Draft Final

DECOMMISSIONING PLAN
Building 7304 Vault
Fort Belvoir, Virginia

Contract Number

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Prepared for:

U.S. Army Field Support Command
Environmental Contracting Division
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Table of Contents

List of Tables

List of Figures

Attachments

Attachment	Description
Attachment 1	Building 7304 Diagrams

Appendices

Appendix	Description
Appendix A	SBCCOM NRC License Number 45-00953-01
Appendix B	Building 7304 Characterization Survey Report
Appendix C	Building 7304 Decommissioning Health and Safety Plan
Appendix D	Building 7304 Decommissioning Final Status Survey Plan

Acronyms and Abbreviations

Ac-228	Actinium 228
AFSC	U.S. Army Field Support Command
ALARA	As Low As Reasonably Achievable
ALI	Allowable Limit on Intake
Am-241	Americium 241
AP	Administrative Procedure
C-14	Carbon 14
CABRERA	Cabrera Services, Inc.
CAR	Corrective Action Request
CECOM	U.S. Army Communications-Electronics Command
CEDE	Committed Effective Dose Equivalent
CFR	U.S. Code of Federal Regulations
cm	Centimeter
cm^2	Square Centimeter
COC	Chain-of-Custody
cpm	Counts per minute
Cs-137	Cesium 137
DAC	Derived Air Concentration
DCGL	Derived Concentration Guidelines
dpm	Disintegrations per Minute
FSS	Final Status Survey
ft	Feet
ft^2	Square Feet
ft^3	Cubic Feet

Ft.	Fort
GET	General Employee Training
GPS	Global Positioning System
GWS	Gamma Walkover Survey
H-3	Tritium
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
HSO	Health and Safety Officer
HTRW	Hazardous, Toxic or Radioactive Waste
LLRW	Low-Level Radioactive Waste
LTR	License Termination Rule
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
mph	Miles per Hour
mrem	Millirem
mrem/yr	Millirem per Year
MSL	Mean Sea Level
NaI	Sodium Iodide
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
OP	Operating Procedure
pCi/g	Picocuries per Gram
PM	Project Manager
Pm-147	Promethium 147
PPE	Personal Protective Equipment

QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
R&D	Research and Development
ROCs	Radionuclides of Concern
RSO	Radiation Safety Officer
RSP	Radiation Safety Program
RWP	Radiation Work Permit
RWT	Radiation Worker Training
SBCCOM	U.S. Army Soldier, Biological and Chemical Command
SOHM	Safety and Occupational Health Manager
SOP	Standard Operating Procedure
TEDE	Total Effective Dose Equivalent
Th-232	Thorium 232
U.S.	United States
Vault	Building 7304 Vault

1.0 EXECUTIVE SUMMARY

Cabrera Services, Inc. (CABRERA) is under contract to the United States (U.S.) Army Field Support Command (AFSC), formerly known as the U.S. Army Joint Munitions Command, to perform the decommissioning of the Fort (Ft.) Belvoir Building 7304 Vault (Vault). The U.S. Army Soldier, Biological and Chemical Command (SBCCOM) is the license holder for this storage facility under U.S. Nuclear Regulatory Commission (NRC) license number 45-00953-01 (NRC 2003), presented in Appendix A. SBCCOM has requested assistance in terminating their NRC license for this location. The decommissioning objective proposed by the licensee is unrestricted use.

CABRERA conducted a Characterization Survey of the Vault in April 2003. Data from this Characterization Survey is being used to support development of this Decommissioning Plan, in accordance with NRC regulations and guidance. This Decommissioning effort is classified as a Group 3 decommissioning as determined using the guidance presented in NUREG-1757 Volume 1 (NRC 2003b).

The Vault is located adjacent to U.S. Army Communications-Electronics Command (CECOM) Research and Development (R&D) Facility, behind Building 7363 located on Totten Road within the Ft. Belvoir Military Reservation in Fairfax County, Virginia. The address of the licensee is:

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The Vault is a concrete construction, bunker-style building enclosed within an earthen covering approximately three feet (ft) thick. The front of the building is concrete, with a walkway and shield wall. The Vault was constructed on a hillside such that the entranceway is at street level facing the rear parking lot for Building 7304. A security fence abuts the rear of the structure. The Vault building is 12 ft by 16 ft, equaling a footprint of 192 square feet (ft^2). The entire area to be remediated is expected to be approximately 476 ft^2. This encompasses an additional 4 ft on three sides of the structure to allow the excavation of the exterior buried drains, and approximately 60 ft^2 in the front of the building for the exterior walkway and shield wall. There are shielded wall storage vaults and floor storage vaults within the Vault structure.

