DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

26 July 2011

MEMORANDUM FOR NRC REGION IV
DIVISION OF NUCLEAR MATERIAL SAFETY
ATTN: MS. COOK
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FROM: HQ USAF/SG (AFMSA/SG3PB)
1780 AF PENTAGON
WASHINGTON DC, 20330-1780

SUBJECT: Buildings 1181, 1191 and 1193 of Brooks City-Base, TX

Attached please find the Radiological Survey Report and Final Status Survey (FSS) Evaluation of Buildings 1181, 1191 and 1193, Brooks City-Base, TX as per the request of Mr. Evans. Approval of the FSS is required prior to demolition of the identifiifed buildings.

We request a priority review as we are trying to transfer the property to the State of Texas by September 2011 as per Base Realignment and Closure actions.

Questions on this matter should be directed to Dr. Ramachandra Bhat at DSN 425-6342, commercial 703-588-6342 or electronic mail at ramachandra.bhat@pentagon.af.mil.

David A. Smith, LtCol, USAF, BSC, PhD
Chief, Radioisotope Committee Secreatariat
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Atch
Survey of the Buildings1181, 1191and 1193, 15 Jul 11

cc:
HQ AFIA/SGI (Lt Col Sassi) Without Atch
311 ABG/CEA (Mr. Brown) Without Atch
USAFSAM/OEHH (Maj Hale) Without Atch
US Army (Lt Col Brown) Without Atch

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U.S. AIR FORCE BROOKS CITY-BASE RADIOLOGICAL SURVEY REPORT AND FINAL STATUS SURVEY EVALUATION FOR BUILDINGS 1181, 1191 AND 1193

SAN ANTONIO, TEXAS

JULY 15, 2011

311 Air Base Group
Civil Engineer Division
Brooks City-Base, Texas

U.S. AIR FORCE

U.S. AIR FORCE BROOKS CITY-BASE RADIOLOGICAL SURVEY REPORT AND FINAL STATUS SURVEY EVALUATION FOR BUILDINGS 1181, 1191 AND 1193

SAN ANTONIO, TEXAS

JULY 15, 2011

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ACRONYMS AND ABBREVIATIONS

ε	efficiency
µR	microroentgen
%	percent
Δ/σ	relative shift
σ	standard deviation
AEC	Atomic Energy Commission
AFB	Air Force Base
AFDTL	Air Force Drug Testing Laboratory
AFIOH	Air Force Institute for Operational Health
AFMC	Air Force Materiel Command
AFRL	Air Force Research Laboratory
Air Force	U.S. Air Force
AL	Armstrong Laboratory
ALARA	as low as reasonably achievable
Am	americium
ANSI	American National Standards Institute
Au	gold
Ba	barium
Be	beryllium
Bq	Bequerel(s)
Br	Bromine
C	carbon
Ca	calcium
Cd	cadmium
Cf	californium
CFR	Code of Federal Regulations
Ci	curie(s)
Cl	clorine
cm	centimeter(s)
Cm	curium
cm^2	square centimeter(s)
Co	cobalt
COPC	constituent of potential concern
CP	Command Post
cpm	counts per minute
Cr	chromium
Cs	cesium
D&D	decontamination and decommissioning
DCGL	derived concentration guideline level
$DCGL_W$	derived concentration guideline level used for statistical tests (Wilcoxon Rank Sum)
DoD	Department of Defense
dpm	disintegrations per minute
DQO	Data Quality Objective

ACRONYMS AND ABBREVIATIONS (Continued)

Eu	europium
Fe	iron
FIDLER	Field Instrument for the Detection of Low-Energy Radiation
FR	Federal Register
FSS	final status survey
ft	foot/feet
H-3	hydrogen-3 (tritium)
H-B	hyperbaric
H_0	null hypothesis
HAZWOPER	Hazardous Waste Operations and Emergency Response
Hg	mercury
hr	hour
HSA	Historical Site Assessment
HSW IN	IN/Human Systems Wing
I	iodine
In	indium
Ir	iridium
K	potassium
Kr	krypton
LBGR	lower bound of the gray region
LSC	Liquid Scintillation Counting
m	meter(s)
m^2	square meter(s)
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	minimum detectable activity
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
MeV	million electron Volts
Mn	manganese
Mo	molybdenum
mrem	millirem
mSv	millisievert
Na	sodium
NaI	sodium iodide
NASA	National Aeronautics and Space Administration
Nb	niobium
Ni	nickel
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NUREG	U.S. Nuclear Regulatory Commission Regulation
OSHA	Occupational Safety and Health Administration
P	phosphorus
Pb	lead
Pm	promethium
Po	polonium
PPE	personal protective equipment

ACRONYMS AND ABBREVIATIONS (Continued)

Pu	plutonium
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
Ra	radium
Rb	rubidium
RPM	Radiation Protection Manager
Ru	ruthenium
s	second
S	sulfur
SAIC	Science Applications International Corporation
SAM	School of Aerospace Medicine
Sc	scandium
SDR	Surveillance Directorate, and Radiation Surveillance Division
Se	selenium
SFS	Security Forces Squadron
SSHO	Site Safety and Health Officer
Sr	strontium
SU	survey unit
TAR	total alpha radium
Tc	technetium
TEDE	total effective dose equivalent
Th	thorium
TPU	total propagated uncertainty
U	uranium
USAF	United States Air Force
USAFSAM	U.S. Air Force School of Aerospace Medicine
WRS	Wilcoxon Rank Sum
Xe	xenon
Y	yttrium
ZnS	zinc sulfide

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EXECUTIVE SUMMARY

United States Air Force organizations on Brooks City-Base have possessed a wide variety of radioactive materials over the last 40 to 50 years including both sealed and unsealed sources. As a result of action by the Base Realignment and Closure Committee, ongoing operations at Brooks City-Base have been transferred to other facilities such that the base can be returned to control of the city of San Antonio, Texas, by September, 2011. As an integral part of the facility transfer process, the Air Force has performed a variety of investigations to assure that the associated facilities are compliant with applicable environmental, safety and health standards. As an integral part of this effort, radiological operations at Brooks City-Base have been subjected to comprehensive surveys consistent with recommendations and guidance contained in the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (DoD 2000) and Title 10, Code of Federal Regulations, Part 20. This report addresses radiological surveys performed for Brooks City-Base Buildings 1181, 1191 and 1193, three of a group of buildings scheduled for demolition prior to their transfer to the control of the city of San Antonio. Two additional radiologically impacted facilities, Buildings 140 and 175E, are also scheduled for demolition upon completion of decontamination, the performance of final status surveys, and coordination with the Nuclear Regulatory Commission and will be addressed separately.

Building 1181 formerly served as the Radioactive Waste Storage Building, with Building 1191 functioning as an administrative support area for Building 1181. Building 1193 housed the former Air Force Radiation Detection, Indication and Computation (RADIAC) Instrument Calibration facility. Comprehensive MARSSIM-compliant radiological surveys were performed of each of these facilities. Surveys included gamma and alpha/beta scan surveys and fixed point measurements of residual activity present on walls, floors, and ventilation systems; swipes for evaluation of the presence of low-energy beta emitting radionuclides (e.g. tritium) in facilities in which such materials were a constituent of potential concern; and investigation of sewers including building drains and p-traps as well as septic systems servicing these buildings. Septic system investigations specifically included sampling of the septic tank as well as areas within the septic field. In addition, surface soils immediately outside Building 1181 were subjected to a gamma walkover survey and soil sampling.

Survey results were compared to the limiting screening level derived concentration guideline levels (DCGLs) for surficial activity or to surface soil DCGLs for soil-like media (e.g., soils and sewer solids), as applicable. Results clearly demonstrate that residual radioactivity in Buildings 1181, 1191 and 1193 achieve NRC screening level DCGLs and thus that the dose to the average member of the critical group is less than the 25 mrem/year dose standard for unrestricted release. This assessment is based on the DCGLs for the most limiting radiological constituents of potential concern (i.e., 100 dpm/100 cm^2 for alpha [Th-232] or 200 dpm/100 cm^2 [total thorium], 7,100 dpm/100 cm^2 for beta [Co-60] and 1.8 x 10^6 dpm/100 cm^2 for low-energy beta emitters). (Consistent with NRC guidance, an assessment is not required to demonstrate that doses are ALARA when NRC screening level DCGLs are used to demonstrate compliance with applicable dose standards for unrestricted release) (NRC 2003a). Based on the information presented, the levels of residual radioactivity present in Buildings 1181, 1191 and 1193 achieve DCGLs such that these facilities are suitable for unrestricted release pursuant to the provisions of 10 CFR 20, Subpart E.

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1.0 INTRODUCTION

1.1 INTRODUCTION

Brooks City-Base is the successor to Brooks Field which was established on February 16, 1918, by the U.S. Army Signal Corps. It is a 1309 acre facility which was named after San Antonio aviator, Sidney Johnson Brooks, Jr. It was previously named Gosport Field and as Signal Corps Aviation School, Kelly Field #5. After World War II, Brooks Field was formally renamed as Brooks Air Force Base (AFB) and was subsequently renamed "Brooks City-Base" in 2002.

United States Air Force (USAF) organizations on Brooks City-Base have possessed a wide variety of radioactive materials over the last 40 to 50 years including both sealed and unsealed sources.

Sealed sources have been contained within a variety of devices such as soil moisture density gauges, gas chromatographs, chemical agent monitors and detectors, x-ray fluorescence devices, for the calibration of radiation survey instrumentation and external dosimetry devices and for various other applications. Although sealed sources receive periodic leak tests to confirm the integrity of the sources, limited leak test records are available.

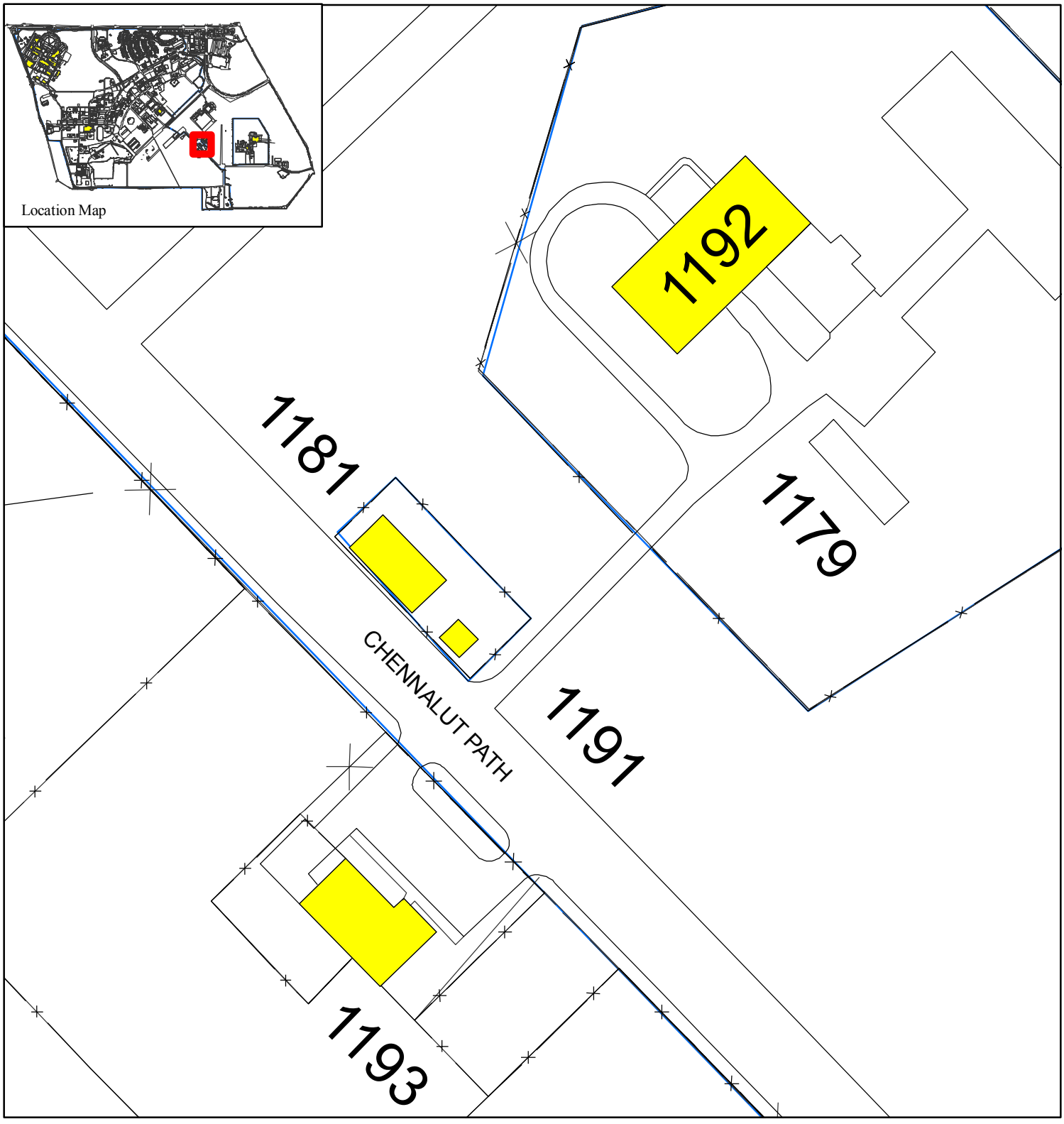
Unsealed radiation sources used at Brooks City-Base have included dials and gauges containing self-luminous radium-sulfate or tritiated paint; radioactive materials used in the diagnosis and treatment of various medical conditions; radioisotopes incorporated as tracers into environmental samples undergoing analysis; and radioactive materials used in a variety of research and development applications. Given that neutron-emitting sources can induce radioactivity in non-radioactive materials, areas in which such neutron sources have been used or stored were carried forward as potentially impacted pending confirmation to the contrary.

As a result of action by the Base Realignment and Closure Committee, ongoing operations at Brooks City-Base are being transferred to other facilities such that the base can be returned to control of the city of San Antonio, Texas, by September, 2011. As an integral part of the facility transfer process, the Air Force has performed a variety of investigations to assure that the associated facilities are compliant with applicable environmental, safety and health standards. With regard to radiological operations at Brooks City-Base, the investigation process is performed consistent with recommendations and guidance contained in the *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* (DoD 2000).

1.2 PURPOSE AND SCOPE

Brooks City-Base has been designated for closure and concurrent termination of facility leases as a result of Base Realignment and Closure Committee recommendations. As such, the Air Force has taken action to confirm that the associated properties are compliant with relevant standards to include those applicable to radioactive materials.

Given that a wide range of radiological constituents of potential concern (COPCs) were used at Brooks City-Base, comprehensive radiological surveys were performed by the U.S. Air Force to confirm that levels of residual radioactivity achieve standards for release of the associated facilities without regard to radiological restrictions. This report specifically addresses Buildings 1181, 1191 and 1193. These buildings are located south of the main portion of Brooks City-Base and are a subset of buildings which are to undergo demolition pursuant to agreement between the U.S. Air Force and the Brooks Development Authority (BDA) prior to their return to BDA control. (See Figure 1-1, Locations of Brooks City-Base Buildings 1181, 1191, and 1193.)



Legend

- Radiologically Impacted Facilities
- Facility Boundary

N

0 30 60 120 Miles

Figure 1-1
Location of Brooks City-Base Buildings 1181, 1191, and 1193

The applicable standards, as defined in Title 10, Code of Federal Regulations, Part 20 (10 CFR 20), Subpart E, Radiological Criteria for License Termination, notes that "a site will be considered acceptable for unrestricted use if residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent to an average member of the critical group that does not exceed 25 millirem (mrem) (0.25 millisievert [mSv]) per year." Achievement of this dose standard can be demonstrated by attainment of conservative, isotope-specific, screening level derived concentration guideline levels (DCGLs) that were developed by the U.S. Nuclear Regulatory Commission (NRC). As NRC screening-level DCGLs are based on conservative, generic input assumptions, the associated building surface and surface soils criteria are such that a formal assessment is not required to demonstrate that doses are "as low as reasonably achievable" (ALARA). Portions of structures surveyed included floors, walls, ventilation systems and sewers. Those limited portions of structures in which the radionuclide concentration exceeded screening level DCGLs were subjected to decontamination or removal and disposal of components exhibiting elevated radioactivity. This report incorporates details with respect to survey procedures and results to demonstrate compliance with applicable isotope-specific screening level DCGLs that, in turn, confirm that the applicable structures are compliant with the above noted standards for residual radioactivity.

The survey effort used qualitative gamma scans together with quantitative alpha and beta scan surveys of floors, walls, ventilation systems, sewers, and structural supports, to confirm that Brooks City-Base structures are compliant with screening level DCGLs. Areas of potentially elevated radioactivity were subjected to further investigation.

Results of radiological surveys performed and included in this report provide essential information for the evaluation of impacted structures. Consistent with paragraph 2.3 of U.S. Nuclear Regulatory Commission Regulation (NUREG)-1757, Volume 2, the radiological surveys performed achieve data quality objectives (DQOs) such that they can be fully integrated into the final status survey (FSS) process.

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2.0 SITE BACKGROUND

From its founding until 1919, Brooks Field was used to provide cadets with initial balloon and airship training. At that time Brooks Field became the Primary Flying School for the Army Air Corps until 1931 when training was relocated to Randolph Field in San Antonio. Brooks Field subsequently became the new home for the Aerial Observation Center.

During World War II, Brooks Field housed the School for Combat Observers and the Advanced Flying School (Observation) until disbanded in 1943 at which point the facility was used for the training of twin-engine aircraft pilots and subsequently B-25 bomber pilots.

In 1959, the School of Aerospace Medicine was relocated from Randolph AFB to Brooks AFB as the U.S. Air Force School of Aerospace Medicine (USAFSAM). USAFSAM aided the National Aeronautics and Space Administration (NASA) with Project Mercury and served as a back-up site for lunar samples brought back to Earth on the Apollo missions between 1969 and 1972. It also served a vital role in the air evacuation program for personnel wounded in Vietnam. The School of Aerospace Medicine was subsequently dedicated by President John F. Kennedy on November 21, 1963.

After the Vietnam War, Brooks AFB's mission consisted of specific research related to U.S. Air Force fliers and personnel. In the early 1980s other organizations including the Air Force Human Resources Laboratory, Air Force Occupational and Environmental Health Laboratory, Air Force Drug Testing Laboratory and the Air Force Systems Command Systems Acquisition School relocated to Brooks AFB. Radioactive materials in unsealed form were used by the Air Force Occupational and Environmental Health Laboratory pursuant to accomplishment of their radiological missions. Similarly, radioactive tracer materials were used by the Air Force Drug Testing Laboratory.

In 1991, the Air Force was selected to house the Armstrong Laboratory (AL). AL organizational elements, consisted of former assets of the Air Force Human Resources Laboratory, the Air Force Drug Testing Laboratory (AFDTL), the Harry G. Armstrong Aerospace Medical Research Laboratory, the Air Force Occupational and Environmental Health Laboratory, and the laboratory functions of USAFSAM. A number of AL projects involved the use of radioactive materials.

In 1992, the Air Force Systems Command and Air Force Logistics Command merged into the Air Force Materiel Command (AFMC). Human Resources Lab functions subsequently became a part of the AFMC, being renamed as the Air Force Human Effectiveness Directorate and subsequently in 1998 as the 311th Human Systems Wing.

Brooks AFB was transitioned from the Air Force to Brooks Development Authority on July 22, 2002, and was renamed "Brooks City-Base." At that time the base was transitioned from Air Force control with the selective retention of specific facilities. Subsequently, in 2005, Brooks City-Base was once again placed on the Base Realignment and Closure Committee list for the subsequent relocation of all military operations to other facilities and concurrent termination of facility leases.

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3.0 SURVEY DESIGN

The methodology described in this document has been applied to all accessible areas within the project scope.

3.1 THE DECISION

The decision for each individual area with static or removable alpha or beta count rates that are elevated with respect to background is whether the area has radiological contaminants present at concentrations that exceed applicable screening level DCGLs.

3.2 INPUTS TO THE DECISION

NUREG-1507 and NUREG-1575 provide methodology for the calculation of minimum detectable concentrations (MDCs). The MDC is the minimum concentration of the contaminant that can be measured with certainty. The MDC of a scan survey "depends on the intrinsic characteristics of the detector (efficiency, physical probe area, etc.), the nature (type and energy of emissions) and relative distribution of the potential contamination (point versus distributed source and depth of contamination), scan rate, and other characteristics of the surveyor" (DoD 2000). The assumptions used to calculate walkover survey MDCs in the NRC's NUREG-1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, are appropriate for this survey. Using the Ludlum Model 44-10 2"x 2" sodium iodide (NaI) detector with Ludlum Model 2221 scaler/ratemeter, the following inputs apply:

- NaI 2"x 2" background count-rate of 3,500 counts per minute (cpm).
- NaI 2"x 2" detector count-rate vs. exposure rate values in NUREG-1507, Table 6.3.
- An observation interval of 1 second (based on a scan rate of 1.6 feet (ft) per second (0.5 meters (m) per second).
- A level of performance to yield an index of sensitivity (d') of 1.38

The 2" x 2" NaI detector and the Field Instrument for the Detection of Low-Energy Radiation (FIDLER) were used for qualitative measurements of gamma activity. Any audible increase in the activity rate (activity distinguishable from background) was investigated.

3.2.1 Data Review

Available existing contamination information was reviewed and the site was visited during initial assessment of the area to provide insights into concentrations that may be expected and areas with greater potential for elevated count rates.

3.2.2 Background Reference Areas

To account for background conditions and the associated variability, reference areas were identified consistent with MARSSIM, Section 4.5 and subjected to radiological measurements. A reference area was established in each of two non-impacted buildings, Building 930 and Building 175W, to establish background conditions for the impacted buildings. Twenty general area measurements were collected from reference areas to establish background conditions. These background measurements were compared to survey data obtained in the impacted buildings to determine the levels of radioactivity for each area. Site background count rates are dependent

upon the radiological characteristics of construction materials (e.g. concrete, steel) so background reference area measurements were collected on different materials including concrete, various metals, wood, drywall, porcelain, carpet and brick. Detailed results from these reference areas can be found in Appendix A, Attachment A-4.

3.3 RADIOLOGICAL SURVEYS

Radiological surveys are performed for a variety of reasons, including: to evaluate whether existing concentrations of site contaminants exceed DCGLs (and as part of the FSS process); to identify the lateral and vertical extent of identified COPCs exceeding DCGLs and thus to enable the scope of remedial actions to be defined; and to evaluate the effectiveness of decontamination. The surveys performed within the impacted buildings at Brooks City-Base address each of these objectives.

Radiological surveys/investigations were conducted during various periods from July, 2010, through March, 2011, to investigate the presence of radiological contaminants in impacted buildings on Brooks City-Base. Radiological investigations included qualitative gamma walkover surveys to identify potentially elevated areas for further investigation; alpha and beta scan and static measurements for direct comparison to screening level DCGLs; removable contamination measurements to confirm the percentage of total activity that is removable; and collection of swipes for total activity screening by liquid scintillation counting (LSC) to quantify the activity present as a result of the presence of low-energy beta emitting radionuclides. Buildings 1191 and 1193 were designated as MARSSIM Class 3 except for Range 3, Building 1193 which was designated as Class 1. Walls and floors of Building 1181 were surveyed as MARSSIM Class 1 with other surfaces such as the ventilation system being surveyed as Class 3.

In conjunction with the building surveys, the sewers associated with the impacted buildings were also investigated such that at least 10% of Class 3, 50% of Class 2 and 100% of Class 1 intakes (e.g., sink p-traps and floor drains) were evaluated. Surveys included at least one p-trap or floor drain in each building. In addition sewers were subjected to surveys consisting of scan and static measurements using gamma and alpha/beta detectors and the evaluation of sewer residuals by the collection and analysis of samples of solids or swipes. Each sewer line connecting to the sewer main was also evaluated by the collection and analysis of sample of sewer solids or by swipes when solids were not available for sampling; direct readings were obtained at the open end of the piping if applicable; and swipes were collected for evaluation using a total activity screen by LSC to evaluate the presence of low-energy beta emitting radionuclides (e.g., hydrogen-3 [H-3] [tritium]) if such isotopes were COPCs in the specific building being surveyed.

Areas exhibiting count rates that were potentially radiologically elevated with respect to background were subjected to additional investigation.

Materials and equipment were surveyed and released pursuant to Air Force Instruction 48-148, *Ionizing Radiation Protection* (USAF 2001) from radiologically impacted portions of buildings.

Mercury was detected in surveys of some building sewers. As such, surveys were performed to investigate the presence of mercury using the Jerome J-405 Mercury Vapor Detector. Details and results of mercury surveys can be found in the *Draft P-Trap/Drain Mercury Survey and Evaluation Report* (USAF 2011a).

Specific surveys performed in each building at Brooks City-Base are detailed in Appendix A. Site specific minimum detectable concentrations (MDCs) for the instruments used at Brooks City-Base are located in Appendix B and Laboratory Analysis Reports are located in

Appendix C. Calibration and instrument quality assurance (QA)/quality control (QC) records are in Appendix D.

Project equipment (e.g., survey instruments) was also monitored to assure that contamination, if encountered, was properly controlled.

3.3.1 Study Boundaries

The *Historical Site Assessment [HSA] for Brooks City-Base* was issued in August 2009 (USAF 2009). Pursuant to this assessment, the Air Force initially classified 25 buildings as "impacted" by radioactive materials as defined by MARSSIM with all other buildings being classified as "non-impacted." "Non-impacted areas—identified through knowledge of site history or previous survey information—are those areas where there is no reasonable possibility for residual radioactive contamination" (DoD 2000). The list of impacted buildings was subsequently reduced to 22 structures based on a variety of factors (e.g., prior building demolition, updated historical information). Buildings initially characterized as impacted are listed in Table 3.1.

