performance Items and Ranges								
Laboratory Control Sample	Recovery (%): > 75 < 125								
Matrix Spike	Recovery (%): > 60 < 140								
	Replicate Error Ratio (RER): < 1								
Duplicate	Duplicate Error Ratio (DER): < 3								
	Relative Pero	ent Difference (RPD %):	≤ 25						

Laboratory Control Sample		Analysis Date	02/05/18 10:46	Analysis Technician	EC <i>A</i>	AMP	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	Expected Value	LCS Rec (%)	MDC
ARS1-B18-00272-01	LCS	AM-241	3.914E+4	2.861E+3	4.000E+4	97.8	738.900
ARS1-B18-00272-01	LCS	CO-60	7.106E+4	3.164E+3	6.719E+4	105.8	821.700
ARS1-B18-00272-01	LCS	CS-137	5.981E+4	2.617E+3	5.727E+4	104.4	331.100

Duplicate RER/DER/RPD		Analysis Date	02/05/18 11:45	Analysis Technician	EC <i>A</i>	AMP	
Analyte	Results LCS	CSU LCS (2s)	Results LCSD	CSU LCSD (2s)	RER	DER	RPD
AM-241	3.914E+4	2.861E+3	3.917E+4	2.838E+3	0.010	0.014	0.1
CO-60	7.106E+4	3.164E+3	6.743E+4	2.987E+3	1.157	1.636	5.2
CS-137	5.981E+4	2.617E+3	5.666E+4	2.519E+3	1.202	1.700	5.4

ethod Blank		Analysis Date	02/05/18 12:16	Analysis Technician	ECAMP		
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	MDC	Qual	
ARS1-B18-00272-03	MBL	AM-241	2.040	18.793	34.100	U	
ARS1-B18-00272-03	MBL	BI-212	48.284	102.970	185.000	U	
ARS1-B18-00272-03	MBL	BI-214	-11.562	78.539	67.400	U	
ARS1-B18-00272-03	MBL	IR-192	1.689	11.816	21.500	U	
ARS1-B18-00272-03	MBL	K-40	-138.430	5.537E+3	565.000	U	
ARS1-B18-00272-03	MBL	PB-212	-11.427	60.076	55.600	U	
ARS1-B18-00272-03	MBL	PB-214	-27.703	207.520	69.300	U	
ARS1-B18-00272-03	MBL	RA-224	96.786	289.570	505.000	U	
ARS1-B18-00272-03	MBL	RA-226	530.760	299.280	333.000		
ARS1-B18-00272-03	MBL	RA-228	-31.142	169.720	119.000	U	
ARS1-B18-00272-03	MBL	SC-46	-3.313	2.736E+3	32.200	U	
ARS1-B18-00272-03	MBL	TL-208	-4.615	33.348	33.400	U	
ARS1-B18-00272-03	MBL	U-235	8.884	16.043	30.500	U	
ARS1-B18-00272-03	MBL	U-238	-30.690	239.280	391.000	U	

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QC Results per Analytical Batch

Analytical Batch	P1((\1.3 L 3 (\)) 273
SDG	ARS1-18-00307
Analysis	Uranium Solid, Waste, Biota, Sediment, Veg
Analysis Test Method	ARS-026/Eichrom ACW-03-15
Analysis Code	ASP-U-SO
Report Units	pCi/g

Acc	Acceptable QC Performance Ranges								
QC Sample Type	Performance Items and Ranges								
Laboratory Control Sample	Recovery (%):	> 75	< 125						
Matrix Spike	Recovery (%):	> 60	< 140						
	Rep	< 1							
Duplicate	Duplicate Error Ratio (DER): < 3								
	Relative Pero	cent Difference (RPD %):	≤ 25						

Laboratory Control Sa	ample		Analysis Date	02/07/18 16:26	Analysis Technician	SCAUSEY	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	Expected Value	LCS Rec (%)	MDC
ARS1-B18-00273-01	LCS	U-238	12.628	1.650	12.886	98.0	0.067

Duplicate RER/DER/RPD			Analysis Date	02/07/18 16:26	Analysis Technician	SCAUSEY	
Analyte	Results LCS	CSU LCS (2s)	Results LCSD	CSU LCSD (2s)	RER	DER	RPD
U-238	12.628	1.650	12.315	1.586	0.190	0.268	2.5

Method Blank		Analysis Date	02/07/18 16:26	Analysis Technician	SCAUSEY	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	MDC	Qual
ARS1-B18-00273-03	MBL	U-234	0.033	0.043	0.068	U
ARS1-B18-00273-03	MBL	U-235	-0.005	0.008	0.058	U
ARS1-B18-00273-03	MBL	U-238	0.005	0.029	0.068	U

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DEPARTMENT OF THE AIR FORCE WASHINGTON DC

31 May 2019

MEMORANDUM FOR NRC REGION IV
ATTN: Dr. Robert Evans

FROM: AFMSA/SG3PB

Subject: Attachment 2 of "Review of the Final Status Survey Report (FSSR) of the Phase 1 of the

Building 181 at Robins AFB GA" dated 20 Sep 18

We attached copy of the Verification Survey of the cell 5 and cell 6 of the Building 181 performed by the USAF School of Aerospace Medicine Occupational and Environmental Health Department/OECM Wright-Patterson AFB, OH to our cover memorandum "Review of the Final Status Survey Report (FSSR) of the Phase 1 of the Building 181 at Robins AFB GA" dated 20 Sep 18. This survey report currently has a limited distribution statement, and is not cleared for public release or posting on the NRC's public ADAMS database.

The verification survey is currently re-routing for security and public affairs release as publically available. We will supply the revised verification survey for public release when it becomes available for posting in ADAMS.

If you have any questions, please contact me at 703-681-6988 or email at alan.c.hale.mil@mail.mil

HALE.ALAN.C. Digitally signed by HALE.ALAN.C.1250341357 Date: 2019.05.31 10:04:50 -04'00'

ALAN C. HALE, Lt Col, USAF, BSC Chief, Radioisotope Committee Secretariat Air Force Medical Support Agency Office of the Surgeon General