Results of the characterization survey radiological analyses indicate the presence of elevated tritium (H-3), carbon 14 (C-14), cesium 137 (Cs-137), promethium 147 (Pm-147), americium 241 (Am-241), and thorium 232 (Th-232). The extent of the contamination onsite is expected to be limited to the surface paint and concrete for most of the radionuclides present at the site. There is a possibility that H-3 contamination has migrated into the concrete structure, but because the whole of the Vault will be demolished and shipped as radioactive waste, any internal contamination will be contained and removed from site. Elevated levels of radioactivity were detected at the interior Vault floor, the soil beneath the floor, at wall storage vaults, and at floor storage vaults. The highest contamination exceedance of action levels included Cs-137 on

the interior Vault floor and in the soil under the floor storage vaults; and H-3 inside the wall storage vaults. Contamination exceeding action levels outside the Vault is minimal and is concentrated on the concrete pad just outside the Vault doorway.

Building plans indicate that a floor drain exists within the Vault and is connected to the exterior building curtain drain. During the Characterization Survey, CABRERA conducted extensive smoke testing and visual walkovers of the area, but was unable to locate the combined drain outfall or to confirm that the floor drain was connected to the exterior building drain. It is possible that the floor drain discharges directly into the ground beneath the vault structure. There was no indication of contamination around the floor drain entry, however, since Cabrera was unable to perform an outfall survey, the drainage system remains as the only potentially contaminated system onsite. The remainder of the floor drain pipe and the exterior foundation drain will be surveyed and remediated upon building demolition and excavation.

Ft. Belvoir has primarily used the Vault as a radioactive waste storage area in support of their research laboratory. Based on the NRC Timeliness Rule, SBCCOM is required to initiate decommissioning if the Vault is not used for a period of two years or if SBCCOM decides to terminate activities involving licensed radioactive materials. Potential decommissioning options range from performance of a site-specific dose assessment resulting in no action, to demolition and offsite disposal of the Vault as low-level radioactive waste (LLRW). The presence of contamination in the soil under the Vault complicates the decommissioning process and makes decommissioning options that involve removal of the Vault the most viable.

CABRERA management and personnel are committed to maintaining exposure of ionizing radiation to workers, the public, and the environment at as low as reasonably achievable (ALARA) levels and will strive to conduct decommissioning activities in a manner that supports this commitment. Safety guidelines for work in radiological controlled areas have been established in the CABRERA Radiation Safety Program (RSP) under the Cabrera Services, Inc NRC license number 06-30556-01. These guidelines have been amended by Radiation Work Permits (RWPs) to provide administrative control of all activity within areas that may have radiological hazards, in order to maintain exposure at ALARA levels. CABRERA will ensure the minimization of the impact of ionizing radiation to human health and the environment through the use of CABRERA's NRC-approved RSP standard operating procedures. CABRERA will also ensure that environmental monitoring and control activities performed during decommissioning activities will comply with 10 U.S. Code of Federal Regulations (CFR) Part 20 regulatory requirements.

The scope of decommissioning activities on the site will include the deconstruction and removal of the Vault structure, concrete foundation, subsurface drainage system associated with the Vault (including the exterior building drains, floor drains, and piping), and soils impacted above the radiological screening guidelines. The licensee assumes the combined drain line is not connected to any other system(s) and that the drain outfall is either under the Vault slab or in close proximity to the Vault. The licensee assumes that the removal of the drain line will not require activities in excess of shallow trenching. The scope of decommissioning activities also includes the proper packaging and transportation of LLRW and non-radioactive industrial waste to licensed burial and industrial landfill facilities, respectively. Radiological Final Status Surveys

will be performed using Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM; NRC 2000) guidance following decommissioning activities.

Post remediation activities at the Vault site will be comprised of placing clean backfill to bring the excavated area up to grade, and using either sod or seeding to reestablish vegetation.