Table 3-1. Buildings Initially Categorized as "Impacted"

Building Number	Current Function/Description
100	U.S. Air Force School of Aerospace Medicine (USAFSAM)
110	Nite Vision / Electroencephalogram / Nuclear Medicine
125	USAFSAM/Air Force Research Laboratory (AFRL)
130	School of Aerospace Medicine (SAM) / Technical Support
135	Chemical Laboratory Storage Area
140	Air Force Institute for Operational Health (AFIOH)
160	USAFSAM Hyperbaric (H-B) and Altitude Chamber/AFRL
167	Instrumentation Calibration
170 and 170E	Medical Services Agency and AFRL Crew Systems
175E	Environmental Health Laboratory
176	Joint Army Directed Energy Laboratory
180	AFIOH (Former USAFSAM School Building)
185	Vivarium (Animal Clinic)
930	AFIOH Epi Lab and Air Force Drug Testing Laboratory (AFDTL)
934	AFIOH Radioisotope Storage
1155	Security Forces Squadron/Command Post (SFS/CP) / 710 IN / Human Systems Wing (HSW IN)
1179	AFRL
1181	AFIOH Directed Energy
1184	AFRL
1185	AFRL
1186	Septic by Building 1192
1189	AFRL Storage
1191	AFRL Radioactive Material Storage
1192	AFRL
1193	AFIOH Radiation, Detection, Indication and Computation Calibration Facility

Although initially classified as impacted, additional information confirmed that Building 930 and the adjacent outdoor waste storage area denoted as Building 934 are non-impacted. Building 1186 was a portable building and has been removed and Building 1179 was determined to be "non-impacted." Surveys were performed in accordance with *U.S. Air Force Brooks City-Base Radiological Survey Plan for Structures*, Revision 0 (USAF 2010a). Survey results for Buildings

1181, 1191 and 1193 are incorporated herein. (Appendix A, Attachments A-1 through A-3, detail the specific surveys performed in each respective building.)

3.3.2 Gamma Walkthrough

Buildings 1181, 1191 and 1193 were qualitatively evaluated by performing walkthrough surveys with gamma detectors to identify and investigate areas that exhibit gamma emissions that are potentially elevated with respect to background. Gamma walkthrough surveys were performed using Ludlum Model 44-10 2"x 2" NaI detectors with Ludlum Model 2221 scaler/ratemeters and FIDLERs. The surveyor advanced at a speed of approximately 0.5 meters per second (m/s) (1.6 ft/s) while passing the detector in a serpentine pattern approximately 10 centimeters (cm) (4 inches) above the ground floor surface. Audible response of the instrument was monitored by the surveyor and locations of elevated audible response, if encountered, were investigated. Elevated areas are those in which the count rate exceeds the applicable background count rate for the media of interest (e.g., concrete, asphalt etc.) by 1500 to 2,000 cpm. Appropriate scan coverage was achieved for all areas within the scope of this investigation.

Areas exhibiting elevated gamma activity were investigated using alpha and beta scan and static measurements that can be directly compared to the DCGLs. Surficial DCGLs are defined in terms of radionuclide-specific activity per unit area (e.g., disintegrations per minute per 100 square centimeters [dpm/100 cm^2]) for alpha and beta activity.

3.3.3 Alpha-Beta Scan Surveys

Buildings 1181, 1191 and 1193 were subjected to scan surveys of the appropriate percentage of the floors, walls etc. based on the applicable MARSSIM classification of the area involved. (See Section 3.10 and Table 3.6, ["MARSSIM Suggested Survey Units" {SUs}]) (DoD 2000). Scan MDCs are included in Appendix B for the instruments used for the surveys addressed in this report. Areas exhibiting elevated activity during scan surveys were subjected to biased static measurements to more precisely quantify radioactivity present.

3.3.4 Static Surveys and Removable Contamination Evaluations

The fixed-point measurements result in units of cpm but have been converted to the units of the surficial release criteria of dpm/100 cm^2 with the following equation:

$$Surficial\ Activity\ \left(\frac{dpm}{100\ cm^2}\right) = \frac{R_g - R_b}{(\varepsilon_i)(\varepsilon_s)\frac{Probe\ Area}{100}}$$

where R_g is the static data point gross count rate (cpm)
R_b is the instrument field background count rate (cpm)
ε_i is the instrument 2 π efficiency (cpm/dpm)
ε_s is the source efficiency
Probe Area is the open area of the detector face (cm^2)

MARSSIM notes on page 6-25, that "A source efficiency of 0.5 is recommended for beta emitters with maximum energies above 0.4 million electron-Volt (MeV). Alpha emitters and beta emitters with maximum beta energies between 0.15 and 0.4 MeV have a recommended source efficiency of 0.25" (DoD 2000). Based on these recommendations, source efficiencies of 0.25 and 0.5 are used for alpha and beta, respectively.

Determination of the percentage of total activity that is removable is generally required to verify that site conditions with regard to the removable fraction are consistent with assumptions integral to the development of DCGLs. This is accomplished by determining the gross alpha and gross beta removable activity by swiping an area of approximately 100 cm^2 with a dry filter paper and then measuring the alpha and beta activity on the swipe. Limited elevated radioactivity was detected in impacted buildings at Brooks City-Base. As such, confirmation that the removable fraction did not exceed 10% of the total activity was neither required nor accomplished.

Given that evaluation of low-energy beta emitting radionuclides cannot generally be directly measured by scan or routine static survey measurements, the activity of such radionuclides was evaluated by total activity screen by LSC. This is accomplished by swiping an area of approximately 100 cm^2 with filter paper dampened with demineralized or "dead" water and evaluating the swipe using a total activity screen by LSC at a properly accredited laboratory.

3.4 INSTRUMENT USE AND QUALITY ASSURANCE

Survey instruments used for radiological measurements were:

- selected based on the survey instrument's detection capability for the COPCs present at Brooks City-Base;
- calibrated in accordance with manufacturers' recommendations and American National Standards Institute (ANSI) N323A, *Radiation Protection Instrumentation Test and Calibration – Portable Survey Instruments* (ANSI 1997);
- calibrated with a National Institute of Standards and Technology (NIST) traceable source to obtain a quantitative measurement ; and
- operated and maintained by qualified personnel, in accordance with Science Applications International Corporation (SAIC) Health Physics Program procedures (e.g., physical inspection, background checks, response/operational checks). (Calibration and instrument quality assurance [QA]/quality control [QC] records are in Appendix D.)

Radiological field instrumentation used for this survey had been calibrated in accordance with ANSI-N323A within the past 12 months. (Instrumentation is calibrated in accordance with manufacturer's recommendations at an interval not to exceed 12 months.) QC checks were performed at the beginning and end of each day consistent with SAIC Health Physics Procedures. Radiological instruments operated as designed, minor deviations were experienced due to light leaks within the mylar window of the Ludlum Model 43-89 ZnS plastic scintillator hand held probe this problem was corrected on-site by replacement of the mylar by the Air Force. All radiation survey data obtained during these efforts used radiation measurement instrumentation that achieved all performance requirements.

The instruments selected for this site included those to be used for the gamma walkthrough surveys as well as instrumentation to assure compliance with contamination limits applicable to project equipment and analytical samples. Field instrumentation used is presented in Table 3-2.

Table 3-2. Survey Instrumentation Used at Brooks City-Base

Measurement Type	Detector Type	Detector Area	Instrument Model	Detector Model
Alpha/Beta Scan/Static	Zinc sulfide (ZnS) scintillator	125 cm^2	Ludlum 2360, 2224-1, 2224	Ludlum 43-89
Gamma Scan/Static	2"x 2" NaI gamma scintillator	5.1 cm diameter (*2 in)	Ludlum 2221	Ludlum 44-10
Low-Energy Gamma Scan	Thin crystal NaI gamma scintillator	12.6 cm diameter (*5 in)	Ludlum 2221	Alpha Spectra FIDLER
Alpha/Beta Scan	P-10 gas proportional	582 cm^2	Ludlum 2224, 2224-1	Ludlum 43-37-1

* Gamma detectors were generally used for qualitative surveys to identify areas that were potentially elevated with respect to background thus detector area is provided for completeness only.

3.4.1 Pre-Operational Checks

Pre-operational checks were performed prior to each use and whenever instrument response became questionable. Pre-operational steps included:

- Verifying instrument calibration was current.
- Visually inspecting instrument for physical damage that may affect operation.
- Performing satisfactory battery check, (manufacturer's operating instructions defined satisfactory battery check).
- Checking cable connection and cable integrity.

3.4.2 Overview of Routine Instrument Quality Evaluations

- Site-specific instrument background is established upon arrival at a site by determining the mean value of 10 each two-minute background counts for the Ludlum Model 43-89 zinc sulfide (ZnS) alpha/beta plastic scintillator, and 10 each one-minute source counts for the Eberline SPA-3, 2" x 2" NaI gamma scintillation detector, the Ludlum Model 43-37-1, P-10 gas proportional counter, and the FIDLER gamma scintillation detector.
- Background checks were performed at the same location in a reproducible geometry at the beginning and end of each survey day and any time the instrument response appeared questionable.
- Radiological field instruments used for collecting static and scan measurements were performance checked at the beginning and end of each survey day to confirm acceptability and usability of data collected. Deviations were experienced due to light leaks within the mylar window of the Ludlum Model 43-89 ZnS plastic scintillator hand held probe this problem was corrected on-site by replacement of the mylar by the Air Force.
- Source checks were performed at the same location in a reproducible geometry at the beginning and end of each survey day. There were no occasions, other than those previously noted, that instrument response appeared questionable; therefore, additional source checks were not required.
- The Ludlum Model 2224-1 ratemeter/scaler coupled with a Ludlum Model 43-89 ZnS plastic scintillator hand held detector was checked with thorium-230 and strontium-yttrium-90 sources.
- The Ludlum Model 2221 scaler coupled with an Eberline SPA-3, 2" x 2" NaI Gamma Scintillation Detector was checked with a cesium-137 (Cs-137) source.

- The Ludlum Model 2221 scaler coupled with the Alpha Spectra FIDLER was checked with an americium-241 (Am-241) source.

The acceptance criterion for background and instrument efficiency was a background count rate or an instrument efficiency within two standard deviations of the mean and appropriate distribution of both background and instrument efficiency around their respective mean values.

Sources were stored and handled as specified in SAIC Health Physics Procedures and were shipped in accordance with Department of Transportation regulations.

3.4.3 Static and Scan Minimum Detectable Concentrations

The MDC is an activity level that a specific instrument and measurement technique will detect 95% of the time. Site-specific detection sensitivities (static and scan MDCs) for Brooks City-Base have been calculated in accordance with the approach detailed in NUREG-1507. These calculations are provided in Appendix B of this document, the results are listed below in Table 3-3.

Table 3-3. Evaluation of Instruments Used at Brooks City-Base[1]

Detector Model	Radiation of Interest	Background (cpm)		2 π Instrument Efficiency (cpm/dpm)		Scan MDC (dpm/ 100 cm^2)		Static MDC (dpm/ 100 cm^2)	
		beta	alpha	beta	alpha	beta	alpha	beta	alpha
Ludlum 43-89 Instrument A	Alpha/Beta	100	0.5	0.227	0.309	528	55	242	40
Ludlum 43-89 Instrument C	Alpha/Beta	180	0.2	0.279	0.321	584	34	262	30
Ludlum 43-89 Instrument I	Alpha/Beta	161	1.5	0.255	0.356	603	83	389	78
Ludlum 43-89 Instrument K-1	Alpha/Beta	185	0.6	0.323	0.383	509	48	229	34
Ludlum 43-89 Instrument L	Alpha/Beta	178	2.8	0.311	0.377	517	107	335	92
Ludlum 43-89 Instrument P	Alpha/Beta	204	1.4	0.237	0.348	726	82	469	78
Ludlum 43-89 Instrument Q	Alpha/Beta	214	0.6	.330	.355	536	53	241	36
Ludlum 43-37-1 Instrument A	Alpha/Beta	169	1.4	0.187	0.022	143	139	N/A	
Ludlum 43-37-1 Instrument B	Alpha/Beta	195	1.0	0.192	0.047	152	89	N/A	
Ludlum 43-10-1	Alpha/Beta Swipes	43	0.6	0.410	0.383	N/A		163	69
Ludlum 44-10	Gamma	3,276 - 5,439 (gamma)		N/A		N/A[2]		N/A[2]	
Alpha Spectra FIDLER	Low-Energy Gamma	442 - 1,800 (gamma)		N/A		N/A[2]		N/A[2]	

[1] The derivation of site-specific MDCs are presented in Appendix B.
[2] Used for qualitative purposes only.

Sample counting times may be increased to obtain lower minimum detectable activity (MDA) or MDC values. (The longer a sample is counted, the lower the MDA/MDC value.) Sample count times are long enough to yield the required sensitivity (DCGL). As discussed in Section 3.6, the

most restrictive screening level DCGL values used for the initial evaluation of surficial activity at Brooks City-Base are 100 dpm/100 cm^2 for alpha and 7,100 dpm/100 cm^2 for beta.

Swipes were collected for total activity screening by LSC and submitted to a fully accredited commercial radioanalytical laboratory. (The laboratory analytical reports are contained in Appendix C.)

3.5 RADIOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN

The radiological COPCs at Brooks City-Base include H-3; all byproduct materials with atomic numbers 3 through 83; any byproduct or accelerator produced byproduct material having atomic numbers above 83; source materials; and special nuclear materials. COPCs specifically include transuranics and neutron emitters consisting of californium-252 (Cf-252) and Cf-253, as well as polonium-beryllium (Po-Be) and plutonium-beryllium (Pu-Be) neutron sources. Given that any radioactive materials may be encountered, the subset of more likely radionuclides consists of those with half-lives exceeding 120 days, possession of which was individually authorized by Air Force permit. These radionuclides are listed in Table 3-4. Although Building 1181 may have stored most radionuclides specified in Table 3-4, available information suggests that Buildings 1191 and 1193 likely possessed a relatively small number of the radioactive sources.

Table 3-4. Individually Authorized Unsealed Radionuclides with Half-Lives of 120 Days or More on Brooks City-Base

Isotope	Half-Life*	Isotope	Half-Life*
** H-3	12.2 years	Iridium-192 (Ir-192)	5 years
**Carbon-14 (C-14)	5730 years	Po-210	138.4 days
Sodium-22 (Na-22)	2.62 years	Radium-226 (Ra-226)	1602 years
Chlorine-36 (Cl-36)	3.08×10^5 years	Thorium-228 (Th-228)	1.91 years
Potassium-40 (K-40)	1.26×10^9 years	Th-230	8.0×10^4 years
Calcium-45 (Ca-45)	165 days	Th-232	1.41×10^{10} years
Manganese-54 (Mn-54)	303 days	Uranium-232 (U-232)	72 years
**Iron-55 (Fe-55)	2.60 years	U-233	1.62×10^5 years
Cobalt-57 (Co-57)	270 days	U-234	2.47×10^5 years
Cobalt-60 (Co-60)	5.263 years	U-235	7.1×10^8 years
**Nickel-63 (Ni-63)	92 years	U-238	4.51×10^9 years
Selenium-75 (Se-75)	120.4 days	Pu-236	2.85 years
Krypton-85 (Kr-85)	10.76 years	Pu-238	86.4 years
**Strontium-90 (Sr-90)	27.7 years	Pu-239	2.44×10^4 years
Cadmium-109 (Cd-109)	453 days	Am-241	458 years
Cesium-137 (Cs-137)	30 years	Am-243	7.9×10^3 years
Barium-133 (Ba-133)	7.2 y/10.7 years	Curium-244 (Cm-244)	17.6 years
Europium-152 (Eu-152)	12.7 years	Cf-252	2.646 years

* Longer-lived—including radionuclides with atomic numbers exceeding 82 (i.e., lead) commonly decay through one or more daughter products prior to decaying to a stable, non-radioactive, constituent. Such progeny must be evaluated concurrent with activity of the respective parent radionuclides.

** Denotes radionuclides with no appreciable gamma emissions

3.6 DERIVED CONCENTRATION GUIDELINE LEVELS

The first step in the process of releasing a given room, building or site is to determine what release criteria apply. In June, 1974 the Atomic Energy Commission (AEC) issued Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors* (AEC 1974), which provided guidance with respect to surface contamination limits. (Historically, this NRC document is commonly referred to as "NRC Reg Guide 1.86" although the NRC did not exist at

the time that the document was initially produced.) Limits contained in Reg Guide 1.86 were derived based on detectability rather than being dose- or risk-based with removable contamination limits equating to 20% of the respective total contamination limits. Air Force Contamination Limits are specified in Table A4.2, "Acceptable Surface Contamination Levels" of Air Force Instruction 48-148, *Ionizing Radiation Protection* (USAF 2001).

In 1997 the NRC published Title 10, CFR, Part 20, Subpart E, "Radiological Criteria for License Termination," in the Federal Register (FR) (62 FR 39058). These regulations included dose-based cleanup levels, also referred to as DCGLs, for releases both with and without radiological restrictions. Section 20.1402 of Subpart E notes that, "A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are ALARA. Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal."

In addition to issuance of radiological criteria for license termination, the NRC also performed "generic modeling" that "addresses residual radioactive contamination inside buildings and in soils." NUREG-5512 screening level DCGLs for structure surfaces were developed based on "building renovation and normal building occupancy" scenarios. The building occupancy scenario accounts for exposure to fixed and removable residual radioactivity on the walls, floor, and ceiling of a decommissioned facility. It assumes that the building will be used for commercial or light industrial activities (e.g., an office building or warehouse) and includes the external radiation, inhalation of (re)suspended removable residual radioactivity; and inadvertent ingestion of removable residual radioactivity. The screening value represents the surface concentration of individual radionuclides that would be deemed in compliance with the 25 mrem/year unrestricted release dose limit in 10 CFR 20.1402 and is derived using conservative assumptions. Given the conservatism built into screening level DCGLs, analysis to demonstrate that the dose to the average member of the critical group is [ALARA] is not required" (NRC 2003a).

The "Screening Values of Common Radionuclides for Building-Surface Contamination Levels," as defined in NRC SECY-98-242, lists "Decommissioning and Demolition (D&D) Screening Values." These screening level DCGLs specified represent the 90th percentile of the output dose distribution equivalent to 25 mrem/year for each of the listed radionuclides. The NRC staff acknowledged that there are several areas in which modeling used to develop screening level DCGLs was overly conservative. One such area is in the selection of resuspension factors. Consequently, NRC issued guidance in "*Re-Evaluation of the Indoor Resuspension Factor for the Screening Analysis of the Building Occupancy Scenario for NRC's License Termination Rule - Draft Report,"* NUREG-1720, (NRC 2002) which recommends a resuspension factor of 1 x 10^{-6} m^{-1}. SAIC recalculated screening level DCGLs using D&D Version 2.1 with the only change being the modification of the value of the resuspension factor to the recommended value of 1 x 10^{-6} m^{-1}. Using a 95% confidence level, this change resulted in derivation of the screening level DCGLs as specified in Table 3-5. Consistent with NUREG-1757, Volume 1, Revision 2, Group 2 licensees include those "that can demonstrate compliance with 10 CFR Part 20.1402 (Radiological criteria for unrestricted use) using the screening methodology." Given the use of such criteria for building surveys at Brooks City-Base, the associated permittees are reasonably categorized as equivalent to "Group 2 Licensees" (NRC 2003a).

Table 3-5. Brooks City-Base Unsealed Source Radiological Contaminants of Potential Concern

Isotope	Half-Life[1]	Screening Level DCGL[2] (dpm/100 cm[1])	Isotope	Half-Life[1]	Screening Level DCGL[2] (dpm/100 cm[1])
H-3	12.2 years	1.2×10^{8}	Niobium-95 (Nb-95)	35.0 days	1.7×10^{5}
C-14	5,730 years	9.1×10^{6}	Molybdenum-99 (Mo-99)	66.7 hours (hrs)	6.4×10^{6}
Na-22	2.62 years	9.5×10^{3}	Technetium-99m (Tc-99m)	6.049 hrs	1.5×10^{8}
Cl-36	3.08×10^{5} years	3.2×10^{6}	Ruthenium-103 (Ru-103)	39.5 days	2.5×10^{5}
K-40	1.26×10^{9} years	1.1×10^{5}	Indium-111 (In-111)	2.81 days	4.1×10^{6}
Ca-45	165 days	1.0×10^{7}	Iodine-125 (I-125)	60.2 days	9.9×10^{5}
Mn-54	303 days	3.2×10^{4}	I-131	8.05 days	1.3×10^{6}
Fe-55	2.60 years	4.5×10^{6}	I-135	6.68 hrs	9.2×10^{6}
Co-57	270 days	2.3×10^{5}	Xenon-133 (Xe-133)	5.27 days	NA
Co-60	5.263 years	7.1 x 103	Ir-192	74.2days	7.8×10^{4}
Ni-63	92 years	1.8×10^{6}	Gold-195 (Au-195) [3]	183days	NL
Se-75	120.4 days	1.1×10^{5}	Au-198	2.697 days	4.1×10^{6}
Krypton-85 (Kr-85)	10.76 years	NA	Mercury-203 (Hg-203)	46.9 days	4.0×10^{5}
Strontium-90 (Sr-90)	27.7 years	8.7×10^{3}	Po-210	138.4 days	2.0×10^{4}
Tc-99	2.12×10^{5} years	8.3×10^{6}	Ra-226	1602 years	5.0×10^{3}
Cd-109	453 days	5.1×10^{5}	Th-228	1.91 years	6.0×10^{2}
Cs-137	30 years	3.0×10^{4}	Th-230	8.0×10^{4} years	5.1×10^{2}
Ba-133 [3]	10.7 years	NL	Th-232	1.4×10^{10} years	1.0×10^{2}
Eu-152	12.7 years	2.0×10^{4}	U-232	72 years	2.3×10^{2}
Na-24	14.96 hrs	2.0×10^{6}	U-233	1.62×10^{5} years	1.2×10^{3}
P-32	14.28 days	2.7×10^{7}	U-234	2.47×10^{5} years	1.3×10^{3}
P-33	24.4 days	1.7×10^{8}	U-235	7.1×10^{8} years	1.3×10^{3}
Sulfur-35 (S-35)	87.9 days	6.2×10^{7}	U-238	4.51×10^{9} years	1.4×10^{3}
Scandium-46 (Sc-46)	83.9 days	2.9×10^{4}	Pu-236	2.85 years	1.2×10^{3}
Chromium-51 (Cr-51)	27.8 days	5.3×10^{6}	Pu-238	86.4 years	4.0×10^{2}
Fe-59	45.6 days	8.9×10^{4}	Pu-239	2.44×10^{4} years	3.7×10^{2}
Cr-51	27.8 days	5.3×10^{6}	Am-241	458 years	4.0×10^{2}
Bromine-82 (Br-82)	35.34 hrs	1.2×10^{6}	Am-243	7.9×10^{3} years	4.0×10^{2}

Table 3-5. Brooks City-Base Unsealed Source Radiological Contaminants of Potential Concern (Continued)

Isotope	Half-Life[1]	Screening Level DCGL[2] (dpm/100 cm[1])	Isotope	Half-Life[1]	Screening Level DCGL[2] (dpm/100 cm[1])
Rubidium-86 (Rb-86)	18.66 days	2.4×10^6	Cm-244	17.6 years	7.0×10^2
Sr-85	64.0 days	1.4×10^5	Cf-252 [3]	2.646 years	Software error
Sr-89	52.7 days	6.3×10^6			

[1] Radionuclides with atomic numbers exceeding 82 (i.e., lead) commonly decay through one or more daughter products prior to decaying to a stable, non-radioactive, constituent. Daughter products of radiological COPCs will be fully evaluated if the parent is detected.

[2] NRC Screening level DCGLs adjusted pursuant to *Re-Evaluation of the Indoor Resuspension Factor for the Screening Analysis of the Building Occupancy Scenario for NRC's License Termination Rule - Draft Report* (NUREG-1720) by use of a resuspension factor of 1×10^{-6} m^{-1} while maintaining all other parameters constant. The screening level DCGL for H-3 is taken directly from NRC guidance and is not modified based on the resuspension factor.

[3] Ba-133 and Au-195 are not listed (NL) in D&D V2.1. In addition, D&D V2.1 has an apparent software error which precludes computation of a screening level DCGL for Cf-252. Site specific DCGLs will be developed for these or other radionuclides for which screening level DCGLs do not exist if they are determined to be present.

Highlighted in Table 3.5 above, the most restrictive screening level DCGLs are 100 dpm/100 cm^2 screening level for thorium-232 (Th-232) (alpha) and 7,100 dpm/100 cm^2 screening level for cobalt-60 (Co-60) (beta).

MARSSIM Section 4.3.2, entitled "DCGLs and the Use of Surrogate Measurements," notes that "compliance with surface activity DCGLs for radionuclides of a decay series (*e.g.*, thorium and uranium) that emit both alpha and beta radiation may be demonstrated by assessing alpha, beta, or both radiations" (DoD 2000).

With respect to decay chains, it also notes that "The relationship of beta and alpha emissions from decay chains or various enrichments of uranium should be considered when determining the surface activity for comparison with the derived concentration guideline level used for statistical tests (Wilcoxon Rank Sum [WRS]) $DCGL_W$ values. When the initial member of a decay chain has a long half-life, the radioactivity associated with the subsequent members of the series will increase at a rate determined by the individual half-lives until all members of the decay chain are present at activity levels equal to the activity of the parent. This condition is known as secular equilibrium.

Consider an example where the average surface activity $DCGL_W$ for natural thorium is 1,000 Bq/m^2 (600 dpm/100 cm^2), and all of the progeny are in secular equilibrium—that is, for each disintegration of Th-232 there are six alpha and four beta particles emitted in the thorium decay series. Note that in this example, the surface activity $DCGL_W$ of 1,000 Bq/m^2 is assumed to apply to the total activity from all members of the decay chain. In this situation, the corresponding alpha activity $DCGL_w$ should be adjusted to 600 Bq/m^2 (360 dpm/100 cm^2) and the corresponding beta activity $DCGL_w$ to 400 Bq/m^2 (240 dpm/100 cm^2), in order to be equivalent to 1,000 Bq/m^2, of natural thorium surface activity" (DoD 2000). Consistent with this MARSSIM guidance, barring activities which would isotopically separate the thorium isotopes of natural thorium, purified natural thorium would consist of equal amounts of Th-232 and Th-228 as these isotopes would be in secular equilibrium. As such, the total activity $DCGL_W$ would be adjusted from 100 dpm/100 cm^2 (Th-232) (166 Bq/m^2) to 200 dpm/100 cm^2 (total thorium) (332 Bq/m^2).

3.7 DECISION ERRORS

Minimum information required to proceed with the MARSSIM process includes defining Type I and Type II decision errors and assigning probability limits for occurrence of these errors. As noted in MARSSIM Section D.6, "The distinctions between these two types of errors are important for two reasons: 1) the consequences of making one type of error versus the other may be very different, and 2) the methods for controlling these errors are different and involve tradeoffs. For these reasons, the decision maker should specify levels for each type of decision error (DoD 2000)." In defining errors one must consider the null hypothesis that is being tested. Generally, the null hypothesis (H_0) tested is that residual contamination exceeds the release criterion with the alternate hypothesis (H_a) being that contamination meets the release criterion.

"A Type I decision error occurs when the null hypothesis is rejected when it is true, and is sometimes referred to as a false positive error. The probability of making a Type I decision error, or the level of significance, is denoted by alpha (α). Alpha reflects the amount of evidence the decision maker would like to see before abandoning the null hypothesis, and is also referred to as the *size* of the test." "A Type II decision error occurs when the null hypothesis is accepted when it is false. This is sometimes referred to as a false negative error. The probability of making a Type II decision error is denoted by beta (β). The term ($1-\beta$) is the probability of rejecting the null hypothesis when it is false, and is also referred to as the *power* of the test." (DoD 2000) As such, the Type I error refers to the probability of determining that the area is below criterion when it is really above (incorrectly releasing the SU). The Type II error refers to the probability of determining that the area is above the criterion when it is really below the criterion (incorrectly failing to release the SU).

Based on the above null hypothesis (H_0), that the areas in question exceed DCGLs, lowering the Type I error decreases the probability of residual contamination exceeding site criteria while increasing the Type I error would have the inverse effect. By contrast, lowering the Type II error decreases the probability of releasing a SU in which residual concentrations of contamination are below site criteria. Failure to release SUs that achieve standards results in increased costs for the removal of residuals that actually achieve criteria but does not impact on human health or the environment. Increasing the Type II error, by contrast, typically results in increased sampling costs but a reduced probability of failing to release a SU that actually achieves cleanup criteria.

The Type I error for Brooks City-Base has been set at 0.05 and the Type II error has been set at 0.20. This means that there is a 5% probability of erroneously releasing a SU whose true mean is greater than the DCGL and a 20% probability of not releasing a site that has attained the DCGL. This implies that if the mean is at a concentration that would produce an exposure at the criterion level, there would be a 5% probability of erroneously finding it below the criterion or a 20% probability of erroneously finding it to be greater than the criterion.

3.8 RELATIVE SHIFT

The relative shift (Δ/σ) is defined such that Δ is the DCGL minus the lower bound of the gray region (LBGR) and standard deviation (σ) is the standard deviation of the contaminant distribution. MARSSIM recommends that the LBGR initially be set one half of the DCGL, but should be adjusted if necessary to provide a relative shift value within the recommended range of between 1 and 3, with up to 4 being acceptable. The DCGLs for Brooks City-Base have been set to 100 dpm/100 cm^2 (alpha) and 7,100 dpm/100 cm^2 (beta). Thus Δ can be found by:

$$\Delta = \text{DCGL} - \text{LBGR}$$

$$\Delta = 100\frac{dpm}{100\ cm^2} - \frac{100\frac{dpm}{100\ cm^2}}{2} = 50\frac{dpm}{100\ cm^2}\ (alpha)$$

$$\Delta = 7{,}100\frac{dpm}{100\ cm^2} - \frac{7{,}100\frac{dpm}{100\ cm^2}}{2} = 3{,}550\frac{dpm}{100\ cm^2}\ (beta)$$

The value for σ can be estimated in a number of ways. Sometimes there is data from the site that is sufficient to calculate the standard deviation within the SU, σ_s. (Note that σ, as used herein, is the standard deviation at the time of release and after material exceeding applicable criteria are thought to have been effectively removed). Data may also be available from a reference or background area. Reference area data can be used to estimate a standard deviation of the contaminant in naturally occurring background, σ_r, if the contaminant is present in background. The larger of σ_s and σ_r should be used when calculating relative shift. Consistent with MARSSIM guidance and with experience implementing MARSSIM, a coefficient of variance of 0.3 (30%) was initially used at Brooks City-Base. Thus the standard deviation can be found by:

$$\sigma = DCGL\ (30\%)$$

$$\sigma = 100\frac{dpm}{100\ cm^2}\ (30\%) = 30\frac{dpm}{100\ cm^2}\ (alpha)$$

$$\sigma = 7{,}100\frac{dpm}{100\ cm^2}\ (30\%) = 2{,}130\ \frac{dpm}{100\ cm^2}\ (beta)$$

As such, the relative shift can be determined as:

$$relative\ shift = \frac{\Delta}{\sigma}$$

$$relative\ shift_{alpha} = \frac{50\frac{dpm}{100\ cm^2}}{30\frac{dpm}{100\ cm^2}} = 3.33$$

$$relative\ shift_{beta} = \frac{3{,}550\frac{dpm}{100\ cm^2}}{2{,}130\frac{dpm}{100\ cm^2}} = 3.33$$

3.9 THE NUMBER OF SAMPLES PER SURVEY UNIT

The calculated value for Δ/σ can be used to obtain the minimum number of samples/measurements necessary to satisfy requirements using the MARSSIM equation presented below:

$$N = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2}$$

The calculated value, N, is the combined number of samples/measurements from the reference area and each SU. $Z_{1-\alpha}$ and $Z_{1-\beta}$ are critical values that can be found in MARSSIM, or statistics textbooks and handbooks, and P_r is a measure of probability available from MARSSIM Table 5.1.

Typically, N/2 samples/measurements are collected in each SU and N/2 are collected in the reference area. That is, N/2 samples/measurements are conducted in *each* SU *and* N/2 samples/measurements are conducted in the reference (background) area. However, the statistical methods are still valid if there are an unequal number of samples/measurements in the SU and reference areas. A 20% increase in this number is recommended to account for lost or unusable samples/measurements. The calculated values apply to each SU. The number of samples required in each SU will vary by area.

The number of data points, N, for the WRS test of each combination of reference area and SU is calculated using Equation 5-1 and Table 5.1 in MARSSIM, given 5% Type I error and 20% Type II error.

$$N = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{3(P_r - 0.5)^2}$$

$$N = \frac{(1.645 + 0.842)^2}{3(0.983039 - 0.5)^2} = 8.8\ samples \cong 9\ samples$$

The uncertainty associated with the calculation, N, should be accounted for during survey planning thus the number of data points is increased by 20% and rounded up. This is to ensure there are sufficient data points to allow for any possible lost or unusable data.

$$N = 9 + 0.2(9) = 11\ samples$$

The 11 samples include the combined samples/measurements from the reference area and one SU. Therefore a minimum of six samples/measurements are required in the reference area and six in each SU. As noted in Appendix A, sufficient numbers of samples were collected within each of the SUs in the buildings at Brooks City-Base.

As noted in Appendix C of the U.S. Air Force Brooks City-Base Radiological Survey Plan for Structures, dated July 7, 2010, (USAF 2010a) a total of 17 measurements were projected to be required for each SU/reference area pair. Given that equal numbers of samples are obtained from the SU and reference area, it was calculated that nine samples/measurements were required for each. Given the low cost required to obtain static measurements, the quantity of static measurements was increased to 20 per SU and 20 per reference area to assure adequate statistical power. "The consequence of inadequate power is that an SU that actually meets the release criterion has a higher probability of being deemed not to meet the release criterion" (DoD 2000). In addition, "When the null hypothesis is rejected, the power of the test becomes a somewhat moot question" (DoD 2000). As such, consistent with MARSSIM guidance, retrospective power curves were not developed for Brooks City-Base buildings. This is particularly appropriate in that the number of static measurements per SU was essentially doubled; each of the SUs clearly rejects the null hypothesis; and the number of measurements required based on actual site conditions was less than the number of measurements obtained.

3.10 CLASSIFICATION OF SURVEY UNITS

Surveys including scoping surveys were designed so that, to the extent practicable, data collected could be used for FSS. Because there was limited data available at this time of initial survey, certain assumptions were made with regard to survey planning based on the contamination potential of each SU. These assumptions were used to design the radiological survey so that a sufficient quantity and quality of data is collected for potential future use in a FSS. The scanning coverage, SU area and random verses systematic measurements are the primary issues considered when classifying a SU. Information from the HSA was the primary source for initial "classification" of SUs.

As described in the MARSSIM, SUs are broken into three classes (Table 3-6). A SU is classified as a Class 1 SU if it meets any one of the following criteria:

1. The area is or was impacted (potentially influenced by contamination);
2. The area has potential for delivering a dose or risk above criteria;
3. There is potential for small areas of elevated activity; or
4. There is insufficient evidence to classify the area as Class 2 or Class 3.

An SU is classified as a Class 2 unit if:

1. The area has the potential to have been impacted;
2. The area has low potential for delivering a dose or risk above criteria; or
3. There is little or no potential for small areas of elevated activity.

An SU is classified as a Class 3 unit if:

1. The area has only minimum potential for being impacted;
2. The area has little or no potential for delivering a dose or risk above criteria; and
3. There is little or no potential for small areas of elevated activity.

Survey units classifications were modified to lower (e.g., 2 to 1) MARSSIM Classes for a given survey unit based on activity actually encountered with Building 1181 being a typical example.

Table 3-6. MARSSIM "Suggested Survey Unit Areas" (DoD 2000)

Classification	Suggested Area
Class 1	Structure: up to 100 m^2 Land Area: up to 2,000 m^2
Class 2	Structure: 100 to 1,000 m^2 Land Area: 2,000 to 10,000 m^2
Class 3	Structure: No Limit Land Area: No Limit

3.11 OPTIMIZATION OF DESIGN FOR OBTAINING DATA

The following actions, methods, and techniques were utilized throughout the data collection process to minimize cost, field effort, and impacts to future associated work.

- Radiological surveys and collected samples were obtained in a defensible manner. Data was collected and managed so that it will be usable in future area evaluations or investigations, if appropriate.
- Investigations utilize the graded approach of site investigations. Areas of highest potential were scrutinized the most, with less effort expended in areas less likely to contain the target contaminants.

3.12 DATA QUALITY OBJECTIVES, QUALITY ASSURANCE AND QUALITY CONTROL

- All data is of the appropriate quality to be usable after validation.
- All radiological survey instruments were operated and maintained by qualified personnel, in accordance with SAIC Health Physics Program procedures
- QA/QC related data from the analytical laboratory is provided in Appendix C.
- The QA/QC data that would validate both the instrument survey measurements and the analytical results is provided in Appendix D.
- Instruments calibration data and source calibration data are located in Appendix D.

4.0 SITE SAFETY AND HEALTH

Site safety and health requirements for site tasks were based on potential physical, radiological, and chemical hazards. The survey team followed the general site safety and health requirements documented in SAIC safety and health procedures. These documents/procedures were written to comply with the NRC and associated Agreement State, and Occupational Safety and Health Administration (OSHA), requirements.

4.1 SAFETY AND HEALTH TRAINING

All survey team personnel had received all required training which included Hazardous Waste Operations and Emergency Response (HAZWOPER) training (40-hour [hr] and current 8-hr refresher), medical surveillance, health and safety orientation, and radiation awareness training. Safety and health records were kept and maintained according to SAIC procedures.

4.2 TASK-SPECIFIC PERSNAL PROTECTIVE EQUIPMENT

The minimum level of protection for non-intrusive survey activities at this site was Level D Protective Equipment (safety boots, hart hat and safety glasses). For intrusive activities such as sewer sampling and for activities that involve the handling of potentially contaminated objects, the minimum level of protection was Modified Level D Protective Equipment. Modified Level D Protective Equipment is defined as:

- impermeable disposable inner gloves (i.e., nitrile, polyvinyl chloride [PVC], or equivalent)
- safety boots (ANSI Z41)
- safety glasses with side shields (ANSI Z87.1)

For sampling sewer laterals the addition of Tyvek coveralls was required.

The designated on-site Site Safety and Health Officer/Radiation Protection Manager (SSHO/RPM) had the responsibility for determining if an upgrade in Personal Protective Equipment (PPE) requirements was appropriate once the survey team mobilized to the site.

4.3 PERSONNEL MONITORING REQUIREMENTS

Based on the minimal potential for levels of radiological constituents that could reasonably result in survey team members receiving external or internal radiation doses exceeding 10% of regulatory dose limits (i.e., 100 mrem), dosimetry was not required per 10 CFR 20.1502 (NRC 2003b).

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5.0 SAMPLE AND WASTE DISPOSITION

The SAIC Project Health Physicist was responsible for proper handling of all collected samples (e.g., swipes for total activity screening by LSC and soil samples). Samples were surveyed, packaged, sealed in strong, tight containers and shipped from Brooks City-Base to Test America in Earth City, MO. The samples did not exceed the concentration and total quantity thresholds for classification as a radioactive material as defined in 49 CFR 173.403.

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6.0 SURVEY RESULTS

6.1 SUMMARY OF SURVEY APPROACH

Each building/room was surveyed in accordance with guidance provided in MARSSIM. Background reference areas were established for each different type of material (e.g., concrete, metal, etc.). The preliminary MARSSIM survey indicated that 11 samples were required per area (six SU measurements and six reference area measurements). To increase statistical confidence, the number of static instrument measurements was increased to 40 (20 SU measurements and 20 reference area measurements). Depending upon the potential for contamination in each area, a MARSSIM Class 1 systematic grid, Class 2 systematic grid or Class 3 random grid was established.

All impacted areas of Brooks City-Base have been evaluated to ensure compliance with MARSSIM. This includes:

- All measurements are compliant with the DCGL.
- Scan coverage was sufficient for each area.
- Removable contamination measurements are less than 10% of the total activity.
- A sufficient number of measurements were collected to correctly evaluate the area.
- The area passes the WRS test, if required. MARSSIM (Table 4, Roadmap-13) states that if the difference between the maximum SU measurement and the minimum reference area measurement is less than the DCGL then the SU meets the release criterion, therefore a WRS test is not required.
- All areas have been accurately classified as a MARSSIM Class 1, Class 2 or Class 3 SU in accordance with Appendix A, Attachments A-1 through A-3 of this document.

As noted in this report, 10% to 100% of the accessible areas of defined impacted areas were surveyed with the precise percentage being dependent upon the MARSSIM classification of each area. For purposes of this report the term accessible does not include areas under large immobile machinery or equipment or areas in which safety concerns overrode (e.g., immediately adjacent to potentially hazardous electrical lines).

6.2 EVALUATION PROCESS OF IMPACTED AREAS

This report includes evaluation of all impacted areas located at Brooks City-Base. The evaluation process consisted of the following:

- Evaluation in the historical site assessment as to whether individual areas were impacted as defined in MARSSIM.
- Scoping surveys appropriate for each impacted area.
- Appropriate background reference areas were established for each different type of material (e.g., concrete, metal, ceramic, etc.) and the appropriate background measurement was used in evaluation of each measurement.
    - Ceramic and porcelain materials commonly include materials that contain levels of naturally occurring radionuclides that are elevated with respect to background activity of most commonly encountered materials (beta).

- Resurvey of areas which exceeded derived concentration guideline levels subsequent to tile removal, wipe down or other decontamination efforts.
- Collection of final status survey data to evaluate whether collected data demonstrated compliance with the DCGL. Areas exceeding DCGLs were subjected to re-classification as MARSSIM Class 1 areas. All impacted areas were subjected to comprehensive scan surveys which to the extent practicable included all accessible areas rather than stated minimums.
- Each SU was individually evaluated to assure that it achieved the criteria appropriate for the assigned MARSSIM classification. Evaluations included assuring:
    - An adequate scan percentage;
    - That a sufficient number of samples was collected; and
    - That systematic or random sampling was performed consistent with MARSSIM.
- Sample numbers listed on the tables within Attachments A-1 through A-24 correspond to those reflected on the associated figures.

6.3 SURVEY RESULTS

Residual levels of radioactivity in Buildings 1191 and 1193 were found to achieve the screening level DCGLs for both alpha and beta emitting radionuclides.

Isolated areas within Building 1181 were found to exceed the screening level DCGL for alpha emitting radionuclides. These areas were subject to additional investigation. Results can be found in Appendix A, Attachments A-1 through A-3.

Information provided in Appendix A includes survey results, a summary of liquid scintillation analysis results, detailed survey information including MARSSIM classification and sample location maps and WRS test results, if required for Buildings 1181, 1191 and 1193.

7.0 CONCLUSION

Comprehensive radiological surveys were performed to assess the status of impacted facilities at Brooks City-Base, specifically to determine whether such facilities achieve screening level criteria for unrestricted release. The nature and extent of residual radioactivity was determined for facilities in which concentrations of radionuclides exceeded screening level DCGLs and such facilities were decontaminated and resurveyed to confirm achievement of criteria. This report is limited to Buildings 1181, 1191, and 1193, three (3) facilities scheduled for demolition prior to transfer of control to the city of San Antonio, Texas.

Detailed survey information addressing each building is contained in Appendix A. This information clearly denotes that residual radioactivity in Buildings 1181, 1191 and 1193 achieve NRC screening level DCGLs and thus that the average dose to the critical group is less than the 25 mrem/year dose standard for unrestricted release. This assessment is based on the DCGLs for the most limiting radiological constituents of potential concern (i.e., 100 dpm/100 cm^2 for alpha [Th-232] or 200 dpm/100 cm^2 [total thorium], 7,100 dpm/100 cm^2 for beta [Co-60] and 1.8 x 10^6 dpm/100 cm^2 for low-energy beta emitters). In addition, concentrations of radiological COPCs in sewers are compliant with surficial screening level DCGLs (or surface soil screening level DCGLs). (Consistent with NRC guidance, an assessment is not required to demonstrate that doses are ALARA when NRC screening level DCGLs are used to demonstrate compliance with applicable dose standards for unrestricted release) (NRC 2003a). Based on the information presented, the levels of residual radioactivity present in Buildings 1181, 1191 and 1193 achieve DCGLs such that these facilities are suitable for unrestricted release pursuant to the provisions of 10 CFR 20, Subpart E.

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8.0 REFERENCES

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APPENDIX A

SURVEY RESULTS

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TABLE OF CONTENTS

SECTION **PAGE**

LIST OF ATTACHMENTS

BACK COVER

* CD-ROM Attachments 5 and 6

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A-1.0 SURVEY RESULTS

A-1.1 INTRODUCTION

This report presents the results of the surveys performed in Buildings 1181, 1191 and 1193 of Brooks City-Base. Radiological survey information was collected to confirm that residual radioactive material exceeding DCGLs was not present in Buildings 1181, 1191 or 1193. The radiological COPCs at Brooks City-Base include H-3; all byproduct materials with atomic numbers 3 through 83; any byproduct or accelerator produced byproduct material having atomic numbers above 83; source materials; and special nuclear materials. COPCs also specifically include transuranics and neutron emitters consisting of Cf-252 and Cf-253, as well as polonium-beryllium and plutonium-beryllium neutron sources. Given that any radioactive materials may be encountered, the subset of more likely radionuclides consists of those with half-lives exceeding 120 days, possession of which was individually authorized by Air Force permit. Detailed information about these radionuclides can be found in Table 3-5 of the main document.

Attachments A-1 through A-3 contain detailed information from surveys at Brooks City-Base to include applicable sample locations and survey results for each building. Attachment A-4 contains Background Reference Area data for the survey units. Attachment A-5 contains the State Of Texas Well Reports and Attachment A-6 contains the applicable Logbook Pages for Buildings 1181, 1191 and 1193.

A-1.2 SUMMARY OF SURVEY APPROACH

Each building/room was surveyed in accordance with guidance provided in MARSSIM. Background reference areas were established for each different type of material (e.g., concrete, metal, etc.) and the appropriate background measurement was used in evaluation of each measurement. The preliminary MARSSIM survey plan indicated that 17 samples were required per area (9 SU measurements and 9 reference area measurements). To ensure compliance with MARSSIM this was generally increased to 40 (20 SU measurements and 20 reference area measurements). Depending upon the potential for contamination in each area, a MARSSIM Class 1 systematic grid, Class 2 systematic grid or Class 3 random grid was established.

All impacted areas of Brooks City-Base have been evaluated to ensure compliance with MARSSIM. This includes;

- All measurements comply with the DCGL.
- Scan coverage was sufficient for each area.
- Although all areas are confirmed as achieving DCGLs, removable contamination was less than 10% of the total activity in areas with elevated radioactivity.
- A sufficient number of measurements were collected to correctly evaluate the area.
- The area passes the WRS test, if required. MARSSIM (Table 4, Roadmap-13) states that if the difference between the maximum SU measurement and the minimum reference area measurement is less than the DCGL then the SU meets the release criterion, therefore a WRS test is not required.
- All areas have been accurately classified as a MARSSIM Class 1, Class 2 or Class 3 SU in accordance with Attachments A-1 through A-3 of this document.

This report states that between 10% to 100% of the accessible areas of each impacted area were surveyed, with the percentage surveyed depending on the MARSSIM classification of each area. For purposes of this report the term accessible does not include areas under large immobile machinery or equipment or areas in which safety concerns (e.g., high voltage electrical lines) precluded the ability to survey in some areas.

A-1.3 EVALUATION PROCESS OF IMPACTED AREAS

This report includes evaluation of Buildings 1181, 1191 and 1193 located at Brooks City-Base. The evaluation process consisted of the following:

- Evaluation in the historical site assessment as to whether individual areas were impacted as defined in MARSSIM.
- Scoping surveys appropriate for each impacted area.
- Resurvey of areas which exceeded derived concentration guideline levels subsequent to wipe down/minor decontamination efforts.
- Collection of final status survey data to evaluate whether collected data demonstrated compliance with the DCGL.
- Each SU was individually evaluated to assure that it achieved the criteria appropriate for the assigned MARSSIM classification. Evaluations included assuring:
    - An adequate scan percentage;
    - That a sufficient number of samples was collected; and
    - That systematic or random sampling was performed consistent with MARSSIM.
- Independent verification of these surveys was performed by an Air Force Health Physicist.

A-1.4 SURVEY RESULTS

Radiological surveys are performed for a variety of reasons including to obtain information: to evaluate whether existing concentrations of site contaminants exceed DCGLs (and as part of the FSS process); to identify the lateral and vertical extent of identified COPCs exceeding DCGLs and thus to enable the scope of remedial actions to be defined; and to evaluate the effectiveness of decontamination. The surveys performed within Buildings 1181, 1191 and 1193 at Brooks City-Base address each of these objectives.

The scope of this survey effort consisted of the survey of: Buildings 1181, 1191 and 1193, as stated in Section 3.3.1 of the main document; the septic system adjacent to Building 1193; and soil areas adjacent to Building 1181 and 1191. In addition, specific surveys performed in each of these areas are stated in Attachment A-1 through Attachment A-3. Information provided in these attachments includes alpha, beta and gamma scan and fixed point measurements, as applicable, results from total activity screen by liquid scintillation counting and detailed survey information relative to MARSSIM classification, measurement location maps and WRS test results if required.

A-1.4.1 General Survey Information

Static measurements were collected using the Ludlum Model 43-89 ZnS detector coupled with a Ludlum Model 2360 scaler, measurements using this instrument are given in cpm. In order to compare this measurement with the DCGLs it must be converted to dpm/100 cm^2. This is done by using the following equation:

$$\frac{dpm}{100\ cm^2} = \frac{measurement(cpm) - background\ (cpm)}{(\varepsilon_i)(\varepsilon_s)(\frac{probe\ area}{100\ cm^2})}$$

where:

measurement (cpm) = reading from the instrument
background (cpm) = appropriate background reference area measurement
ε_i = instrument efficiency
ε_s = surface efficiency
probe area = area of the detector face

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ATTACHMENT A-1

BUILDING 1181

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BUILDING 1181

Building 1181 was under control of the AFIOH (Directed Energy), and was used as the Radioactive Waste Storage Building. It stored waste pending disposal and was subject to contain a wide range of radionuclides including any byproduct material with atomic numbers 3 through 83 except 36; up to 10,000 Curies (Ci) of H-3; and Ra-226 as radium paint. These are the COPCs (with half-lives exceeding 120 days) for this building. Initially the floor of this building was classified as a MARSSIM Class 2 area with the walls to 1.8 m (6 ft) above floor level, and ventilation system duct work being classified as MARSSIM Class 3 areas. The MARSSIM classification of the floor was subsequently changed to Class 1 based on survey results which exceeded the most limiting alpha DCGL of 100 dpm/100 cm^2. The temporary storage structure located adjacent to Building 1181 was also subjected to surveys as a MARSSIM Class 3 area.

Overview of Surveys Performed. Qualitative gamma walkthrough surveys were performed with Ludlum Model 44-10 gamma scintillation detectors with Model 2221 scaler/ratemeters and with FIDLERs using decision criteria of 1500 to 2000 and 50 to 100 counts per minute, respectively. Quantitative alpha/beta scan surveys were performed with Ludlum Model 43-89 with a Model 2360 scaler/ratemeter, and/or Ludlum Model 43-37 floor monitor with a Ludlum Model 2360 scaler/ratemeter. All floor areas were subjected to scan surveys and systematic fixed point measurements. In addition, although not classified as MARSSIM Class 1 areas, walls to 1.8 m (6 ft) above the floor, ventilation system duct work, and sewers were also subjected to 100% surveys. Given the large amounts of activity of low-energy beta emitting radionuclides stored in Building 1181, it was also subjected to the collection of swipe samples which were subsequently analyzed by total activity screen by LSC to evaluate the presence of low-energy beta emitting radionuclides. Soil areas located adjacent to Building 1181 were surveyed pursuant to NRC recommendation. These surveys consisted of gamma scans using 2 ” x 2 ” NaI detectors and the FIDLERs, as well as the collection and laboratory analysis of two potentially elevated soil samples. Results of the final status survey are indicative of the residual levels of radioactivity present within or, for soil areas, adjacent to Building 1181.

Scan Surveys. Initial scan results for the concrete floor within Building 1181 reflected the presence of radioactivity exceeding the most limiting DCGLs. Results of scan surveys of other areas were within the range of background for alpha, beta and gamma radiation. Walkover scan surveys were also performed on areas immediately outside Building 1181. The walkover surveys and associated soils sampling were performed in response to request/recommendation of the NRC Project Senior Health Physicist as the area in question appeared to exhibit elevated radioactivity.

Static Measurements, Floor – Class 1 Areas. Scabbling was performed on radiologically elevated portions of the floor of this building to obtain isotope-specific data on floor surface contamination. Laboratory analysis results for scabbled materials are contained in Tables A1.5 through A1.16. Post-scabbling resurveys included scan surveys of 100% of the floor area as well as static measurements which were obtained from the requisite number of systematic locations. All survey results performed after scabbling were below the most limiting DCGLs of 100 dpm/100 cm^2 (Th-232) for alpha emitting radionuclides and 7,100 dpm/100 cm^2 (Co-60) for beta emitting radionuclides. Results of the static measurement of floors are listed in Tables A1.1 and A1.2 and locations are shown on Figures A1.1 and A.3.

Table A1.1 Building 1181 Class 1 Floor Static Measurement Results – SU-1

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
3	Concrete Floor	Building 1181	12	239
4	Concrete Floor	Building 1181	25	227
7	Concrete Floor	Building 1181	25	201
8	Concrete Floor	Building 1181	34	186
11	Concrete Floor	Building 1181	21	208
12	Concrete Floor	Building 1181	30	233
15	Concrete Floor	Building 1181	43	283
16	Concrete Floor	Building 1181	21	205
19	Concrete Floor	Building 1181	70	321
20	Concrete Floor	Building 1181	57	201
23	Concrete Floor	Building 1181	75	314
24	Concrete Floor	Building 1181	48	223
27	Concrete Floor	Building 1181	57	274
28	Concrete Floor	Building 1181	43	223
31	Concrete Floor	Building 1181	34	374
32	Concrete Floor	Building 1181	30	154
35	Concrete Floor	Building 1181	70	167
36	Concrete Floor	Building 1181	43	132
39	Concrete Floor	Building 1181	57	195
40	Concrete Floor	Building 1181	34	258
42*	Concrete Floor	Building 1181	30	527
43*	Concrete Floor	Building 1181	3	595
44*	Concrete Floor	Building 1181	-2	581
46*	Concrete Floor	Building 1181	-6	-371
31+	Concrete Floor	Building 1181	45	309

* QC Sample

+ Biased Sample

The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).

The instrument MDCs for samples 1-40 are 78 (alpha) and 389dpm/100 cm^2 (beta), for samples 41-46 the MDCs are 78 (alpha) and 469 dpm/100 cm^2 (beta), and for QC samples 31 and 34 the MDCs are 92 (alpha) and 335 dpm/100 cm^2 (beta),

Negative results indicate that data is below background for the respective building material.

SU-1 is 102 m^2.

Table A1.2 Building 1181 Class 1 Floor Static Measurement Results – SU-2

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
1	Concrete Floor	Building 1181	3	-106
2	Concrete Floor	Building 1181	25	173
5	Concrete Floor	Building 1181	30	280
6	Concrete Floor	Building 1181	34	258
9	Concrete Floor	Building 1181	16	151
10	Concrete Floor	Building 1181	30	242
13	Concrete Floor	Building 1181	39	223
14	Concrete Floor	Building 1181	43	198
17	Concrete Floor	Building 1181	34	230
18	Concrete Floor	Building 1181	43	63
21	Concrete Floor	Building 1181	39	239
22	Concrete Floor	Building 1181	61	211
25	Concrete Floor	Building 1181	12	179
26	Concrete Floor	Building 1181	21	380
29	Concrete Floor	Building 1181	30	308
30	Concrete Floor	Building 1181	30	358
33	Concrete Floor	Building 1181	25	151
34	Concrete Floor	Building 1181	61	405
37	Concrete Floor	Building 1181	57	208

Table A1.2 Building 1181 Class 1 Floor Static Measurement Results – SU-2 (Continued)

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
38	Concrete Floor	Building 1181	39	258
41*	Concrete Floor	Building 1181	26	483
45*	Concrete Floor	Building 1181	12	-188
34+	Concrete Floor	Building 1181	70	515

* QC Sample

+ Biased Sample

The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).

The instrument MDCs for samples 1-40 are 78 (alpha) and 389dpm/100 cm^2 (beta), for samples 41-46 the MDCs are 78 (alpha) and 469 dpm/100 cm^2 (beta), and for QC samples 31 and 34 the MDCs are 92 (alpha) and 335 dpm/100 cm^2 (beta),

Negative results indicate that data is below background for the respective building material.

SU-2 is 102 m^2.

Static Measurements, Walls – Class 1 Area. Static measurements of the walls were obtained from systematic locations. The systematic locations followed a triangular grid and were spaced at heights 2 ft (.6 m) and 5 ft (1.5 m) above the floor. All results were below the most limiting DCGLs of 100 dpm/100 cm^2 for alpha emitting radionuclides and 7,100 dpm/100 cm^2 for beta emitting radionuclides. Results are listed in Table A1.3 and locations are shown on Figure A1.2.

Table A1.3 Building 1181 Class 1 Wall Static Measurement Results

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
51	Sheet Metal	Building 1181	-9	144
52	Metal Door	Building 1181	-1	288
53	Sheet Metal	Building 1181	-1	159
54	Sheet Metal	Building 1181	-14	182
55	Sheet Metal	Building 1181	-9	205
56	Sheet Metal	Building 1181	-14	218
57	Sheet Metal	Building 1181	-14	223
58	Sheet Metal	Building 1181	-14	236
59	Sheet Metal	Building 1181	3	252
60	Sheet Metal	Building 1181	-5	313
61	Sheet Metal	Building 1181	-1	259
62	Sheet Metal	Building 1181	-9	216
63	Sheet Metal	Building 1181	-9	210
64	Sheet Metal	Building 1181	3	-6
65	Sheet Metal	Building 1181	-5	115
66	Sheet Metal	Building 1181	-5	192
67	Sheet Metal	Building 1181	3	131
68	Overhead Door	Building 1181	-1	110
69	Overhead Door	Building 1181	8	141
70	Overhead Door	Building 1181	3	123
71	Sheet Metal	Building 1181	-9	141
72	Sheet Metal	Building 1181	8	210
73	Sheet Metal	Building 1181	-1	532
74	Sheet Metal	Building 1181	8	84
75	Sheet Metal	Building 1181	-14	167
76	Sheet Metal	Building 1181	-9	123
77	Sheet Metal	Building 1181	-1	306
78	Sheet Metal	Building 1181	-14	113
79	Sheet Metal	Building 1181	-5	105
80	Sheet Metal	Building 1181	-5	187
81	Sheet Metal	Building 1181	-1	192
82	Sheet Metal	Building 1181	-5	156
83	Sheet Metal	Building 1181	-5	84

Table A1.3 Building 1181 Class 1 Wall Static Measurement Results (Continued)

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
84	Sheet Metal	Building 1181	-9	177
85	Sheet Metal	Building 1181	-5	69
86	Sheet Metal	Building 1181	-5	151
87	Sheet Metal	Building 1181	-5	180
88	Sheet Metal	Building 1181	3	190
89	Sheet Metal	Building 1181	-5	198
90	Sheet Metal	Building 1181	8	187
64*	Sheet Metal	Building 1181	17	225
89*	Sheet Metal	Building 1181	8	197

* QC Sample
The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).
The instrument MDCs for samples 51-90 are 92 (alpha) and 335 dpm/100 cm^2 (beta), for QC samples 64 and 89 the MDCs are 78 (alpha) and 389 dpm/100 cm^2 (beta).
Negative results indicate results that are below background for the respective building material.
The Class 1 wall SU is 105 m^2.

Low-Energy Beta Emissions. Given that the COPCs included a low-energy beta emitter (e.g., H-3), 18 swipes were collected within Building 1181 for analysis by total activity screen by LSC. All results were below the most limiting screening level DCGL for low-energy beta emitting COPCs of 1.8 x 10^6 dpm/100 cm^2 (Ni-63). These results are listed below in Table A1.4 and locations are shown on Figure A1.4.

Table A1.4 Building 1181 Liquid Scintillation Results

Sample Number	Survey Surface	Location	Total Activity of Low-Energy Beta-Emitting Radionuclides (dpm/100 cm^2)	Sample MDC
BCB118101	Concrete Floor	Building 1181	3.7	3.5
BCB118101-1	Concrete Floor	Building 1181	1.2	3.3
BCB118102	Concrete Support	Building 1181	4.4	4.5
BCB118103	Metal Floor Drain	Building 1181	12.6	4.4
BCB118104	Electric Outlet	Building 1181	0.4	3.3
BCB118105	Metal Siding	Building 1181	1.5	3.4
BCB118106	Concrete Floor	Building 1181	2.4	3.5
BCB118107	Metal Overhead Door	Building 1181	1.1	3.5
BCB118108	Metal Door	Building 1181	1360	4.0
BCB118109	Concrete Floor	Building 1181	10.2	3.4
BCB118110	Concrete Floor	Building 1181	105	3.0
BCB118111	Concrete Floor	Building 1181	5.0	3.5
BCB118112	Concrete Floor	Building 1181	115	4.0
BCB118113	Concrete Floor	Building 1181	53.4	3.5
BCB118114	Concrete Floor	Building 1181	23.0	3.6
BCB118115	Concrete Floor	Building 1181	13.3	3.7
BCB118116	Concrete Ledge	Building 1181	2.0	3.4
BCB118117	Concrete Ledge	Building 1181	1.2	3.4
BCB118118	Metal Shed	Outbuilding	92	5.0

Gamma Spectroscopy. As noted above, scabbling was performed on radiologically elevated portions of the floor of this building to obtain more accurate data with respect to floor surface contamination. Samples of the scabbled concrete floor were collected and submitted for laboratory analysis by Test America Laboratory, Earth City, MO. These samples were analyzed for gamma emitting constituents by gamma spectroscopy and for thorium content by alpha spectrometry. Each of these samples was collected from an area that exceeded the most limiting alpha DCGL of 100 dpm/100 cm^2; with sample BCBS118120 being collected at the most

elevated location. Gamma spectroscopy and isotopic thorium results are listed below in Tables A1.5 through A1.12 with the full laboratory reports being included in Appendix C. Review of radioanalytical results is inconclusive with respect to the radionuclide(s) present in areas of elevated activity thus continued use of the most restrictive DCGLs is appropriate.

Table A1.5 Gamma Spectroscopy Results / Isotopic Thorium for Concrete Floor Sample BCBS118101

Isotope	Activity (dpm/sample)	MDC (dpm/sample)
Actinium-227	-0.02	0.56
Actinium-228	0.214	0.14
Americium-241	0.0006	0.094
Bismuth-212	0.04	0.44
Bismuth-214	0.36	0.11
Cesium-134	-0.001	0.045
Cesium-137	0.099	0.055
Cobalt-57	0.0	0.027
Cobalt-60	-0.005	0.065
Europium-152	-0.00003	0.14
Europium-154	0.0	0.62
Europium-155	-0.020	0.104
Lead-210	0.03	1.6
Lead-212	0.154	0.079
Lead-214	0.44	0.11
Manganese-54	-0.0009	0.058
Potassium-40	0.76	0.87
Sodium-22	0.004	0.061
Thallium-208	0.098	0.028
Thorium-234	0.03	1.1
Uranium-235	0.06	0.21
Uranium-238	0.03	1.1
Thorium-227[1]	0.006	0.036
Thorium-228[1]	0.206	0.066
Thorium-230[1]	0.59	0.12
Thorium-232[1]	0.183	0.061

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.6 Gamma Spectroscopy / Isotopic Thorium Results for Concrete Floor Sample BCBS118103

Isotope	Activity (dpm/sample)	MDC (dpm/sample)
Actinium-227	-0.003	0.31
Actinium-228	0.13	0.25
Americium-241	0.054	0.15
Bismuth-212	0.03	0.70
Bismuth-214	0.94	0.21
Cesium-134	-0.034	0.10
Cesium-137	-0.02	0.11

Table A1.6 Gamma Spectroscopy / Isotopic Thorium Results for Concrete Floor Sample BCBS118103 (Continued)

Isotope	Activity (dpm/sample)	MDC[1] (dpm/sample)
Cobalt-57	0.0	0.040
Cobalt-60	-0.04	0.1
Europium-152	0.028	0.17
Europium-154	-0.004	0.62
Europium-155	-0.022	0.16
Lead-210	0.7	2.0
Lead-212	0.198	0.098
Lead-214	0.97	0.19
Manganese-54	0.002	0.082
Potassium-40	1.46	1.4
Sodium-22	-0.009	0.11
Thallium-208	0.144	0.025
Thorium-234	0.06	1.4
Uranium-235	-0.1	0.4
Uranium-238	0.06	1.4
Thorium-227[1]	0.021	0.038
Thorium-228[1]	0.248	0.030
Thorium-230[1]	0.54	0.03
Thorium-232[1]	0.157	0.030

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.7 Gamma Spectroscopy/ Isotopic Thorium Results for Concrete Floor Sample BCBS118105

Isotope	Activity (dpm/sample)	MDC(dpm/sample)
Actinium-227	-0.03	0.37
Actinium-228	0.1	0.29
Americium-241	0.003	0.10
Bismuth-212	0.0	0.85
Bismuth-214	0.44	0.21
Cesium-134	0.016	0.051
Cesium-137	0.014	0.095
Cobalt-57	-0.005	0.040
Cobalt-60	-0.02	0.11
Europium-152	0.016	0.16
Europium-154	-0.09	0.71
Europium-155	-0.009	0.17
Lead-210	0.15	1.8
Lead-212	0.220	0.093
Lead-214	0.42	0.18
Manganese-54	0.017	0.056
Potassium-40	1.19	1.2
Sodium-22	0.0	0.038
Thallium-208	0.133	0.054
Thorium-234	0.45	1.4
Uranium-235	-0.05	0.31

Table A1.7 Gamma Spectroscopy/ Isotopic Thorium Results for Concrete Floor Sample BCBS118105 (Continued)

Isotope	Activity (dpm/sample)	MDC(dpm/sample)
Uranium-238	0.45	1.4
Thorium-227[1]	0.017	0.024
Thorium-228[1]	0.144	0.033
Thorium-230[1]	0.453	0.024
Thorium-232[1]	0.157	0.026

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.8 Gamma Spectroscopy/ Isotopic Thorium Results for Concrete Floor Sample BCBS118106

Isotope	Activity (dpm/sample)	MDC(dpm/sample)
Actinium-227	-0.03	0.57
Actinium-228	0.12	0.22
Americium-241	0.004	0.11
Bismuth-212	0.17	0.44
Bismuth-214	0.52	0.12
Cesium-134	-0.001	0.054
Cesium-137	0.007	0.14
Cobalt-57	0.002	0.031
Cobalt-60	0.003	0.069
Europium-152	-0.002	0.13
Europium-154	0.0	0.40
Europium-155	0.053	0.13
Lead-210	0.2	2.0
Lead-212	0.153	0.098
Lead-214	0.56	0.11
Manganese-54	-0.009	0.066
Potassium-40	0.85	0.89
Sodium-22	-0.004	0.068
Thallium-208	0.069	0.051
Thorium-234	0.66	1.2
Uranium-235	0.11	0.23
Uranium-238	0.66	1.2
Thorium-227[1]	0.022	0.012
Thorium-228[1]	0.183	0.031
Thorium-230[1]	0.55	0.03
Thorium-232[1]	0.164	0.024

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.9 Gamma Spectroscopy/ Isotopic Thorium Results for Concrete Floor Sample BCBS118108

Isotope	Activity (dpm/sample)	MDC(dpm/sample)
Actinium-227	-0.05	0.34
Actinium-228	0.24	0.22
Americium-241	-0.012	0.10
Bismuth-212	0.14	0.39
Bismuth-214	0.65	0.10
Cesium-134	-0.007	0.059
Cesium-137	-0.002	0.067
Cobalt-57	-0.004	0.029
Cobalt-60	0.007	0.069
Europium-152	-0.0004	0.13
Europium-154	0.09	0.369
Europium-155	-0.007	0.14
Lead-210	0.12	1.4
Lead-212	0.188	0.084
Lead-214	0.54	0.11
Manganese-54	0.009	0.055
Potassium-40	1.34	0.79
Sodium-22	-0.005	0.082
Thallium-208	0.039	0.071
Thorium-234	0.15	1.2
Uranium-235	-0.09	0.26
Uranium-238	0.15	1.2
Thorium-227[1]	0.039	0.013
Thorium-228[1]	0.206	0.034
Thorium-230[1]	0.73	0.01
Thorium-232[1]	0.194	0.026

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.10 Gamma Spectroscopy / Isotopic Thorium Results for Concrete Floor Sample BCBS118110

Isotope	Activity (dpm/sample)	MDC (dpm/sample)
Actinium-227	0.0	0.63
Actinium-228	0.17	0.20
Americium-241	-0.016	0.12
Bismuth-212	0.14	0.46
Bismuth-214	0.35	0.17
Cesium-134	0.001	0.071
Cesium-137	-0.002	0.046
Cobalt-57	0.0005	0.031
Cobalt-60	-0.006	0.074
Europium-152	-0.008	0.14
Europium-154	0.07	0.49
Europium-155	-0.015	0.13

Table A1.10 Gamma Spectroscopy / Isotopic Thorium Results for Concrete Floor Sample BCBS118110 (Continued)

Isotope	Activity (dpm/sample)	MDC[1] (dpm/sample)
Lead-210	1.1	1.8
Lead-212	0.175	0.099
Lead-214	0.405	0.16
Manganese-54	0.002	0.060
Potassium-40	2.13	0.88
Sodium-22	0.005	0.069
Thallium-208	0.077	0.062
Thorium-234	1.9	1.5
Uranium-235	0.06	0.32
Uranium-238	1.9	1.5
Thorium-227[1]	0.023	0.022
Thorium-228[1]	0.166	0.030
Thorium-230[1]	0.484	0.019
Thorium-232[1]	0.146	0.019

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.11 Gamma Spectroscopy / Isotopic Thorium Results for Concrete Floor Sample BCBS118114

Isotope	Activity(dpm/sample)	MDC (dpm/sample)
Actinium-227	-0.06	0.35
Actinium-228	0.33	0.14
Americium-241	-0.010	0.12
Bismuth-212	0.0	0.20
Bismuth-214	0.38	0.20
Cesium-134	-0.0007	0.042
Cesium-137	-0.04	0.09
Cobalt-57	-0.001	0.035
Cobalt-60	-0.03	0.10
Europium-152	0.014	0.15
Europium-154	0.07	0.60
Europium-155	0.044	0.13
Lead-210	0.44	1.5
Lead-212	0.217	0.092
Lead-214	0.44	0.17
Manganese-54	0.017	0.063
Potassium-40	1.19	1.2
Sodium-22	0.016	0.077
Thallium-208	0.056	0.073
Thorium-234	0.39	1.4
Uranium-235	-0.1	0.4
Uranium-238	0.39	1.4

Table A1.11 Gamma Spectroscopy / Isotopic Thorium Results for Concrete Floor Sample BCBS118114 (Continued)

Isotope	Activity (dpm/sample)	MDC[1] (dpm/sample)
Thorium-227[1]	0.018	0.022
Thorium-228[1]	0.168	0.026
Thorium-230[1]	0.61	0.02
Thorium-232[1]	0.205	0.024

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.12 Gamma Spectroscopy/ Isotopic Thorium Results for Concrete Floor Sample BCBS118120

Isotope	Activity (dpm/sample)	MDC (dpm/sample)
Actinium-227	0.02	0.25
Actinium-228	0.25	0.23
Americium-241	0.07	0.19
Bismuth-212	0.15	0.46
Bismuth-214	0.46	0.13
Cesium-134	-0.0006	0.052
Cesium-137	0.037	0.15
Cobalt-57	-0.0006	0.048
Cobalt-60	0.001	0.080
Europium-152	-0.003	0.14
Europium-154	0.0	0.63
Europium-155	-0.36	0.40
Lead-210	0.06	2.2
Lead-212	0.150	0.088
Lead-214	0.49	0.13
Manganese-54	-0.019	0.078
Potassium-40	1.72	0.94
Sodium-22	0.013	0.071
Thallium-208	0.125	0.042
Thorium-234	0.07	2.1
Uranium-235	0.15	0.33
Uranium-238	0.07	2.1
Thorium-227[1]	0.030	0.033
Thorium-228[1]	0.193	0.040
Thorium-230[1]	0.55	0.04
Thorium-232[1]	0.170	0.028

[1] Isotopic Thorium results.
N/A Not Applicable

Sewer Investigations. Building 1181 sewers were investigated such that the only sewer intake, a floor drain, was subjected to surveys consisting of scan and static measurements using gamma and alpha/beta detectors and the evaluation of sewer residuals by the collection and analysis of samples of solids or swipes. No sample was obtained from the sewer main of Building 1181 as the line connects to a septic system which also services Building 1192 and is addressed in the consolidated report with Building 1192. Results of this septic system investigation are specified in Table A21.3 of Attachment A.21 of the consolidated survey report and indicate that elevated radioactivity was not encountered. As part of this sewer evaluation, one swipe sample was

collected and analyzed for gross alpha and gross beta at Brooks City-Base and a swipe was collected for evaluation using a total activity screen by LSC to evaluate the presence of low-energy beta emitting radionuclides. All survey results performed after scabbling were below the most limiting DCGLs of 100 dpm/100 cm^2 (Th-232) for alpha emitting radionuclides and 7,100 dpm/100 cm^2 (Co-60) for beta emitting radionuclides. Further, low-energy beta activity was multiple orders of magnitude below 1.8 x 10^6 dpm/100 cm^2 (Ni-63), the most limiting screening level DCGL for low-energy beta COPCs. Results support the conclusion that contamination exceeding screening level DCGLs was not present in Building 1181 sewers. Results are listed in Table A1.13. (Swipes were compared directly to applicable screening level DCGLs.)

Table A1.13 Building 1181 Sewer Results

Sample Number	Sample Type	Survey Surface	Location	Total Activity of Low-Energy Beta-Emitting Radionuclides (dpm/100 cm^2)	LSC Sample MDC	Gross Alpha Results (dpm/100 cm^2)	Gross Beta Results (dpm/100 cm^2)
BKR1002-21[1]	Swipe	Floor Drain	Building 1181	N/A	N/A	< 4.44	2.44 +/- 2.22
BKR1001-21	LSC	Floor Drain	Building 1181	0.1	3.7	N/A	N/A

[1] Results converted from picocuries/swipe to dpm/100 cm^2 but otherwise reported as provided by analytical laboratory.
The term "swipe" is used to denote gross alpha/beta contamination surveys with the term "LSC" being used to denote low-energy beta contamination surveys evaluated by liquid scintillation counting.
N/A – Not Applicable

For additional information regarding the sewer tanks and the piping and components associated with Building 1192, the *Report of Radiological Findings Brooks City-Base Tank Assessments for Buildings 110 and 1192, March 2010* (USAF 2010b) is included in Attachment 29 of the consolidated survey report.

Temporary Structure Adjacent to Building 1181 – Radiological investigations of the temporary structure located adjacent to Building 1181 consisted of scan surveys and fixed point measurements. Given that scan surveys did not identify elevated radioactivity, static measurements were obtained from random locations with emphasis on areas with a greater likelihood of residual activity. Results of the static measurement are listed in Table A1.14 and locations are shown on Figure A1.5. All results were below the most limiting DCGLs of 100 dpm/100 cm^2 for alpha (Th-232) emitting radionuclides and 7,100 dpm/100 cm^2 for beta (Co-60) emitting radionuclides.

Table A.14 Temporary Structure Adjacent to Building 1181. Static Measurement Results

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
1	Painted Metal	Wall	-1	-215
2	Painted Metal	Wall	-11	-145
3	Painted Metal	Wall	-6	-184
4	Painted Metal	Floor	-6	-219
5	Painted Metal	Floor	-1	-131
6	Painted Metal	Floor	-1	-85
7	Painted Metal	Floor	-5	-215

The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).
The instrument MDCs are 40 (alpha) and 242 dpm/100 cm^2 (beta).
Negative results indicate results that are below background for the respective building material.

Soil Sampling. Qualitative gamma walkover surveys were performed on soil adjacent to Building 1181. These surveys used both the FIDLER and Ludlum Model 44-10 2"x 2" NaI

detectors coupled to Ludlum Model 2221 scaler/ratemeters to investigate areas exhibiting elevated gamma activity. Technicians observed two areas along a small drainage ditch that produced gamma count rates that were slightly elevated with respect to background. Two soil samples were collected and submitted for laboratory analysis by Test America Laboratory, Earth City, MO. These samples were analyzed for gamma emitting constituents by gamma spectroscopy and for thorium content by alpha spectrometry. Sample #1 was located approximately 7 ft from the center of Building 1181 on the southeastern side with Sample #2 being located approximately 12 ft north and 11 ft east of Sample #1. Gamma spectroscopy and isotopic thorium results are listed below in Tables A1.15 and A1.16. The full laboratory reports can be found in Appendix C. Review of analytical results for the two soil samples supports the conclusion that radioactivity is within the range of background with naturally occurring potassium-40 being the likely basis for elevated gamma activity.

Table A1.15 Gamma Spectroscopy/ Isotopic Thorium Results for Soil Sample BKS1181-01-01

Isotope	Activity (dpm/sample)	MDC (dpm/sample)
Actinium-227	-0.81	0.47
Actinium-228	1.19	0.13
Americium-241	0.002	0.11
Bismuth-212	0.84	0.27
Bismuth-214	0.92	0.1
Cesium-134	0.033	0.13
Cesium-137	0.111	0.033
Cobalt-57	0.001	0.029
Cobalt-60	-0.001	0.042
Europium-152	0.0001	0.084
Europium-154	0.05	0.31
Europium-155	0.075	.012
Lead-210	0.66	1.2
Lead-212	1.28	0.07
Lead-214	0.97	0.09
Manganese-54	-0.0005	0.044
Potassium-40	12.8	0.5
Sodium-22	-0.005	0.045
Thallium-208	0.437	0.041
Thorium-234	0.60	1.1
Uranium-235	-0.04	0.24
Uranium-238	0.60	1.1
Thorium-227[1]	0.013	0.022
Thorium-228[1]	1.05	0.03
Thorium-230[1]	0.82	0.03
Thorium-232[1]	1.15	0.03

[1] Isotopic Thorium results.
N/A Not Applicable

Table A1.16 Gamma Spectroscopy/ Isotopic Thorium Results for Soil Sample BKS1181-01-02

Isotope	Activity (dpm/sample)	MDC (dpm/sample)
Actinium-227	-0.080	0.16
Actinium-228	0.77	0.09
Americium-241	-0.038	0.099
Bismuth-212	0.70	0.24
Bismuth-214	0.672	0.080
Cesium-134	0.007	0.11
Cesium-137	0.066	0.031
Cobalt-57	0.004	0.019
Cobalt-60	-0.007	0.036
Europium-152	0.013	0.098
Europium-154	-0.03	0.28
Europium-155	0.110	0.10
Lead-210	1.08	1.0
Lead-212	0.744	0.058
Lead-214	0.794	0.069
Manganese-54	-0.002	0.045
Potassium-40	8.15	0.40
Sodium-22	-0.007	0.037
Thallium-208	0.262	0.036
Thorium-234	0.41	0.84
Uranium-235	0.0	0.22
Uranium-238	0.41	0.84
Thorium-227[1]	0.007	0.032
Thorium-228[1]	0.74	0.04
Thorium-230[1]	0.57	0.02
Thorium-232[1]	0.71	0.02

[1] Isotopic Thorium results.
N/A Not Applicable

Summary. Residual levels of radioactivity in Brooks City-Base Building 1181 clearly demonstrate that residual concentrations of radionuclide COPCs achieve the most restrictive screening level DCGLs of 100 dpm/100 cm^2 (alpha) and 7,100 dpm/100 cm^2 (beta). Results of all samples for total activity screenings by LSC measurements are well below the low-energy beta emitting DCGL of 1.8×10^6 dpm/100 cm^2.

Given these results, the null hypothesis, that Building 1181 exceeds DCGLs, is rejected. Review of survey data supports the conclusion that Building 1181 contains an adequate number of samples; a sufficient percentage has been scanned; and the building has been appropriately classified consistent with MARSSIM requirements using the process noted in Section 3.10 of the main text of this document. All scan and fixed point measurement results collected from Building 1181 of Brooks City-Base subsequent to decontamination were below the $DCGL_W$. As such, formal assessment using the Sign Test or WRS Test is not required.

Conclusion. Levels of radioactivity in Building 1181 achieve screening level DCGLs for unrestricted release consistent with the provisions of Title 10, CFR, Part 20, Subpart E.

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ATTACHMENT 1

FIGURES

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Figure A1.1 Class 1 Floor Fixed Point Locations

Survey Number:	Building 1181
Legend: ★ = Class 1 Fixed Points Location	

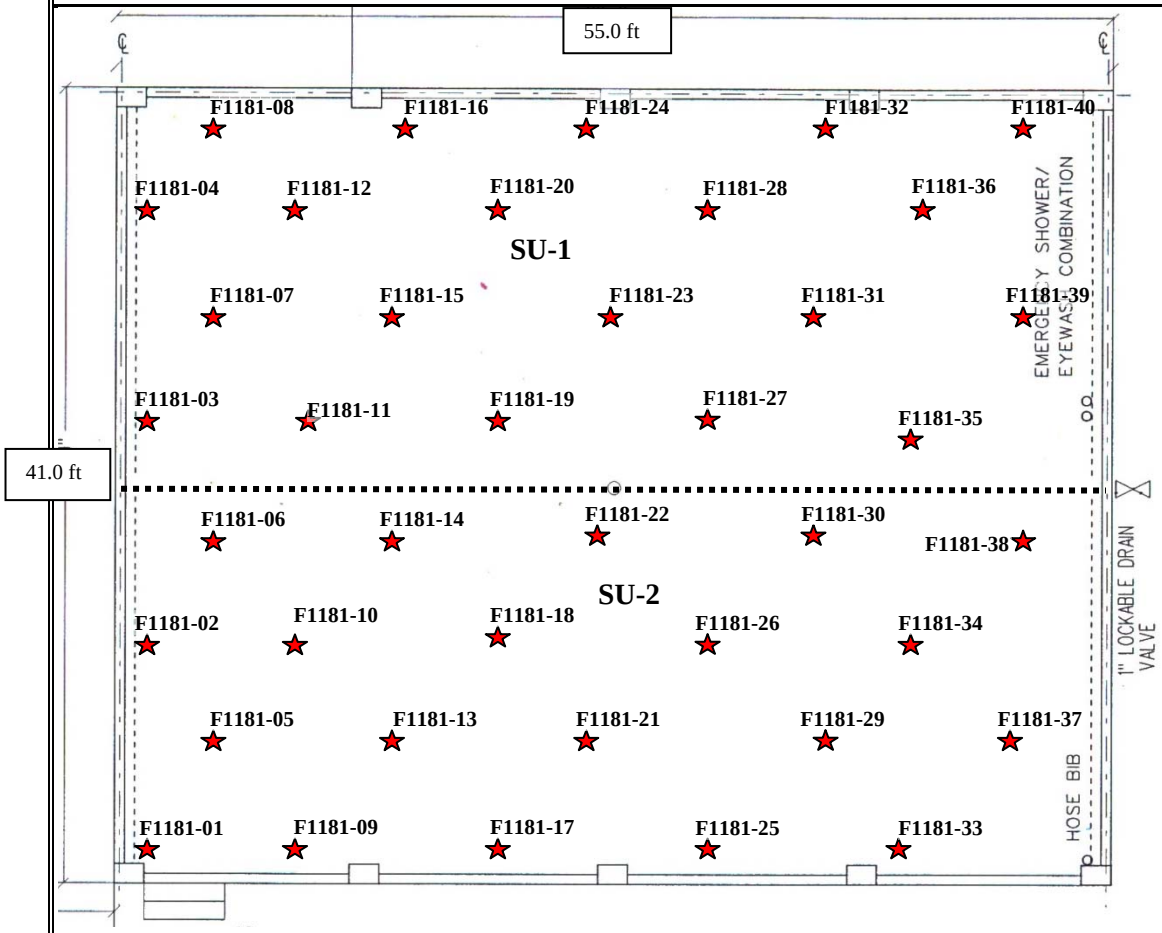


Figure A1.2 Class 1 Wall Fixed Point Locations

Survey Number**:**	Building 1181

Legend: ★ = Class 1 Fixed Points Location

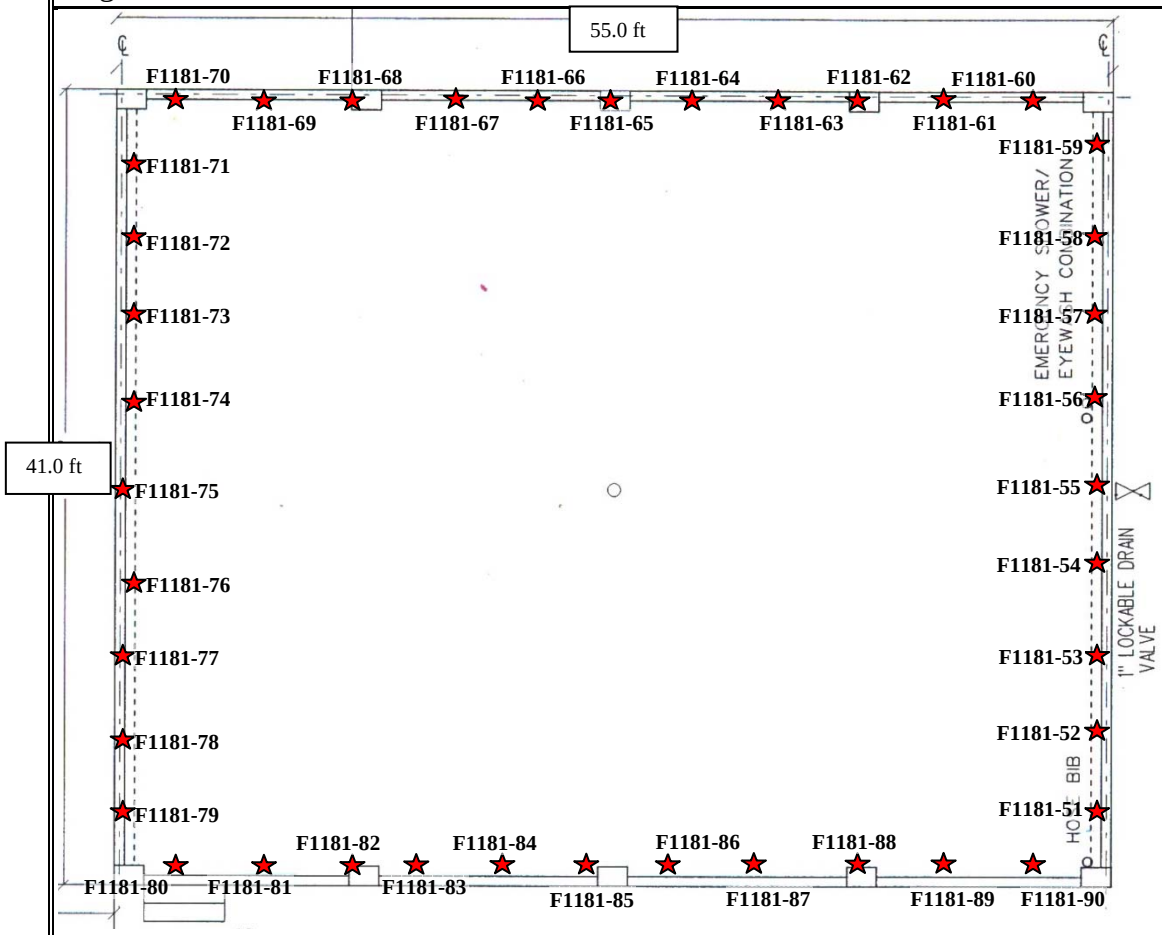


Figure A1.3 Biased Fixed Point Locations

Survey Number**:**	Building 1181

Legend:⬢= Biased Fixed Point Location (floor)

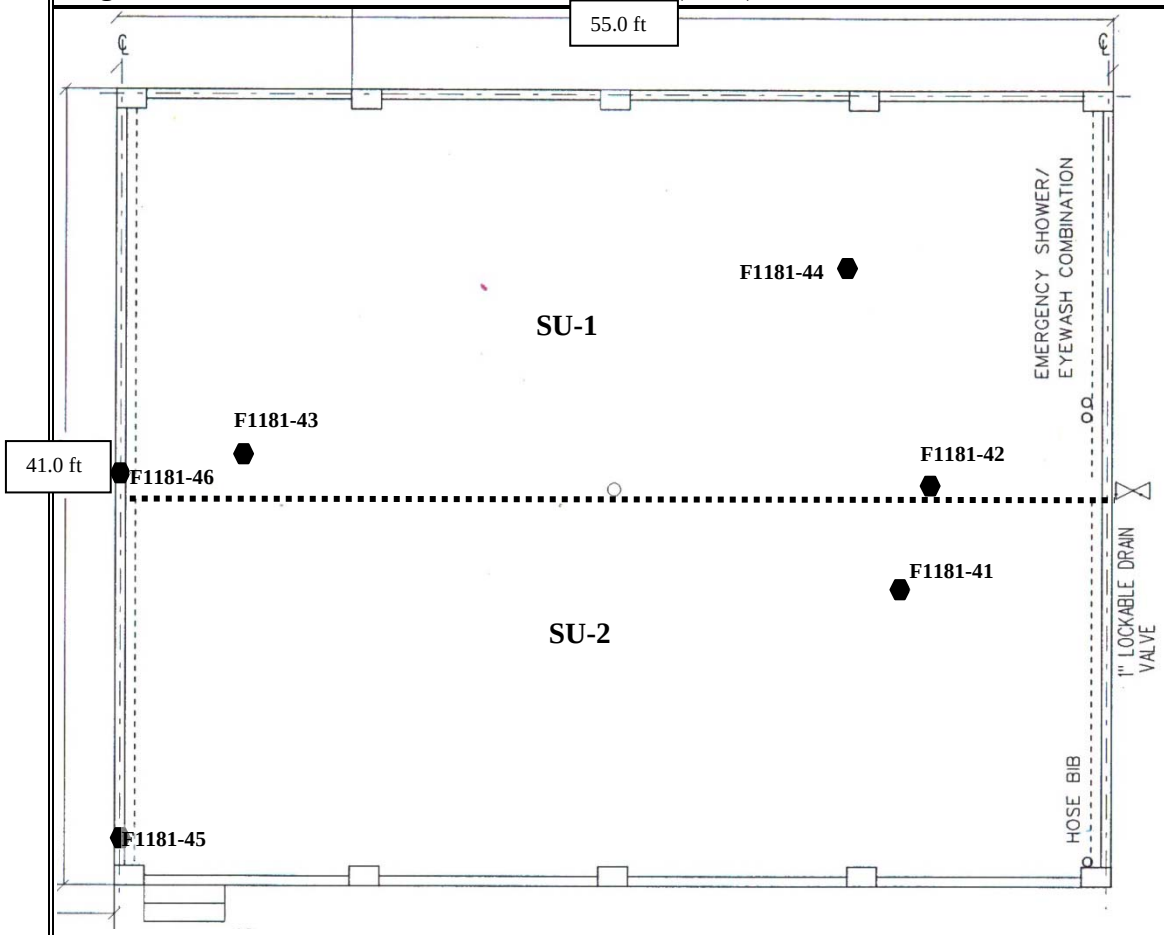
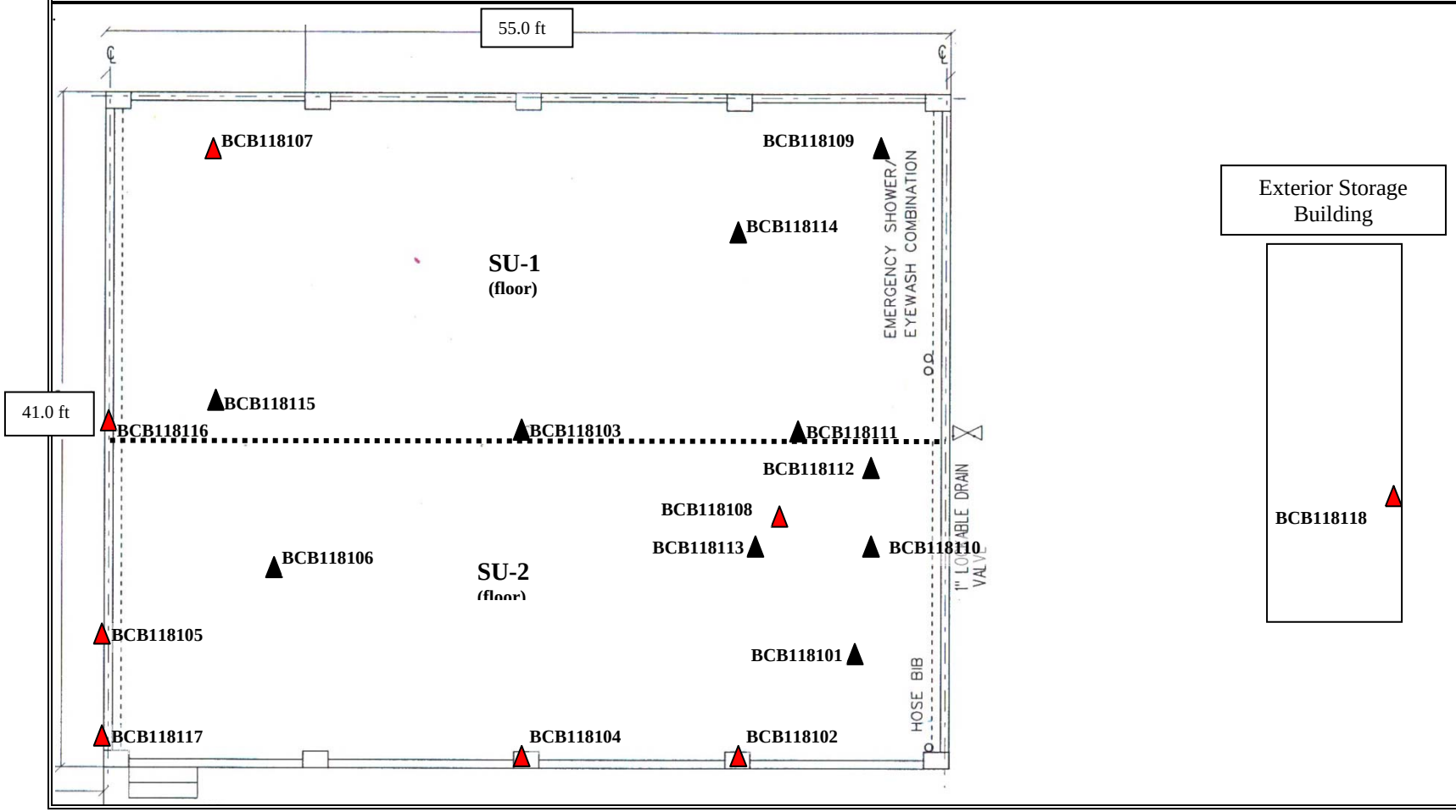


Figure A1.4 LSC Locations

Survey Number**:**	Building 1181

Legend: ▲ = LSC Location (floor) ▲ = LSC Location (wall/location above floor)



* For more specific location information see Table A1.3.

Figure A1.5 Class 3 Fixed Point Locations

Survey Number**:**	Building 1181
Legend: _____= Class 3 Fixed Points Location	

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ATTACHMENT A-2

BUILDING 1191

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BUILDING 1191

Building 1191 contained the administrative support area for the Radioactive Waste Storage Area. Given that all radionuclides authorized to be possessed at Brook City-Base were potentially present in the radioactive waste storage building all such materials were taken as COPCs for the support area. This building was classified as a MARSSIM Class 3 area.

Overview of Surveys Performed. Both qualitative gamma walkthrough surveys and quantitative alpha/beta scan surveys were performed on up to 10% of the floors, walls to 1.8 m (6 ft) above the floor, ventilation system duct work, and sewers. These surveys used both FIDLER and Ludlum Model 44-10 2 inch x 2 inch NaI detectors with Ludlum Model 2221 scaler/ratemeters to identify areas exhibiting elevated gamma activity and Ludlum Model 43-89 detectors coupled with Ludlum Model 2360 scalers for alpha/beta scan surveys. Quantitative alpha/beta static measurements were also performed at randomly generated locations using the Ludlum Model 43-89 scintillation detector coupled with a Ludlum Model 2360 scaler. In addition, the presence of low-energy beta emitting radionuclides (e.g., tritium) was assessed by a total activity screen by LSC.

Scan Surveys. Scan results for Building 1191 were within the range of background for alpha, beta and gamma radiation for the various media surveyed (e.g., concrete floors, drywall, and ceramic tiles).

Static Measurements. Given that scan surveys did not identify elevated radioactivity, static measurements were obtained from random locations with emphasis on areas (e.g., cracks in the floor) with a greater likelihood of residual activity. Results of the static measurement are listed in Table A2.1 and locations are shown on Figure A2.1. All results were below the most limiting DCGLs of 100 dpm/100 cm^2 (Th-232) for alpha emitting radionuclides and 7,100 dpm/100 cm^2 (Co-60) for beta emitting radionuclides

Table A2.1 Building 1191 Static Measurement Results

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
1	Drywall	Building 1191	-1	-116
2	Linoleum	Building 1191	8	-130
3	Drywall	Building 1191	4	-27
4	Electric Conduit	Building 1191	15	91
5	Linoleum	Building 1191	3	-183
6	Metal Box	Building 1191	5	95
7	Linoleum	Building 1191	-2	-119
8	Drywall	Building 1191	-1	-119
9	Plastic Shower	Building 1191	-2	-243
10	Drywall	Building 1191	14	-94
11	Ceramic Sink	Building 1191	21	127
12	Metal Door	Building 1191	-6	-99
13	Linoleum	Building 1191	3	53
14	Metal Box	Building 1191	5	-99
15	Linoleum	Building 1191	-2	-31
16	Cinder Block	Building 1191	10	-84
17	Painted Wood	Building 1191	2	-302
18	Linoleum	Building 1191	24	-162
19	Drywall	Building 1191	4	121
20	Water Heater	Building 1191	-6	-39
21	Linoleum	Building 1191	-2	-67
22	Drywall	Building 1191	4	15

Table A2.1 Building 1191 Static Measurement Results (Continued)

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
23	Plastic Shower	Building 1191	13	-246
24	Linoleum	Building 1191	8	-116
25	Metal Box	Building 1191	5	-78
26	Plastic Kick Board	Building 1191	8	-299
27	Wood Door Frame	Building 1191	7	-182
28	Wall Putty	Building 1191	-2	-77
29	Linoleum	Building 1191	8	-102
30	Wood Board	Building 1191	12	-154
31	Drywall	Building 1191	35	110
32	Drywall	Building 1191	14	131
33	Glass Shower Door	Building 1191	19	-285
34	Drywall	Building 1191	9	-66
35	Metal Junction Box	Building 1191	-11	-39
36	Linoleum	Building 1191	19	-45
37	Linoleum	Building 1191	19	-95
38	Linoleum	Building 1191	29	88
39	Linoleum	Building 1191	8	-77
40	Linoleum	Building 1191	8	11
9*	Plastic Shower	Building 1191	13	106
11*	Ceramic Sink	Building 1191	55	731
12*	Metal Door	Building 1191	-10	304
13*	Linoleum	Building 1191	3	382
14*	Metal Box	Building 1191	0	246

* QC Sample

The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).

The instrument MDCs for samples 1-40 are 40 (alpha) and 242 dpm/100 cm^2 (beta) and for all QC samples the MDCs are 30 (alpha) and 262 dpm/100 cm^2 (beta).

Negative results indicate results that are below background for the respective building material.

The Building 1191 SU area is 81 m^2 for the floor and walls.

Low-Energy Beta Emissions. Given that the COPCs included low-energy beta emitters (e.g., H-3, C-14, Fe-55, and Ni-63), ten swipes were required to be collected within Building 1191 for analysis by total activity screen by LSC. All results were below the most limiting screening level DCGL for low-energy beta emitting COPCs of 1.8×10^6 dpm/100 cm^2 (Ni-63). These results are listed below in Table A2.2 and locations are shown on Figure A2.2.

Table A2.2 Building 1191 Liquid Scintillation Results

Sample Number	Survey Surface	Location	Total Activity of Low-Energy Beta-Emitting Radionuclides (dpm/100 cm^2)	Sample MDC
BCB119101	Metal Drain	Building 1191	25.8	3.8
BCB119102	Linoleum	Building 1191	11.4	3.1
BCB119103	Light Switch	Building 1191	4.7	3.0
BCB119104	Linoleum	Building 1191	68.1	3.0
BCB119105	Drywall	Building 1191	6.1	2.9
BCB119106	Wood Door Frame	Building 1191	32.6	3.2
BCB119107	Linoleum	Building 1191	10.4	3.1
BCB119108	Water Heater	Building 1191	12.5	3.1
BCB119109	Drywall	Building 1191	2.6	2.9
BCB119110	Metal Door Knob	Building 1191	2.8	2.9

Sewer Investigations. Building 1191 sewers were investigated such that 10% of the intakes (e.g., sink p-traps and floor drains) were subjected to surveys consisting of scan and static measurements using gamma and alpha/beta detectors and the evaluation of sewer residuals by

the collection and analysis of samples of solids or swipes. No sample was obtained from the sewer main of Building 1191 as the line connects to a septic system which also services Building 1192 and is addressed in the consolidated report with Building 1192. Results of this septic system investigation are specified in Table A21.3 of Attachment A.21 of the consolidated survey report and indicate that elevated radioactivity was not encountered. As part of this sewer evaluation swipes were collected for evaluation using a total activity screen by LSC to evaluate the presence of low-energy beta emitting radionuclides. Results support the conclusion that contamination exceeding screening level DCGLs was not present in Building 1191 sewers. Results are listed in Table A2.3.

Table A2.3 Building 1191 Sewer Results

Sample Number	Sample Type	Survey Surface	Location	Total Activity of Low-Energy Beta-Emitting Radionuclides (dpm/100 cm^2)	LSC Sample MDC
BKR1001-17	LSC	Sink Drain	N/A	31.2	3.9
BKR1001-18	LSC	Stool	N/A	-0.3	3.3
BKR1001-19	LSC	Shower	N/A	2.8	3.4
BKR1001-20	LSC	Vent Pipe	N/A	2.6	3.5

N/A – Not Applicable

For additional information regarding the sewer tanks and the piping and components associated with Building 1192, the *Report of Radiological Findings Brooks City-Base Tank Assessments for Buildings 110 and 1192, March 2010* (USAF 2010b) is included in Attachment 29 of the consolidated survey report.

Summary. Residual levels of radioactivity in Brooks City-Base Building 1191 clearly demonstrate that residual concentrations of radionuclide COPCs achieve the most restrictive screening level DCGLs of 100 dpm/100 cm^2 (alpha) and 7,100 dpm/100 cm^2 (beta). Results of all samples for total activity screenings by LSC measurements are below the low-energy beta emitting DCGL of 1.8×10^6 dpm/100 cm^2. In addition, concentrations of radiological COPCs in sewers were compliant with surficial screening level DCGLs (or surface soil screening level DCGLs).

Given these results, it is clearly demonstrated that the H_0 (i.e., that Building 1191 exceeds DCGLs) is rejected. Review of survey data supports the conclusion that Building 1191 contains an adequate number of samples; a sufficient percentage has been scanned; and it has been appropriately classified consistent with MARSSIM requirements using the process noted in Section 3.10 of the main text of this document. All scan and fixed measurement results collected from Building 1191 of Brooks City-Base were below the $DCGL_W$. As such, formal assessment using the Sign Test or WRS Test is not required.

Conclusion. Levels of radioactivity in Building 1191 achieve screening level DCGLs for unrestricted release consistent with the provisions of Title 10, CFR, Part 20, Subpart E.

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ATTACHMENT 2

FIGURES

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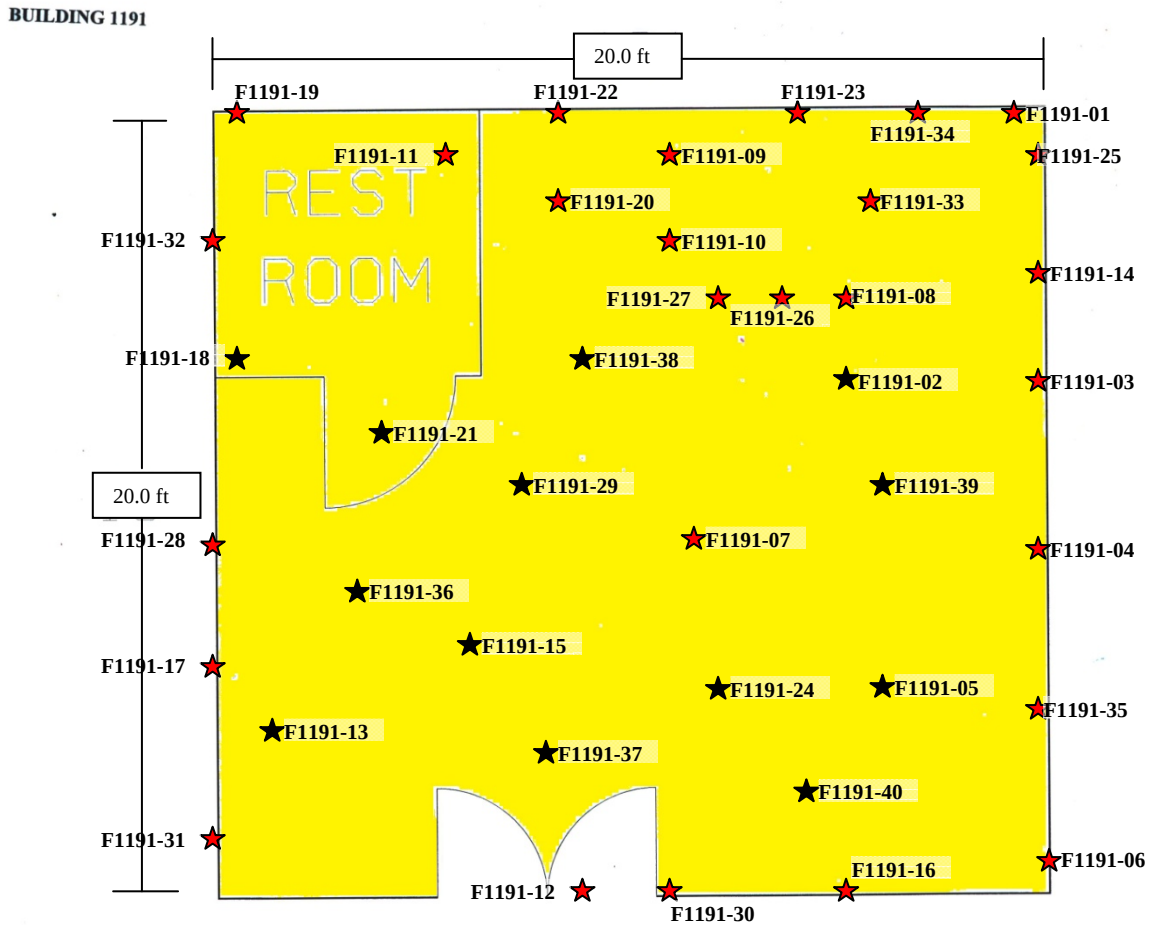
Figure A2.1 Fixed Point Locations

BROOKS CITY-BASE	Building 1191
Legend: ★ = Fixed Point Location (floor) ★ = Fixed Point Location (wall/location above floor)*	

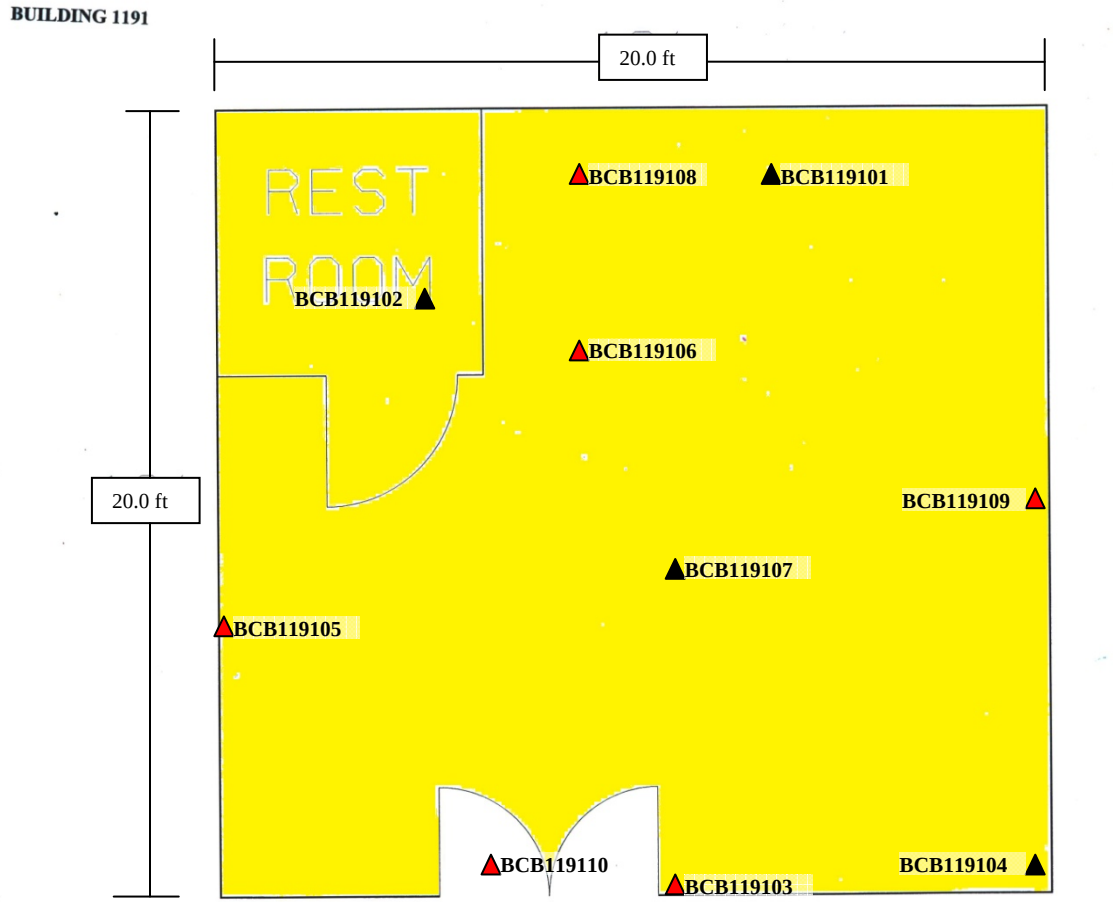


* For more specific location information see Table A2.1.

FigureA2.2 LSC Locations

BROOKS CITY-BASE	Building 1191

Legend: ▲ = LSC Location (floor) ▲ = LSC Location (wall/location above floor)*



* For more specific location information see Table A2.2.

ATTACHMENT A-3

BUILDING 1193

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BUILDING 1193

Building 1193 contained the AFIOH Radiation Detection, Identification and Computation (RADIAC) Instrument Calibration Facility. Co-60, Cs-137, U-235, Pu-236, Pu-238, Pu-239, Pu-242 and Cf-252 are the COPCs (with half-lives exceeding 120 days) in this building. Range 3 was classified as Class 1 based on the potential for residual neutron-induced activity with other portions of building being classified as a MARSSIM Class 3 area. The Class 3 designation for areas of the building other than Range 3 is based on preliminary survey information and on the fact that sources contained in Building 1193 were generally limited to sealed or plated sources which present a lower potential for residual activity.

Overview of Surveys Performed. Both qualitative gamma walkthrough surveys and quantitative alpha/beta scan surveys were performed on between 10% (Class 3 SUs) and 100% (Class 1 SUs) of the floors, walls to 1.8 m (6 ft) above floor level, ventilation system duct work, and sewers. These surveys used both FIDLER and Ludlum Model 44-10 2"x 2" NaI detectors coupled with Model 2221 scaler/ratemeters to identify areas exhibiting elevated gamma activity and Ludlum Model 43-89 detectors coupled with Ludlum Model 2360 scalers for alpha/beta scan surveys and fixed point (static) measurements.

Scan Surveys. Scan results for Building 1193 were within the range of background for alpha, beta and gamma radiation for the various building media surveyed (e.g., concrete floors, drywall, and ceramic tiles).

Static Measurements, Class 3 Area. Given that scan surveys did not identify elevated radioactivity, static measurements were obtained from random locations with emphasis on areas (e.g., cracks in the floor) with a greater likelihood of residual activity. Results of the static measurement are listed in Table A3.1 and locations are shown on Figure A3.1. All results were below the most limiting DCGLs of 100 dpm/100 cm^2 (Th-232) for alpha emitting radionuclides and 7,100 dpm/100 cm^2 (Co-60) for beta emitting radionuclides.

Table A3.1 Building 1193 Class 3 Static Measurement Results

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
1	Metal	Door – Range 2 (6 ft)	-5	4
2	Concrete	Wall – Hallway (5 ft)	7	389
3	Metal	Wall – Hallway (4 ft)	-9	220
4	Tile	Floor – Hallway	-43	-411
5	Concrete	Floor – Range 2	19	456
6	Concrete	Wall – Range 2 (3 ft)	3	290
7	Concrete	Wall – Range 2 (6 ft)	3	310
8	Metal	Wall – Range 2 (3 ft)	-9	272
9	Tile	Floor – Hallway	-51	-577
10	Concrete	Wall – Hallway (5 ft)	7	223
11	Concrete	Floor – Range 1	23	503
12	Concrete	Floor – Range 1	15	491
13	Concrete	Wall – Range 1 (3 ft)	3	337
14	Concrete	Wall – Range 1 (6 ft)	7	300
15	Metal	Wall – Range 1 (6 ft)	-9	250
16	Tile	Floor – Hallway	-55	-616
17	Tile	Floor – Hallway	-51	-520
18	Sheet Rock	Wall – Room 2 (3 ft)	3	159
19	Tile	Floor – Room 2	-59	-455
20	Sheet Rock	Wall – Room 2a (6 ft)	3	176

Table A3.1 Building 1193 Class 3 Static Measurement Results (Continued)

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
21	Sheet Rock	Wall – Hallway (5 ft)	3	90
22	Tile	Floor – Hallway	-51	-539
23	Sheet Rock	Wall – Hallway (3ft)	-1	127
24	Tile	Floor - Restroom	-55	-435
25	Tile	Floor – Room 4	-55	-596
26	Sheet Rock	Wall – Room 4 (3 ft)	-5	109
27	Sheet Rock	Wall – Room 4 (6 ft)	12	251
28	Sheet Rock	Wall – Room 5 (5 ft)	16	87
29	Tile	Floor – Room 5a	-51	-532
30	Sheet Rock	Wall – Room 5 (5 ft)	-5	181
31	Tile	Floor – Room 5	-55	-527
32	Tile	Janitor's Closet Floor – Room 5	-51	-458
33	Tile	Floor – Room 5	-59	-539
34	Sheet Rock	Wall – Room 5 (5 ft)	-1	161
35	Tile	Floor – Room 5	-47	-517
36	Tile	Floor – Room 5b	-55	-500
37	Tile	Floor – Room 5b	-59	-475
38	Metal	Wall – Room 5b (6 ft)	-13	203
39	Concrete	Mechanical Room Floor	28	545
40	Sheet Rock	Mechanical Room Wall (3 ft)	20	186
1*	Metal	Door – Range 2 (6 ft)	-1	182
18*	Sheet Rock	Wall – Room 2 (3 ft)	8	362

* QC Sample

The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).

The instrument MDCs for samples 1-40 are 34 (alpha) and 229 dpm/100 cm^2 (beta) and for QC samples 1 and 18 the MDCs are 36 (alpha) and 241 dpm/100 cm^2 (beta).

Negative results indicate results that are below background for the respective building material.

The Building 1193 Class 3 SU is 373 m^2 for the walls and the floor.

Static Measurements, Class 1 Areas. Range 3 of Building 1193 was classified as a MARSSIM Class 1 area. The floor (SU-1) and walls (SU-2) of Range 3 were subsequently subjected to 100% scan surveys and systematic static sampling. Results of the static measurements are listed in Tables A3.2 and A3.3 and are shown on Figure A3.2. All sample results were below the DCGLs for alpha and beta emitting radionuclides.

Table A3.2 Range 3 Class 1 Floor Static Measurement Results

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
1	Concrete Floor	Range 3	3	520
2	Concrete Floor	Range 3	3	526
3	Concrete Floor	Range 3	12	509
4	Concrete Floor	Range 3	16	594
5	Concrete Floor	Range 3	7	623
6	Concrete Floor	Range 3	12	643
7	Concrete Floor	Range 3	7	657
8	Concrete Floor	Range 3	3	692
9	Concrete Floor	Range 3	25	626
10	Concrete Floor	Range 3	3	689
11	Concrete Floor	Range 3	7	694
12	Concrete Floor	Range 3	12	563
13	Concrete Floor	Range 3	16	743
14	Concrete Floor	Range 3	12	780
15	Concrete Floor	Range 3	7	680

Table A3.2 Range 3 Class 1 Floor Static Measurement Results (Continued)

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
16	Concrete Floor	Range 3	3	569
17	Concrete Floor	Range 3	25	549
18	Concrete Floor	Range 3	-2	720
19	Concrete Floor	Range 3	12	769
20	Concrete Floor	Range 3	-2	617
21	Concrete Floor	Range 3	3	697
16*	Concrete	Range 3	-2	451
40*	Concrete	Range 3	32	567

* QC Sample
The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).
The instrument MDCs for samples 1-41 are 36 (alpha) and 241 dpm/100 cm^2 (beta) and for QC samples 16 and 40 the MDCs are 34 (alpha) and 229 dpm/100 cm^2 (beta).
Negative results indicate results that are below background for the respective building material.
The Range 3 floor SU is 80 m^2.

Table A3.3 Range 3 Class 1 Wall Static Measurement Results (Continued)

Sample Number	Survey Surface	Location	Alpha Results (dpm/100 cm^2)	Beta Results (dpm/100 cm^2)
22	Metal – Wall (2 ft)	Range 3	-5	285
23	Metal – Wall (5 ft)	Range 3	-14	274
24	Metal – Wall (2 ft)	Range 3	-10	354
25	Concrete – Wall (5 ft)	Range 3	-6	597
26	Concrete – Wall (2 ft)	Range 3	-6	643
27	Concrete – Wall (5 ft)	Range 3	3	500
28	Concrete – Wall (2 ft)	Range 3	-2	340
29	Concrete – Wall (5 ft)	Range 3	7	440
30	Concrete – Wall (2 ft)	Range 3	-2	386
31	Concrete – Wall (5 ft)	Range 3	3	557
32	Concrete – Wall (2 ft)	Range 3	12	426
33	Metal Door – Wall (5 ft)	Range 3	-14	694
34	Concrete – Wall (2 ft)	Range 3	25	246
35	Concrete – Wall (5 ft)	Range 3	-2	426
36	Concrete – Wall (2 ft)	Range 3	21	475
37	Metal – Wall (5 ft)	Range 3	-14	202
38	Metal – Wall (2 ft)	Range 3	-10	217
39	Metal – Wall (5 ft)	Range 3	-14	322
40	Metal – Wall (2 ft)	Range 3	-10	251
41	Metal – Wall (5 ft)	Range 3	3	520

* QC Sample
The MDC is the minimum detectable concentration on a surface, that an instrument is expected to detect (e.g., activity expected to be detected with 95% confidence).
The instrument MDCs for samples 1-41 are 36 (alpha) and 241 dpm/100 cm^2 (beta) and for QC samples 16 and 40 the MDCs are 34 (alpha) and 229 dpm/100 cm^2 (beta).
Negative results indicate results that are below background for the respective building material.
The Range 3 wall SU is 40 m^2.

Low-Energy Beta Emitters. Radiological COPCs did not include low-energy beta emitting radionuclides thus surveys did not include collection or analysis of samples for liquid scintillation counting.

Sewer and Septic Investigations. Building 1193 sewers were classified as a MARSSIM Class 3 area such that 10% of the intakes (e.g., sink p-traps and floor drains) were subjected to surveys consisting of scan and static measurements using gamma and alpha/beta detectors and the evaluation of sewer residuals by the collection and analysis of samples of solids or swipes. As

part of this sewer evaluation, swipes were collected for evaluation using a total activity screen by LSC to evaluate the presence of low-energy beta emitting radionuclides. The LSC results are listed in Table A3.3. As noted below, the building septic system was investigated as an integral component of the sewer system. Analytical results of sewer and septic system solids were compared initially with the most limiting surface soil screening level DCGLs. Given that samples exceeded these levels, additional analysis consisting of gamma spectroscopy and alpha spectrometry for thorium were performed to assure that such samples were compliant with radionuclide specific surface soil screening level DCGLs.

Table A3.4 Building 1193 Sewer Results

Sample Number	Sample Type	Survey Surface	Location	Total Activity of Low-Energy Beta-Emitting Radionuclides (dpm/100 cm^2)	LSC Sample MDC	Gross Alpha Results (dpm/100 cm^2)	Gross Beta Results (dpm/100 cm^2)
BRKR11119-01	LSC/Swipe	P-Trap	Restroom Room 3	-0.3	4.8	-6	-104
BRKR 11119-02	LSC	Sewer Cleanout	Building 1193	0.3	4.7	N/A	N/A

The instrument MDCs for sample BRKR11119-01 is 69 (alpha) and 163 dpm/100 cm^2 (beta).

Septic System Soil Sampling. The septic system associated with Building 1193 was investigated to confirm that the system had not been used at some point in the past for the disposal of radioactive materials. This investigation included both the septic tank and the field. Including QA/QC samples, a total of 10 samples were obtained from the Building 1193 septic system. Gross alpha and gross beta sample results, radiation measurement data and sampling locations are reflected in Table A3.4.Samples collected from the septic fields were obtained using a direct push GeoProbe with a 1.5 m (5 ft) auger and 5 cm (2 in) diameter acetate (polyvinyl chloride) liners. One sample of solids was collected from the septic tank. Radiation screenings were performed to identify most elevated point of the sample column using both Ludlum Model 44-10 2"x 2" NaI gamma scintillation detectors coupled with Ludlum Model 2221 scaler-ratemeters and Ludlum Model 43-89 ZnS alpha/beta detectors to identify areas exhibiting elevated activity.

The septic field soil samples were submitted for laboratory analysis for gross alpha and beta and total activity screen by liquid scintillation counting at Test America Laboratory, Earth City, MO. Four of the ten samples were submitted for isotopic thorium and gamma spectroscopy analysis with the associated results, inclusive of naturally occurring background, being listed in Tables A3.6 through A3.9. Background data as listed in Table A3.5 was obtained previously from five locations within the sewer systems associated with Buildings 175W and 930, two buildings determined to be non-impacted. This data has been augmented by San Antonio vicinity data as stated in *State Background Radiation Levels: Results of Measurements Taken During 1975 – 1979*, T.E. Myrick et al, Oak Ridge National Laboratory (ORNL 1983). This study reflects mean surface soil concentrations of 0.80 ± 0.75 for Th-232, 0.9 for U-238 and 1.2 ± 0.30 for Ra-226. (Th-232 and Ra-226 errors are reported as the "2σ value" while U-238 error was reported as "≤ 5%.) Comparison of above background concentrations of radionuclides as specified in Table A3.7 through A3-10 are clearly compliant with NRC surface soil screening level DCGLs.

The State of Texas Well Reports for these septic system borings are included in Attachment 6.

Table A3.5. Isotopic Background Data for Detected Radionuclides

Sample Identification Number	Bi-214 Activity (pCi/g)	Pb-212 Activity (pCi/g)	Pb-214 Activity (pCi/g)	Ra-226 Activity (pCi/g)	Tl-208 Activity (pCi/g)
Building 930					
1004-07	0.29 +/- 0.15	U	0.29 +/- 0.15	0.29 +/- 0.15	U
Building 175W					
1005-07	0.60 +/- 0.15	0.29 +/- 0.09	0.71 +/- 0.14	0.60 +/- 0.15	0.12 +/- 0.05
1005-08	1.7 +/- 0.40	0.26 +/- 0.16	2.1 +/- 0.32	1.7 +/- 0.40	U
1005-09	0.26 +/- 0.15	U	0.58 +/- 0.15	0.26 +/- 0.15	U
1005-10	0.47 +/- 0.15	0.19 +/- 0.10	0.54 +/- 0.13	0.47 +/- 0.15	U
Mean of Site Data	0.66 +/- 0.50	0.25 +/- 0.21	0.85 +/- 0.43	0.66 +/- 0.50	0.12 +/- 0.05
TX-1	NR	NR	NR	1.0 +/- 0.08	NR
TX-6	NR	NR	NR	1.4 +/- 0.30	NR
TX-7	NR	NR	NR	1.1 +/- 0.10	NR
Mean of TX-1, -6 and -7	NR	NR	NR	1.2 +/- 0.33	NR
Mean of All Data	0.66 +/- 0.50	0.25 +/- 0.21	0.85 +/- 0.43	0.85 +/- 0.60	0.12 +/- 0.05

All data is rounded to two significant figures and all uncertainties are given in two standard deviations.
U represents non-detect; NR is "not reported"
Data reflected as TX-1, TX-6 and TX-7 represent values in the San Antonio vicinity as stated in *State Background Radiation Levels: Results of Measurements Taken During 1975 – 1979*, T.E. Myrick et al, Oak Ridge National Laboratory (ORNL 1983).
U - not detected
NR - not reported

Table A3.6 Building 1193 Soil Sampling and Septic System Results

Sample Number	Station ID	Depth	2" x 2" (cpm)[1]	43-89 alpha (cpm)[2]	43-89 beta (cpm)[2]	Total Activity (pCi/g)	Gross Alpha Results (pCi/g)	Gross Beta Results (pCi/g)	Easting[3]	Northing[3]
B11119-03	TANK	N/A	N/A	N/A	N/A	-0.1	6.8	6.8	2179782.11	547706.34
B11119-04	SB1	2'-3'	4817	0	261	-0.1	7.1	7.5	2179785.74	547710.69
B11119-05	SB2	4'-6'	4911	2	240	-0.1	7.8	8.5	2179776.16	547702.01
B11119-06	SB5	3'-5'	4838	3	254	-0.1	5.2	6.9	2179757.24	547682.00
B11119-07	SB9	3'-5'	4833	1	234	0.3	8.0	17.0	2179740.45	547689.20
B11119-08	SB8	3'-5'	4720	3	270	-0.2	5.1	14.9	2179767.99	547666.73
B11119-09	SB7	3'-5'	4976	1	266	0.4	16.2	23.4	2179749.43	547671.76
B11119-10	SB4	3'-5'	4919	1	232	0.2	14.4	27.5	2179721.67	547678.52
B11119-11	SB6	3'-5'	4749	0	249	0.1	4.0	6.5	2179734.72	547663.33
B11119-12	SB3	3'-5'	4871	2	260	0.2	6.9	17.4	2179750.27	547649.15

[1] General area background radiation with the 2" x 2" was 3214 cpm.
[2] General area background radiation with the 43-89 for alpha radiation was 1 cpm and for beta radiation was 162 cpm.
[3] NAD_1927_StatePlane_Texas_South_Central_FIPS_4204.
N/A – Not Applicable

Table A3.7 Isotopic Thorium and Gamma Spectroscopy Results for Building 1193 – Sample BKS11119-09 - that Exhibited Elevated Radioactivity

Isotope	Total Activity (pCi/g)	MDC (pCi/g)	Screening-Level DCGLs (pCi/g)
Actinium-228	0.93	0.30	N/A
Bismuth-214	0.92	0.17	N/A
Cesium-137	0.002	0.093	11
Lead-212	0.94	0.16	N/A
Lead-214	0.87	0.17	N/A
Potassium-40	11.2	0.9	N/A
Thallium-208	0.443	0.066	N/A
Thorium-227	0.026	0.012	N/A
Thorium-228	0.88	0.03	4.7
Thorium-230	0.83	0.01	1.8
Thorium-232	0.95	0.02	1.1

N/A Not Applicable

Table A3.8 Isotopic Thorium and Gamma Spectroscopy Results for Building 1193 – Sample BKS11119-10 - that Exhibited Elevated Radioactivity

Isotope	Total Activity (pCi/g)	MDC (pCi/g)	Screening-Level DCGLs (pCi/g)
Actinium-228	0.70	0.36	N/A
Bismuth-214	0.99	0.16	N/A
Cesium-137	0.0	0.12	11
Lead-212	0.88	0.17	N/A
Lead-214	1.03	0.16	N/A
Potassium-40	10.9	1.2	N/A
Thallium-208	0.306	0.084	N/A
Thorium-227	0.007	0.018	N/A
Thorium-228	0.81	0.02	4.7
Thorium-230	0.88	0.02	1.8
Thorium-232	0.89	0.02	1.1

N/A Not Applicable

Table A3.9 Isotopic Thorium and Gamma Spectroscopy Results for Building 1193 – Sample BKS11119-11 - that Exhibited Elevated Radioactivity

Isotope	Total Activity (pCi/g)	MDC (pCi/g)	Screening-Level DCGLs (pCi/g)
Actinium-228	0.89	0.27	N/A
Cesium-137	-0.006	0.092	11
Lead-212	0.90	0.13	N/A
Lead-214	1.25	0.15	N/A
Potassium-40	10.2	1	N/A
Thorium-227	0.0029	0.018	N/A
Thorium-228	1.02	0.02	4.7
Thorium-230	1.07	0.02	1.8
Thorium-232	0.90	0.03	1.1

N/A Not Applicable

Table A3.10 Isotopic Thorium and Gamma Spectroscopy Results for Building 1193 – Sample BKS11119-12 - that Exhibited Elevated Radioactivity

Isotope	Total Activity (pCi/g)	MDC (pCi/g)	Screening-Level DCGLs (pCi/g)
Actinium-228	0.94	0.29	N/A
Bismuth-214	0.47	0.18	N/A
Cesium-137	0.022	0.085	11
Lead-212	0.89	0.15	N/A
Lead-214	0.84	0.15	N/A
Potassium-40	11.8	1	N/A
Thallium-208	0.289	0.092	N/A
Thorium-227	0.035	0.021	N/A
Thorium-228	0.95	0.03	4.7
Thorium-230	1.12	0.03	1.8
Thorium-232	1.05	0.02	1.1

N/A Not Applicable

Summary. Residual levels of radioactivity in Brooks City-Base Building 1193 clearly demonstrate that residual concentrations of radionuclide COPCs achieve the most restrictive screening level DCGLs of 100 dpm/100 cm^2 (alpha) and 7,100 dpm/100 cm^2 (beta). Results of all samples for total activity screenings by LSC measurements are below the low-energy beta emitting DCGL of 1.8 x 10^6 dpm/100 cm^2. In addition, concentrations of radiological COPCs in sewers were compliant with surficial screening level DCGLs or surface soil screening level DCGLs, as applicable.

Given these results, it is demonstrated that the H_0 (i.e., that Building 1193 exceeds DCGLs) is rejected. Review of survey data supports the conclusion that Building 1193 contains an adequate number of samples; a sufficient percentage has been scanned; and it has been appropriately classified consistent with MARSSIM requirements using the process noted in Section 3.10 of the main text of this document. All scan and fixed measurement results collected from Building 1193 of Brooks City-Base were below the $DCGL_W$. As such, formal assessment using the Sign Test or WRS Test is not required.

Conclusion. Levels of radioactivity in Building 1193 achieve screening level DCGLs for unrestricted release consistent with the provisions of Title 10, CFR, Part 20, Subpart E.

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ATTACHMENT 3

FIGURES

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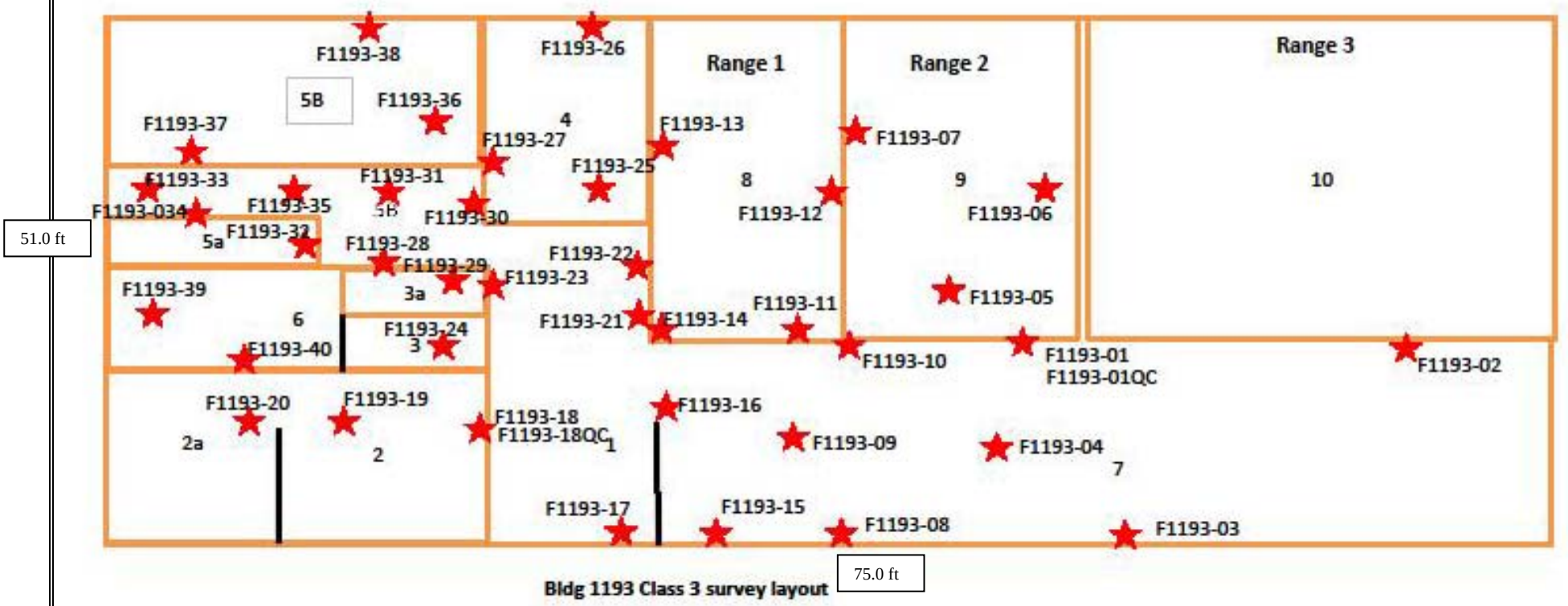
Figure A3.1 Fixed Point Locations

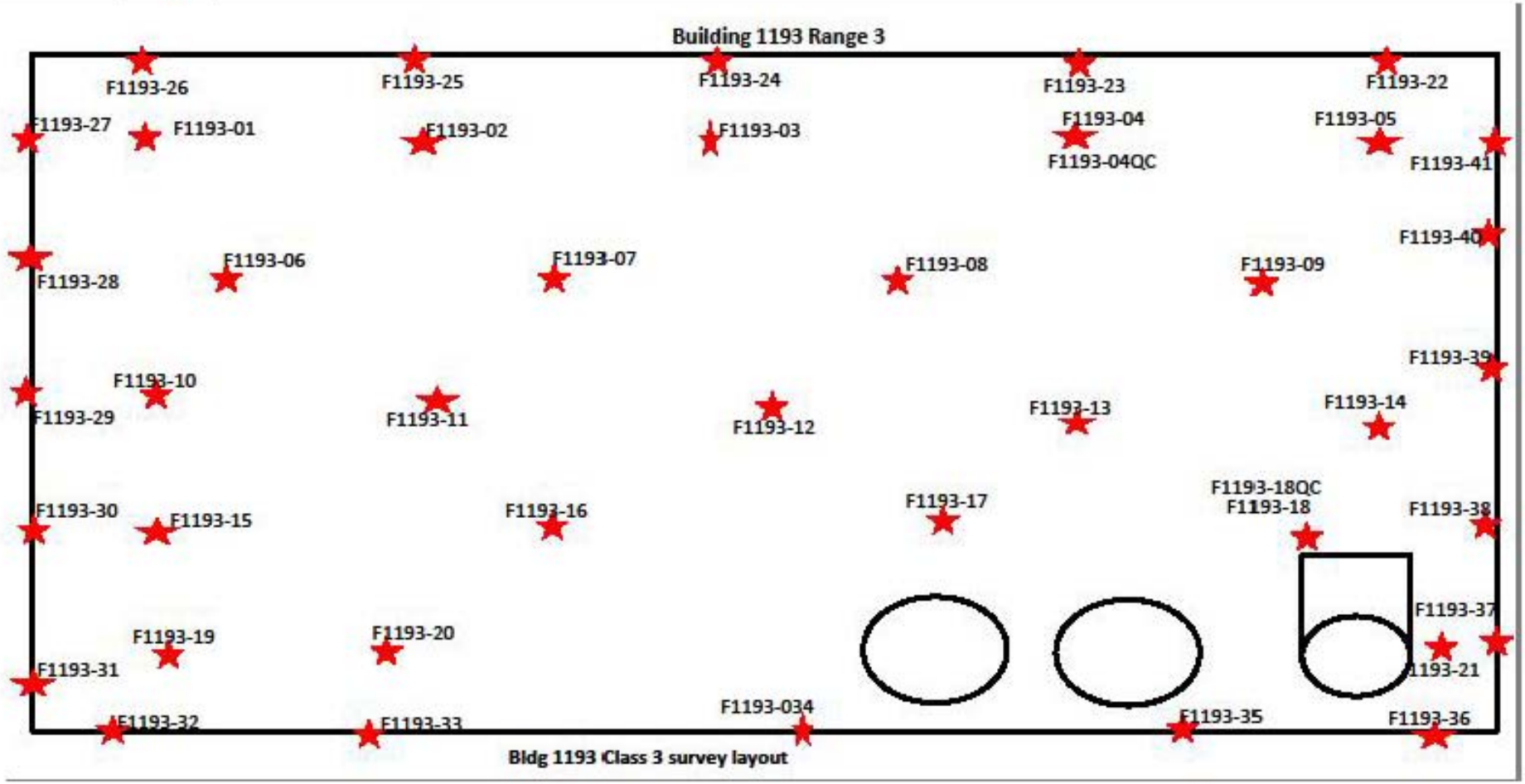
BROOKS CITY-BASE	Building 1193
Legend: ★ = Fixed Point Location*	



*See Table A3.1 for differentiation between samples collected on the walls and samples collected on the floor.

Figure A3.2 Fixed Point Locations

BROOKS CITY-BASE	Building 1193
Legend: ★ = Fixed Point Location*	



*See Table A3.2 for differentiation between samples collected on the walls and samples collected on the floor.

ATTACHMENT A-4

REFERENCE AREA BACKGROUND DATA

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Reference Area Concrete
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Concrete Floor	0.5	142.5
2	43-89 A	Concrete Floor	2	140.5
3	43-89 A	Concrete Floor	1.5	154.5
4	43-89 A	Concrete Floor	1.5	163
5	43-89 A	Concrete Floor	1.5	161.5
6	43-89 A	Concrete Floor	0.5	149
7	43-89 A	Concrete Floor	2	156.5
8	43-89 A	Concrete Floor	2	109
9	43-89 A	Concrete Floor	1	111
10	43-89 A	Concrete Floor	0.5	111.5
11	43-89 A	Concrete Floor	0	117.5
12	43-89 A	Concrete Floor	1	106
13	43-89 A	Concrete Floor	0.5	107
14	43-89 A	Concrete Floor	1	107.5
15	43-89 A	Concrete Floor	0.5	120
16	43-89 A	Concrete Floor	0.5	108
17	43-89 A	Concrete Floor	2	112.5
18	43-89 A	Concrete Floor	0.5	96
19	43-89 A	Concrete Floor	0	102.5
20	43-89 A	Concrete Floor	1	105.5
1	43-89 C	Concrete Floor	2.5	217.5
2	43-89 C	Concrete Floor	1.5	243
3	43-89 C	Concrete Floor	0.5	215
4	43-89 C	Concrete Floor	2	232
5	43-89 C	Concrete Floor	0	229
6	43-89 C	Concrete Floor	1.5	221.5
7	43-89 C	Concrete Floor	1.5	219.5
8	43-89 C	Concrete Floor	0	155.5
9	43-89 C	Concrete Floor	0	143.5
10	43-89 C	Concrete Floor	0.5	152.5
11	43-89 C	Concrete Floor	0	157.5
12	43-89 C	Concrete Floor	1.5	154.5
13	43-89 C	Concrete Floor	1	149
14	43-89 C	Concrete Floor	1	154.5
15	43-89 C	Concrete Floor	1	154.5
16	43-89 C	Concrete Floor	0	170.5
17	43-89 C	Concrete Floor	0	163.5
18	43-89 C	Concrete Floor	0	163
19	43-89 C	Concrete Floor	0.5	164.5
20	43-89 C	Concrete Floor	1	163
1	43-89 E	Concrete Floor	0.5	138
2	43-89 E	Concrete Floor	0	125

Reference Area Concrete
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
3	43-89 E	Concrete Floor	0.5	126.5
4	43-89 E	Concrete Floor	0	132.5
5	43-89 E	Concrete Floor	0	122
6	43-89 E	Concrete Floor	0	122
7	43-89 E	Concrete Floor	0.5	111
8	43-89 E	Concrete Floor	0	135
9	43-89 E	Concrete Floor	0	124
10	43-89 E	Concrete Floor	0	125
11	43-89 E	Concrete Floor	0	134
12	43-89 E	Concrete Floor	0	112
13	43-89 E	Concrete Floor	0	138.5
14	43-89 E	Concrete Floor	1.5	131
15	43-89 E	Concrete Floor	0.5	125
16	43-89 E	Concrete Floor	0	127
17	43-89 E	Concrete Floor	0	148
18	43-89 E	Concrete Floor	1	120
19	43-89 E	Concrete Floor	0.5	115.5
20	43-89 E	Concrete Floor	0.5	119.5
		Average	0.7	143.9

Reference Area Metal
Reference Area Buidling 930 and Building 175W

Sample #	**Meter**	**Material Description**	**CPM Alpha**	**CPM Beta**
1	43-89 A	Metal	2	101.5
2	43-89 A	Metal	3.5	106
3	43-89 A	Metal	1.5	93
4	43-89 A	Metal	1	99.5
5	43-89 A	Metal	1.5	92
6	43-89 A	Metal	1	100
7	43-89 A	Metal	0	93.5
1	43-89 E	Metal- Galvonized	0.5	105
2	43-89 E	Metal- Galvonized	3	112.5
3	43-89 E	Metal- Galvonized	1	114.5
4	43-89 E	Metal- Galvonized	1	102.5
5	43-89 E	Metal - Stainless	0	113
6	43-89 E	Metal - Stainless	0	97.5
7	43-89 E	Metal - Stainless	0	107
8	43-89 E	Metal	3	154
9	43-89 E	Metal	5	154.5
10	43-89 E	Metal	2	156
11	43-89 E	Metal	1	153.5
12	43-89 E	Metal	2.5	138
13	43-89 E	Metal	0	117.5
14	43-89 E	Metal	0	102
15	43-89 E	Metal	1	112
16	43-89 E	Metal	1.5	120.5
17	43-89 E	Metal	0	88.5
18	43-89 E	Metal	3.5	150.5
19	43-89 E	Metal	2.5	95.5
20	43-89 E	Metal	4	140.5
		Average	1.6	115.6

Reference Area Wood
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Wood Table Tops	0.5	109.5
2	43-89 A	Wood Table Tops	1.5	92.5
3	43-89 A	Wood Table Tops	0.5	102.5
4	43-89 A	Wood Table Tops	0	96.5
5	43-89 A	Wood Table Tops	0.5	101
6	43-89 A	Wood Table Tops	0.5	101
1	43-89 C	Wood Table Top	0	185
2	43-89 C	Wood Table Top	0	164
3	43-89 C	Wood Table Top	0	160
4	43-89 C	Wood Table Top	0	188.5
5	43-89 C	Wood Table Top	1	169
6	43-89 C	Wood Table Top	0	187
7	43-89 C	Wood Table Top	0	170
1	43-89 E	Wood Table Top	0	140.5
2	43-89 E	Wood Table Top	0.5	155.5
3	43-89 E	Wood Table Top	0	152
4	43-89 E	Wood Table Top	0	159
5	43-89 E	Wood Table Top	0.5	149.5
6	43-89 E	Wood Table Top	0	151.5
7	43-89 E	Wood Table Top	0.5	152.5
		Average	0.3	144.4

Reference Area Plaster
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Interior Plaster Wall	0.5	114.5
2	43-89 A	Interior Plaster Wall	1	117
3	43-89 A	Interior Plaster Wall	0.5	113
4	43-89 A	Interior Plaster Wall	0.5	117
5	43-89 A	Interior Plaster Wall	1.5	105.5
6	43-89 A	Interior Plaster Wall	0	118.5
7	43-89 A	Interior Plaster Wall	0	119
1	43-89 C	Interior Plaster Wall	0.5	164.5
2	43-89 C	Interior Plaster Wall	0	147.5
3	43-89 C	Interior Plaster Wall	0	178
4	43-89 C	Interior Plaster Wall	0.5	157
5	43-89 C	Interior Plaster Wall	0	168.5
6	43-89 C	Interior Plaster Wall	0	167.5
7	43-89 C	Interior Plaster Wall	0.5	165.5
1	43-89 E	Interior Plaster Wall	0.5	140
2	43-89 E	Interior Plaster Wall	0	147.5
3	43-89 E	Interior Plaster Wall	0	122.5
4	43-89 E	Interior Plaster Wall	1	128.5
5	43-89 E	Interior Plaster Wall	0.5	140.5
6	43-89 E	Interior Plaster Wall	0	123
7	43-89 E	Interior Plaster Wall	2	125
8	43-89 E	Interior Plaster Wall	0	111.5
9	43-89 E	Interior Plaster Wall	0	128
10	43-89 E	Interior Plaster Wall	0	119.5
11	43-89 E	Interior Plaster Wall	0	116.5
12	43-89 E	Interior Plaster Wall	0	138.5
13	43-89 E	Interior Plaster Wall	2	115
14	43-89 E	Interior Plaster Wall	1.5	120
15	43-89 E	Interior Plaster Wall	0.5	133.5
16	43-89 E	Interior Plaster Wall	1.5	125.5
17	43-89 E	Interior Plaster Wall	3.5	131.5
18	43-89 E	Interior Plaster Wall	1.5	122
19	43-89 E	Interior Plaster Wall	0	140
20	43-89 E	Interior Plaster Wall	0	120.5
		Average	0.6	132.4

Reference Area Plaster
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Exterior Plaster Wall	0	146
2	43-89 A	Exterior Plaster Wall	1.5	136
3	43-89 A	Exterior Plaster Wall	0.5	145
4	43-89 A	Exterior Plaster Wall	0.5	140.5
5	43-89 A	Exterior Plaster Wall	0.5	161
6	43-89 A	Exterior Plaster Wall	0.5	155
7	43-89 A	Exterior Plaster Wall	0	150.5
1	43-89 C	Exterior Plaster Wall	1	230.5
2	43-89 C	Exterior Plaster Wall	1.5	209.5
3	43-89 C	Exterior Plaster Wall	0	204.5
4	43-89 C	Exterior Plaster Wall	0	203
5	43-89 C	Exterior Plaster Wall	0.5	233.5
6	43-89 C	Exterior Plaster Wall	1	229
7	43-89 C	Exterior Plaster Wall	0.5	221.5
		Average	0.6	183.3

Reference Area Tile
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Ceramic Tile	6	309
2	43-89 A	Ceramic Tile	9.5	279.5
3	43-89 A	Ceramic Tile	9.5	275.5
4	43-89 A	Ceramic Tile	11	279.5
5	43-89 A	Ceramic Tile	8	277
6	43-89 A	Ceramic Tile	6.5	289
7	43-89 A	Ceramic Tile	6	283
1	43-89 E	Ceramic Tile	7	318.5
2	43-89 E	Ceramic Tile	10.5	316
3	43-89 E	Ceramic Tile	4.5	300.5
4	43-89 E	Ceramic Tile	7.5	298
5	43-89 E	Ceramic Tile	9.5	295.5
6	43-89 E	Ceramic Tile	9	302
7	43-89 E	Ceramic Tile	8	285.5
8	43-89 E	Ceramic Tile	6	326.5
9	43-89 E	Ceramic Tile	12.5	318.5
10	43-89 E	Ceramic Tile	11.5	297
11	43-89 E	Ceramic Tile	4.5	333.5
12	43-89 E	Ceramic Tile	4.5	307.5
13	43-89 E	Ceramic Tile	3.5	368.5
14	43-89 E	Ceramic Tile	2.5	326.5
15	43-89 E	Ceramic Tile	6.5	356
16	43-89 E	Ceramic Tile	4	323
17	43-89 E	Ceramic Tile	4.5	339
18	43-89 E	Ceramic Tile	5.5	302.5
19	43-89 E	Ceramic Tile	8	345.5
20	43-89 E	Ceramic Tile	5	314.5
		Average	7.1	309.9

Reference Area for Porcelain
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Porcelain Fixtures	4	314
2	43-89 A	Porcelain Fixtures	9	308.5
3	43-89 A	Porcelain Fixtures	6	310.5
4	43-89 A	Porcelain Fixtures	6	280
5	43-89 A	Porcelain Fixtures	9	335
6	43-89 A	Porcelain Fixtures	5	308.5
7	43-89 A	Porcelain Fixtures	2.5	316.5
1	43-89 E	Porcelain Fixtures	7	358
2	43-89 E	Porcelain Fixtures	10	331
3	43-89 E	Porcelain Fixtures	11.5	329.5
4	43-89 E	Porcelain Fixtures	3.5	333
5	43-89 E	Porcelain Fixtures	6	337
6	43-89 E	Porcelain Fixtures	1.5	348.5
7	43-89 E	Porcelain Fixtures	3	332.5
		Average	6.0	324.5

Reference Area Ventilation
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Cold air returns	1	96.5
2	43-89 A	Cold air returns	5.5	113
3	43-89 A	Cold air returns	3.5	126
4	43-89 A	Cold air returns	4	126
5	43-89 A	Cold air returns	2	110
6	43-89 A	Cold air returns	5	125
7	43-89 A	Cold air returns	4.5	116.5
8	43-89 A	Cold air returns	4	122
1	43-89 E	Cold air returns	7.5	121.5
2	43-89 E	Cold air returns	1.5	119
3	43-89 E	Cold air returns	1.5	108
4	43-89 E	Cold air returns	2.5	124
5	43-89 E	Cold air returns	4.5	145.5
6	43-89 E	Cold air returns	2.5	115
7	43-89 E	Cold air returns	5.5	130
8	43-89 E	Cold air returns	2	112.5
		Average	3.6	119.4

Reference Area Carpet
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Carpeted Floor	1.5	113.5
2	43-89 A	Carpeted Floor	0.5	103
3	43-89 A	Carpeted Floor	0.5	101
4	43-89 A	Carpeted Floor	2	108
5	43-89 A	Carpeted Floor	0	113
6	43-89 A	Carpeted Floor	0.5	100.5
7	43-89 A	Carpeted Floor	0	115.5
1	43-89 E	Carpeted Floor	1.5	131.5
2	43-89 E	Carpeted Floor	0	133.5
3	43-89 E	Carpeted Floor	1	143
4	43-89 E	Carpeted Floor	0	124.5
5	43-89 E	Carpeted Floor	0	121.5
6	43-89 E	Carpeted Floor	0	119.5
7	43-89 E	Carpeted Floor	0	135.5
		Average	0.5	118.8

Reference Area Brick
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 A	Brick	2.5	188.5
2	43-89 A	Brick	2	176.5
3	43-89 A	Brick	2.5	201.5
4	43-89 A	Brick	2	206.5
5	43-89 A	Brick	3.5	191.5
6	43-89 A	Brick	3	195.5
7	43-89 A	Brick	4	220
8	43-89 A	Brick	6.5	202.5
9	43-89 A	Brick	3.5	203
10	43-89 A	Brick	6.5	207
1	43-89 E	Brick	4.5	210
2	43-89 E	Brick	3.5	216
3	43-89 E	Brick	2	211.5
4	43-89 E	Brick	0.5	216.5
5	43-89 E	Brick	2.5	203.5
6	43-89 E	Brick	2	218
7	43-89 E	Brick	2	206
8	43-89 E	Brick	3.5	229
9	43-89 E	Brick	5	223
10	43-89 E	Brick	5	210
		Average	3.3	206.8

Reference Area Brick
Reference Area Buidling 930 and Building 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 C	Painted Concrete Blocks	1	253
2	43-89 C	Painted Concrete Blocks	0.5	245.5
3	43-89 C	Painted Concrete Blocks	0	255
4	43-89 C	Painted Concrete Blocks	0.5	221.5
5	43-89 C	Painted Concrete Blocks	0.5	269
6	43-89 C	Painted Concrete Blocks	1	270.5
7	43-89 C	Painted Concrete Blocks	0.5	252.5
1	43-89 E	Painted Concrete Block	0	209
2	43-89 E	Painted Concrete Block	0	193
3	43-89 E	Painted Concrete Block	0	221.5
4	43-89 E	Painted Concrete Block	0.5	190.5
5	43-89 E	Painted Concrete Block	0	197
6	43-89 E	Painted Concrete Block	0	219
7	43-89 E	Painted Concrete Block	0	186
		Average	0.3	227.4

Reference Area Ceramic Block
Reference Area Buidling 140 (above 6 ft)

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 Q	Ceramic Block	17	575
2	43-89 Q	Ceramic Block	15	569.5
3	43-89 Q	Ceramic Block	17.5	608
4	43-89 Q	Ceramic Block	18.5	571.5
1	43-89 K	Ceramic Block	19	627
2	43-89 K	Ceramic Block	19	536
3	43-89 K	Ceramic Block	25.5	585.5
4	43-89 K	Ceramic Block	15	593.5
1	43-89 D	Ceramic Block	31.5	685
2	43-89 D	Ceramic Block	19	649.5
3	43-89 D	Ceramic Block	18.5	725
4	43-89 D	Ceramic Block	20	641
		Average	19.6	613.9

Reference Area Roof Metal
Reference Area Buidling 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 Q	Roof Metal	20.5	237.5
2	43-89 Q	Roof Metal	22.5	228.5
3	43-89 Q	Roof Metal	23	234
4	43-89 Q	Roof Metal	4.5	213
5	43-89 Q	Roof Metal	19	214
6	43-89 Q	Roof Metal	27	233.5
7	43-89 Q	Roof Metal	3	210
8	43-89 Q	Roof Metal	6.5	232.5
9	43-89 Q	Roof Metal	7.5	234
10	43-89 Q	Roof Metal	7	223
		Average	14.1	226.0

Reference Area Cast Iron Pipe
Reference Area Buidling 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 D	Cast Iron Pipe	4.5	153
2	43-89 D	Cast Iron Pipe	3	180
3	43-89 D	Cast Iron Pipe	7	211
4	43-89 D	Cast Iron Pipe	1.5	194
5	43-89 D	Cast Iron Pipe	2	193.5
6	43-89 D	Cast Iron Pipe	3.5	167
7	43-89 D	Cast Iron Pipe	3	155
8	43-89 B	Cast Iron Pipe	2	526.5
9	43-89 B	Cast Iron Pipe	4	594.5
10	43-89 B	Cast Iron Pipe	3.5	579.5
11	43-89 B	Cast Iron Pipe	3.5	692.5
12	43-89 B	Cast Iron Pipe	1	609
13	43-89 B	Cast Iron Pipe	3.5	642.5
14	43-89 B	Cast Iron Pipe	5.5	611.5
		Average	3.4	393.5

Reference Area Glass Pipe
Reference Area Buidling 175W

Sample #	Meter	Material Description	CPM Alpha	CPM Beta
1	43-89 D	Glass Pipe	4	213
2	43-89 D	Cast Iron Pipe	4.5	174.5
3	43-89 D	Cast Iron Pipe	3.5	195.5
4	43-89 D	Cast Iron Pipe	1.5	182
5	43-89 D	Cast Iron Pipe	1	192.5
6	43-89 D	Cast Iron Pipe	2	189.5
7	43-89 D	Cast Iron Pipe	2	182
8	43-89 B	Cast Iron Pipe	3	653.5
9	43-89 B	Cast Iron Pipe	1	657
10	43-89 B	Cast Iron Pipe	2.5	671
11	43-89 B	Cast Iron Pipe	3	608.5
12	43-89 B	Cast Iron Pipe	3	633.5
13	43-89 B	Cast Iron Pipe	2	615
14	43-89 B	Cast Iron Pipe	1	652
		Average	2.4	415.7

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ATTACHMENT A-5

STATE OF TEXAS WELL REPORTS

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STATE OF TEXAS WELL REPORT for Tracking #247709

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-001**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking #247709) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247710

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-002**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247711

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-003**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: From (ft) To (ft) Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247712

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-004**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247713

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-005**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247714

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-006**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info:
Casing left in well: From (ft) To (ft) — Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247715

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-007**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info:
Casing left in well: From (ft) To (ft) — Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247716

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-008**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247717

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-009**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking number (Tracking #**247717**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247718

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**B1192 SB-010**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8248 Chennault Path Brooks City Base , TX 78235**	Latitude:	**29° 20' 20" N**
Well County:	**Bexar**	Longitude:	**098° 26' 07" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247719

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-001**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:
From (ft) To (ft) From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247720

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-002**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:
From (ft) To (ft) From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247721

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-003**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info:
Casing left in well: From (ft) To (ft) — Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247722

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-004**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data: 1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:
From (ft) To (ft) From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247723

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-005**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info:
Casing left in well: From (ft) To (ft) — Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247724

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-006**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247725

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-007**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info:
Casing left in well: From (ft) To (ft) — Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking #**247725**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247726

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-008**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247727

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-009**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info: Casing left in well: Cement/Bentonite left in well:

From (ft)	To (ft)	From (ft)	To (ft)	Cem/Bent	Sacks Used
N/A					

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

STATE OF TEXAS WELL REPORT for Tracking #247728

Owner:	**US Air Force, 311 MSG/CE**	Owner Well #:	**Tejeda SB-010**
Address:	**2664 Flight Nurse Brooks City-Base , TX 78235**	Grid #:	**68-45-2**
Well Location:	**8320 Hawks Road Brooks City Base , TX 78235**	Latitude:	**29° 20' 19" N**
Well County:	**Bexar**	Longitude:	**098° 25' 47" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **3/18/2011**
Completed: **3/18/2011**

Diameter of Hole: Diameter: **3 in From Surface To 5 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **Plugged**

Annular Seal Data:
1st Interval: **From 0 ft to 2 ft with 0.15 Cement (#sacks and material)**
2nd Interval: **From 2 ft to 5 ft with 0.25 Bentonite (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand Mixed**
Cemented By: **Vortex Drilling, Inc.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Alternative Procedure Used**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **N/A**

Plugging Info:
Casing left in well: From (ft) To (ft)
Cement/Bentonite left in well: From (ft) To (ft) Cem/Bent Sacks Used
N/A

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:	**Vortex Drilling, Inc.** **4412 Bluemel Road** **San Antonio , TX 78240**
Driller License Number:	**55002**
Licensed Well Driller Signature:	**Gary B. Leifeste**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

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DESC. & COLOR OF FORMATION MATERIAL

From (ft)	To (ft)	Description
0	**5**	**Lt.brw./brw.silty clay**

CASING, BLANK PIPE & WELL SCREEN DATA

Dia.	New/Used	Type	Setting From/To
N/A			

ATTACHMENT A-6

LOGBOOK PAGES

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Contents **Page**

Name Printed	Initials	Company
Eric Schrumpf	EL	SAIC - StL
Jay Wilkins	JW	SAIC - StL
Quentina Borgic	QB	SAIC - StL
Hope Sexton	HS	SAIC - StL
Timothy Harris III	TH	SAIC - StL
Andy Holtkamp	AH	SAIC - STL

Field Crew Staff

Field Manage — Tom Schnitzius - SAIC - St. Louis

EH&S — Oscar Martinez - SAIC - San Antonio
Dustin Wilson - SAIC - San Antonio

HPTs — Hope Sexton - Jr HPT - SAIC - St. Louis
Quentina Borgic - Sr HPT - SAIC - St. Louis
Jay Wilkins - Jr HPT - SAIC - St. Louis
Andy Holtkamp - Jr HPT - SAIC - St. Louis
Eric Schrumpf - Sr HPT - SAIC - St. Louis
Tim Harris III - Sr HPT - SAIC - St Louis

Trips to Bldg 140 7/19/10

- Pickup meters
- Return for Calibration ~~papers~~ certificates 7-30-10 for 2 meters
- Return for 3 SPA-3 meters
- Return for ~~44-10~~ 43-89 KW 7/19/10 error "OverCal"
  - meter paperwork showed the meter was in calibration, but a diagnostic check ~~was~~ KW 7/19/10 showed the meter was defective.

— Bldg 530 7/19/10 1310 count #1 (Reference Readings)

Meter	count	material
Micro-R	5-6	wood table top (room 107)
43-89 E	0/281	
~~44-10 B~~ SPA-3 B	13688	
~~44-10 6~~ SPA-3 C	8516	
Fiddler B	4269	
~~44-10 A~~ SPA-3 A	8999	
Fiddler C	4025	
43-89 B	657 β / 1 alpha	
43-89 A	1 alpha / 219 beta	
43-89 D	4/365	
~~43-89 A~~ 7/19/10		
2224-1 C	0/370	

KW 7/19/10

Bldg 930 7/19/10 1319 Count 2

meter	count
43-89a	3/185
43-89B	1/644
Fiddler C	3940
44-10A	8877
Fiddler B	4238
44-10C	9208
43-89E	1/311
44-10B	13399
43-89D	2/305
2224-1C	0/328
Micro R	5-6

Surface
wood table top (rm 107)

Bldg 930 7/19/10 1323 Count 3

meter	count
43-89a	1/205
43-89B	1/644
Fiddler C	4007
44-10A	8877
Fiddler B	4082
44-10C	9235
43-89E	0/304
44-10B	14021
43-89D	2/336
2224-1C	0/320

Surface
wood table top (rm 107)

JW

Bldg 930 7/19/10 1327 Count 4

43-89A	0/193	wood table top rm 107
43-89B	0/576	
Fiddler C	3974	
44-10A	9087	
Fiddler B	4058	
44-10C	8930	
43-89E	0/318	
~~44-10B~~ SPA-3 B Adj 7-20-10	14066	
43-89D	9/338	
2224-1C	0/377	

7/19/10 1330 Count 5
Wood Table top rm 107

43-89A	1/202
43-89B	1/579
Fiddler C	4009
~~44-10A~~ SPA-3 A Adj 7-20-10	8980
Fiddler B	4033
~~44-10C~~ SPA-3 C Adj 7-20-10	9112
43-89E	1/299
~~44-10B~~ SPA-3 B Adj 7-20-10	13554
43-89D	5/387
2224-1C	2/338

7/19/10 1334 Count 6
Wood table top rm 107

43-89A	1/202
43-89B	1/618
Fiddler C	4022
~~44-10A~~ SPA-3 A Adj 7-20-10	9132
Fiddler B	3929
~~44-10C~~ SPA-3 C Adj 7-20-10	9059
43-89E	0/303
~~44-10B~~ SPA-3 B Adj 7-20-10	14528
43-89D	4/327
2224-1C	0/374

JW

Bldg 930 7/19/10 1337 count 7

43-89A	1/210	wood table top rm 107
43-89B	1/519	Bldg 930
Fiddler C	3936	
~~44-10A~~ SPA-3 A 7-20-10	8814	
Fiddler B	4103	
~~44-10C~~ SPA-3 C 7-20-10	9189	
43-89E	1/305	
~~44-10B~~ SPA-3 B 7-20-10	13485	
43-890	7/316	
2224-1C	0/340	

jw 7/19/10

Micro-R (room 107) Bldg 930

Painted Concrete Block

Micro R 18-22 ~~mR/hr~~ µR/hr jw 8/30/10 7/19/10 1327

Wall board (dry Wall) exterior 1329 7/19/10
16-20 ~~mR/hr~~ µR/hr jw 8/30/10

Dry Wall interior 1328 7/19/10
8-10 ~~mR/hr~~ µR/hr jw 8/30/10

Carpet on Concrete 1333 7/19/10
~~6-9 mR/hr jw 7/19/10~~
5-9 ~~mR/hr~~ µR/hr jw 8/31/10

Ceramic tile 1336 7/19/10
4-7 ~~mR/hr~~ µR/hr jw 8/31/10

Metal air Return 1339 7/19/10
3-6 ~~mR/hr~~ µR/hr jw 8/31/10

jw 7/19/10

Bldg 930 Interior wall room 107 Drywall jw 8/31/10
7/19/10 1343

43-89A	~~44-10~~ jw 7/19/10 A	1/229	
7/19/10 1343	43-89B	1/520	count 1
	43-89E	1/280	
	2224-1C	1/329	
	43-89D	6/338	
1345	43-89A	2/234	count 2
	43-89B	0/561	
	43-89E	1/274	
	43-89D	5/341	
	2224-1C	0/295	
1348	43-89A	1/226	count 3
	43-89B	0/507	
	43-89E	0/245	
	2224-1C	0/356	
	43-89D	4/292	
1350	43-89A	1/234	count 4
	43-89B	3/584	
	43-89E	2/257	
	2224-1C	1/314	
	43-89D	7/335	
1352	43-89A	3/211	count 5
	43-89B	0/569	
	43-89E	1/281	
	2224-1C	0/337	
	43-89D	10/336	

jw

1355	43-89A	0/237	count 7 jw 7/19/10
	43-89B	0/559	6
	43-89E	0/246	
	2224-1C	0/335	
	43-89D	4/347	
1357	43-89A	0/238	Count 7
	43-89B	1/554	
	43-89E	4/250	
	2224-1C	1/331	
	43-89D	4/368	

jw 7/19/10

Exterior Wall — Drywall — JW 8/31/10 — Room 107 — count 1

7/19/10 1400	43-89 A	0/292
	43-89 B	1/643
	43-89 E	Not taken
	2224-1C	2/461
	43-89 D	not taken
7/19/10 1402	43-89 A	3/272
	43-89 B	3/663
	2224-1C	3/419
7/19/10 1407	43-89 A	1/290
	43-89 B	1/683
	2224-1C	0/409
7/19/10 1410	43-89 A	1/281
	43-89 B	1/663
	2224-1C	0/406
7/19/10 1414	43-89 A	1/322
	43-89 B	3/662
	2224-1C	1/467
7/19/10 1417	43-89 A	1/310
	43-89 B	1/702
	2224-1C	2/458
7/19/10 1420	43-89 A	0/301
	43-89 B	2/646
	2224-1C	1/443

count 2 — count 3 — count 4 — count 5 — count 6 — count 7

JW 7/19/10

Bldg 930

Ceramic tile near Room 107

43-89E	14/637	7/19/10	1404
	21/632		1406
	9/601		1408
	15/596		1411
	19/591		1414
	18/604		1417
	16/571		1419

cmu is painted concrete block

Painted CMU near RM 107

43-89 D	4/459	7/19/10	1404
	10/510		1407
	12/512		1410
	6/536		1413
	3/515		1415
	7/~~533~~ 537 JW 7/19/10		1418
	5/500		1422

1	2224-1C	2/506	1427
	43-89E	0/418	1427
2	2224-1C	1/491	1430
	43-89E	0/386	1430
3	2224-1C	0/510	1434
	43-89E	0/443	1434
4	2224-1C	1/443	1437
	43-89E	1/381	1437
5	2224-1C	1/538	1440
	43-89E	0/394	1440

	C	T
6	2224-1C 2/541	1444
	43-89E 0/438	1444
7	2224-1C 1/505	1447
	43-89E 0/372	1447

JW

Bldg 930 carpet Room 107 7/19/10

44-10 B	count	Time
SPA-3B	6195	1414
SPA-3C	4351	1414
SPA-3B	5864	1415
SPA-3C	4571	1415
SPA-3A	4642	1415
SPA-3B	6539	1416
SPA-3C	4943	1416
SPA-3A	4748	1416
SPA-3B	7164	1418
SPA-3C	5273	1418
SPA-3A	4794	1419
SPA-3B	6795	1419
SPA-3C	5547	1419
SPA-3A	5491	1422
SPA-3B	7188	1422
SPA-3C	5734	1422
SPA-3A	6109	1423
SPA-3B	6595	1424
SPA-3C	4496	1424
SPA-3A	6073	1424

2 min counts

1	Fiddler B	4911	1428
	Fiddler C	4396	1428
2	Fiddler B	4150	1431
	Fiddler C	3221	1431
3	Fiddler B	5532	1434
	Fiddler C	5154	1434
4	Fiddler B	4662	1438
	Fiddler C	4651	1438
5	Fiddler B	2168	1441
	Fiddler C	2052	1441
6	Fiddler B	2470	1443
	Fiddler C	2053	1443

7		C	T
	Fiddler B	1984	1446
	Fiddler C	1943	1446

JW

Bldg 930 metal outside room 107 7/19/10

43-89D	9/309	Galv Plate JW 8/31/10
	10/289	
	7/286	
	8/340	
	5/408	Stainless Steel Duct
	4/371	
	5/298	
43-89E	1/210	Galv Plate JW 8/31/10
	6/225	
	2/229	
	2/205	
	0/226	Stainless Steel
	0/195	
	0/214	

JW 7/19/10

Bldg 930 Asbestos Floor tile outside 107

				C	T
7/19/10	~~SPA-3 B 44-10 AW 7/19/10~~ SPA-3 B	6957	Fid B	2125	1459
1425	SPA-3 C	4152	Fid C	1840	1459
	SPA-3 A	4177			
			Fid B	1881	AW 7/19/10 44 1507
1429	~~SPA-3 B 44-10 B SH 7-20-10~~	6186	Fid C	1659	
	SPA-3 C	3958			
	SPA-3 A	4131	Fid B	2081	1512
			Fid C	1609	
1433	~~SPA-3 44-10 B SH 7-20-10~~	6064			
	SPA-3 C	3986	Fid B	1505	1516
	SPA-3 A	4154	Fid C	1395	
1436	~~SPA-3 B 44-10 B SH 7-20-10~~	6102	Fid B	1647	1521
	SPA-3 C	3948	Fid C	1466	
	SPA-3 A	3880			
			Fid B	2328	1527
1441	~~SPA-3 B AW 7-20-10 44-10 B~~	6084	Fid C	2241	
	SPA-3 C	4017			
	SPA-3 A	4049	Fid B	1589	1530
			Fid C	1676	
1447	~~SPA-3 B AW 7-20-10 44-10 B~~	5665			
	SPA-3 C	3926			
	SPA-3 A	4095			
1451	~~SPA-3 B AW 7-20-10 44-10 B~~	5978			
	SPA-3 C	3854			
	SPA-3 A	4038			

AW 7/19/10

Bld 930

Ceramic tile outside rm 107 (wall)

7/19/10	43-89A	12/618
1426	43-89B	17/1076
1429	43-89A	19/559
	43-89B	17/1036
1433	43-89A	19/551
	43-89B	21/1052
1437	43-89A	22/559
	43-89B	19/1028
1440	43-89A	16/554
	43-89B	18/1022
1444	43-89A	13/578
	43-89B	19/1038
1448	43-89A	12/566
	43-89B	19/1087

AW 7/19/10

Bldg 930 Bathroom 1x1 tile 7/19/10

	SPA-3 B ~~44-10 B~~	SPA-3C	SPA-3A	FM #1
1425	8116	6359	6506	0/162
1430	8395	6425	6846	3/140
1435	8479	6495	6863	2/142
1440	8235	6530	6714	0/165
1445	8911	6290	6619	3/155
1450	8342	6417	6761	2/154
1455	8046	6550	6849	2/152

Bathroom Floor tile 7/19/10

FM #1 = Floor Monitor #1
SN# 137728

FM #1
2/503
3/511
5/510
0/459
0/505
3/418
2/378

Carpet room 107 7/19/10

FM #1
1/201
0/183
0/166
1/170
3/180
2/193
0/165
2/191
1/171
1/183

Micro R Bldg 930 7/19/10 1502

General Walkthough 4 - 6 ~~mR/hr~~ uR/hr 8/31/10

Room 127A 6 - 12 ~~mR/hr~~ uR/hr 8/31/10

Bldg 930 Asbestos Floor Tile 7/19/10

FM #1
0/162
3/140
2/142
0/165
3/155
2/154
2/152
2/171
0/160
1/177

Bldg 930 Concrete Floor Room 127A 7/19/10

FB → Fiddler B
FC → Fiddler C

FB	FC
2796	2435
3189	2271
2752	2230
2723	2703
2364	2643
2778	2131
2852	2501

7/19/10

7/19/10 Concrete floor Room 127A Bldg 930

1507	SPA-3A	7661
	SPA-3B	6074
	SPA-3C	7806
	43-89A	1/285
	43-89B	2/735
	~~43-89E~~ jw 7/19/10	~~4/366~~ shield still on
	~~2224~~-1C	5/435
1509	SPA-3B	9394
	SPA-3C	8203
	SPA-3A	7625
	43-89A	4/281
	43-89D	3/432
	~~2~~224-1C	3/486
	~~44-10A~~ jw 7/19/10	
1512	SPA-3A	7391
	SPA-3B	8904
	SPA-3C	8168
	Floor Mon #1	0/272
	Floor #1	4/300
1513	SPA-3A	7364
	SPA-3B	9306
	SPA-3C	7955
	43-89A	3/309
	43-89B	2/729
	43-89D	14/410
	~~2~~224-1C	1/430
	Floor #1	1/278

jw

1515	SPA-3A	7461
	SPA-3B	9591
	SPA-3C	7843
	43-89A	3/326
	Floor #1	3/286
	43-89D	7/418
	2224-1C	4/464
	43-85B	1/768
1518	SPA-3A	7640
	SPA-3B	8974
	SPA-3C	7807
	Floor #1	3/284
1519	SPA-3A	7314
	SPA-3B	9048
	SPA-3C	8078
	43-89A	3/323
	43-89B	3/720
	43-89D	6/425
	2224-1C	0/458
	Floor #1	0/294
1522	Floor #1	2/287
1523	43-89A	1/298
	43-89B	2/690
	43-89D	4/411
	2224-1C	3/443
1526	43-89A	4/313
	43-89B	2/678
	43-89D	9/454
	2224-1C	3/439
1530	43-89D	7/427

jw

Bldg 930 Ceramic floor tile
Women's Restroom 7/19/10

FB	FC
2845	2852
2244	2041
2424	2075
2363	1939
2268	1868
2133	2027
1974	1856

7/19/10 - 1530

- Floor monitor #2 returned for repair along with a micro-R & a 43-89. Micro-R & 43-89 were returned for repair due to abnormally low readings. FM #2 returned due to high voltage readings (~150V to high)

JW 7/19/10
FM #1

- Th-230 source used to verify alpha response for FM #1 & #2 (once repaired). Am-241 source was a coated source & provided no alpha response.

7/19/10 - 1617
Micro-R Verification ~~uR/hr~~ JW 8/31/10
A & B 8.5-9 ~~mR/hr~~ at 1 1/2 inches.
A & B 280-290 ~~mR/hr~~ MR/hr JW 8/31/10 on contact

JW 7/19/10

Pre-Work Activities 7-20-10

0615 Daily instrument QC checks
called RSO, Dennis Chambers regarding the absence of an Am-241 plated source.
0700 Work crew all present
0720 Daily safety mtg. and HSWP review.
0815 Arrived on site for Building 125

Building 125

Background 43-89	meter C	meter D	Meter E	meter A	floormonitor 1	
Room 164	0/317	4/468	0/262	1/247	0/206	1st Fl
Room 22	2/366	8/509	1/214	3/231		
hall outside Room 164					0/212	
Room 183-A	0/355	10/509	3/294	6/242	1/220	
Room 141	2/367	6/329	0/221	1/230	4/197	
Room 232	0/413	5/478	2/298	0/294	5/206	2nd Fl
Room 223	1/393	3/495	1/259	1/255	0/210	
Room 247	0/437	5/462	2/296	0/260	0/228	
hall outside 219	7/377	4/440	0/294	3/274	5/224	
Room 325a	6/476	10/539	2/365	1/337	2/234	3rd Fl
Room 349	0/366	7/458	2/266	2/246	4/192	
Room 325a	0/469	7/960	1/334	3/287	4/243	
hall outside 306	0/450	2/423	0/285	1/278	2/251	
Room 401	1/458	8/807	0/314	3/351	3/288	4th Fl
Room 405	1/430	5/1166	1/297	1/285		
Room 449		~~2/750~~ JW 7-20-10 1/386		3/330	2/221	
Room 437	1/456	2/750	1/386	3/330	1/300	

Limit investigation Levels: 16/800 5 40/261 48 — 10/5 263/310

Random counts	Meter C		Meter A QC meter	
Room 407	15/791	wall tile	20/616	Floor 4
	~~15/791~~ + 13 7-20-10			
Room 443	12/1016	sink & drain		
Room 425	24/896	wall tile		
accross from Elevator	19/867	wall tile		
" "	" & B 7-20-10 12/856	wall tile		
Room 470	24/1166	ceramic sink		

Building 176 Random samples cont.

7	Bchind water fountain		20/807	ceramic tile
8	Room 100	meter C	3/579	Brick
9	Room 133		4/314	wallpaper
10	Room 104		0/340	carpet
11	Room 108		7/370	floor tile
12	Room 109		2/275	wood door
13	Room 135		2/302	metal electric box
14	Room 136		2/289	dry wall
15	Room 136a		18/346	Metal vent

QB 7-21-10

Building 175W Reference Points

Material: Concrete Floor

Meter	Time = 2 min			
	43-89 A	43-89 C	43-89 D	43-89 E
1.	4/218	0/311	6/373	1/276
2.	2/222	0/287	5/376	0/250
3.	1/223	1/305	8/328	1/253
4.	0/235	0/315	4/344	0/265
5.	2/212	3/309	2/285	0/244
6.	1/214	1/298	11/314	0/244
7.	2/215	2/309	6/340	1/222
8.	1/240	0/341	11/342	0/270
9.	1/216	0/327	10/314	0/248
10.	4/225	0/326	2/310	0/250
11.	1/192	1/329	3/323	0/258
12.	0/205	2/326	10/339	0/224
13.	2/211	2/309	4/299	0/277
14	*	*	*	3/262
15				1/250
16				0/254
17				0/296
18				2/240
19				1/231
20				1/239

* Measurements combined w/ concrete floor measurements from Bldg 930.

EG

Building: 175W
Material: Asbestos Tile
Meter: FIDLER
Time: 1 min

	FIDLER (B)	FIDLER (C)
1	1562	1257
2	1411	1354
3	1475	1748
4	1247	1232
5	1459	1245
6	1211	1293
7	1313	1547
8	2016	1623
9	1297	1319
10	1505	1601
11	1481	1285
12	1653	1362
13	1726	1239
14	*	*
15		
16		
17		
18		
19		
20		

* Combined w/ measurements from Bldg 0930.

Building: 175W
Material: Ceramic Tile
Meter: FIDLER
Time: 1 min

	FIDLER (B)	FIDLER (C)
1	1747	1773
2	1889	1735
3	2219	1888
4	2301	1950
5	1577	1651
6	2037	2043
7	1945	2113
8	1827	1879
9	1918	2018
10	2047	2074
11	2284	1982
12	2111	2109
13	1904	1848
14	2007	1971
15	2183	2024
16	1862	1723
17	1798	1882
18	2133	2079
19	2201	2116
20	1920	2155

Building: 175W
Material: Asbestos Tile
Meter: SPA-3 (2x2)
Time: 1 min

	SPA-A	SPA-B	SPA-C
1	4652	6395	4447
2	5339	7768	5227
3	4604	7144	4210
4	4269	5967	4327
5	4380	5895	4277
6	4291	5845	4057
7	4146	5612	4043
8	5453	7301	4514
9	4187	5818	4071
10	4101	5960	4210
11	4425	5777	3932
12	4353	5919	4214
13	4411	5816	4079
	*	*	*

* Combined w/ measurements from Bldg 0930.

Bldg 175W
SPA-C, Wood, Time = 1min

1	4466
2	4502
3	4669
4	4579
5	4549
6	4405
7	4540
8	4473
9	4368
10	4324
11	4349
12	4431
13	4617 *

*Combined w/ Bldg 0930

Bldg 175W SPA-C
Exterior Plaster Wall

	6453
	6249
	5715
	6428
	6139
	6416
	6118
	6305
	5850
	5977
	5936
	6400
	6267 *

*Combined

SPA-C
Bldg 175W
Porcelain

1.	8028	15	7744
2.	7762	16	7216
3.	7134	17	8004
4.	7040	18	7781
5.	5839	19	7910
6.	6763	20	7879
7	5964		
8	6235		
9	6232		
10	5988		
11	6098		
12	7100		
13	7122		
14	6967		

	Building 175W Material: Asbestos Tile Meter: Floor Monitor -A Time: 1 min	Ceramic Tile Floor Monitor -A Time = 1 min	Concrete Floor Monitor -A Time = 1 min
1	1/123	3/464	4/123
2	0/97	2/425	1/164
3	0/115	0/438	0/137
4	3/153	2/452	0/144
5	1/154	1/450	1/162
6	2/153	0/447	1/169
7	4/175	1/465	1/126
8	1/148	1/445	1/128
9	2/159	2/474	3/122
10	2/165	3/427	0/173
11	2/164	2/458	1/147
12	0/160	0/459	0/189
13	0/133	1/431	2/160

Micro-R	Bldg 175W
Ceramic Tile	4-6 μR/hr
Drywall	3-5 μR/hr
Porcelin	7-10 μR/hr
Wood	4-6 μR/hr
Exterior Plaster	7-10 μR/hr
Metal	7-10 μR/hr

EL

	Building: 175W Material: Porcelin Meter: 43-89 D Time: 2 min	Building: 175W Material: Metal Meter: 43-89 E Time: 2 min	Bldg: 175W Material: Ceramic Tile Meter: 43-89 E Time: 2 min	Bldg: 175W Material: Exterior Plaster Wall Meter: 43-89 D Time: 2 min
1	16/932	6/308	12/653	12/410
2	18/850	10/309	25/637	2/406
3	22/786	4/312	23/594	2/378
4	22/882	2/307	9/667	8/408
5	21/960	5/276	9/615	4/450
6	19/875	0/235	7/737	2/465
7	18/891	0/204	5/653	7/465
8	19/961	2/224	13/712	0/453
9	22/952	3/241	8/646	5/446
10	21/937	0/177	9/678	0/394
11	21/899	7/301	11/605	4/438
12	17/903	5/191	16/691	1/398
13	12/804	8/281	10/629	2/406
14	8/838	* Combined w/ Bldg 0930	* Combined w/ Bldg 0930	* Combined w/ Bldg 0930
15	15/911			
16	14/815			
17	20/928			
18	12/883			
19	16/906			
20	21/892			

Building: 175W
Material: Interior Drywall
Meter: 43-89 E
Time: 2 min

1	0/223	6	4/230	11	3/244
2	0/256	7	3/240	12	0/280
3	0/239	8	1/267	13	0/241
4	0/233	9	3/251	* Combined w/ Bldg 0930.	
5	0/277	10	7/263		

EL 8.21.10