The proposed schedule to accomplish the decommissioning activities, as outlined in this plan is as follows:

- Decommissioning Plan Review/NRC Approval 26 April – 28 May 2004 (30 days)
- Final Plan Submittal – 14 June 2004 (10 days after receipt of comments)
- Decommissioning Activities (including FSS, mob/demob) – 15 June – 11 August 2004 (45 days)
- Submit Draft Final Status Survey Report – 7 October 2004 (45 days)

Based on NRC guidance, if decommissioning actions are not currently authorized under an existing license, the licensee must develop a Decommissioning Plan and submit a request for a license amendment. SBCCOM's NRC radioactive materials license number 45-00953-01 (included in Appendix A) authorizes the following uses of radioactive material:

> *For possession and use in conducting research and development as defined in 10 CFR 30.4, calibration of instruments, training of students, and demonstration of items being developed and/or tested. Preparation of low level counting standards. Quality control and prototype testing of manufactured items utilizing licensed materials.*
>
> *For collection and analysis of leak and wipe test samples from Department of Army radioactive commodities.*

Regarding the need for a development of a Decommissioning Plan, 10 CFR 30.36(g)(1) states:

> *A decommissioning plan must be submitted if required by license condition or if the procedures and activities necessary to carry out decommissioning of the site or separate building or outdoor area have not been previously approved by the Commission and these procedures could increase potential health and safety impacts to workers or to the public, such as in any of the following cases: (i) Procedures would involve techniques not applied routinely during cleanup or maintenance operations; (ii) Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation; (iii) Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or (iv) Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.*

The SBCCOM NRC license does not specifically authorize physical remediation of building surfaces or demolition of structures. In addition, such activities are not routinely applied during

radioactive material cleanup and maintenance operations at the facility, could result in significantly greater airborne concentrations of radioactive materials than are present during operation, and could result in significantly greater releases of radioactive material to the environment than those associated with operation. Thus, SBCCOM must submit a Decommissioning Plan (i.e., this plan) to the NRC and is applying for a license amendment to support decommissioning actions.

2.0 FACILITY OPERATING HISTORY

2.1 License Status and Authorized Activities

2.1.1 License Number/Status

SBCCOM is the license holder for this storage facility, NRC license number 45-00953-01 (NRC 2003; Appendix A). The license is current and the Vault's decommissioning is being sought in support of releasing the Vault property for unrestricted use. Amendment #42 is the most current version of this license, issued on April 17, 2003.

2.1.2 Authorized Activities

The Vault was previously used as a radioactive material storage area. It is not known if additional activities beyond storage were conducted at the Vault.

Presently, the radionuclides at the site are in the form of loose and fixed contamination upon solid materials (e.g. walls, floors, surfaces within storage vaults.). All stored radioactive materials were removed and shipped to an offsite disposal facility prior to initiation of the Characterization Survey of the Vault. The NRC license presented in Appendix A indicates the radionuclides and maximum activities and quantities authorized and used under the current license.

2.2 License History

There are no previous licenses issued to this facility.

2.3 Previous Decommissioning Activities

This project has been scoped into two phases:

- Phase I – Inventory and limited sampling and analysis.
- Phase II – Characterization Survey, Transportation of Waste and Preparation of Decommissioning Plan

Phase I was completed in June 2002. It consisted of a site visit to inventory unwanted radioactive materials and to conduct limited sampling and analysis to support disposal decisions. Phase II included a characterization survey and the transportation and disposal of the unwanted radioactive materials to offsite facilities. The site work portion of Phase II was completed during the last week of January 2003. The generation of this Decommissioning Plan marks the initiation of Phase III. No known decontamination activities have been performed to date on the Vault structure in support of decommissioning activities.

2.4 Spills

There is no written record of spills within the Vault. However, the contamination levels on the floor and within the floor and wall vaults indicate that spills may have occurred during the use of the building.

3.0 FACILITY DESCRIPTION

3.1 Site Location and Description

The Vault is a concrete construction, bunker-style building, enclosed within an earthen covering approximately three ft thick. The front of the building is concrete, with a walkway and shield wall. A security fence abuts the rear of the structure. The Vault building is 12 ft by 16 ft, with a footprint of approximately 192 ft^2. The entire area to be remediated is approximately 476 ft^2. This encompasses an additional 4 ft on three sides of the structure to allow the excavation of the exterior buried drains, and approximately 60 ft^2 in the front of the building for the exterior walkway and shield wall. Diagrams of the Vault are presented as Attachment 1.

The Vault is located on the western shore of the Potomac River within the Ft. Belvoir Military Reservation in Fairfax County, Virginia (see Figure 3-1). It is approximately 16 miles south by southwest of the center of Washington D.C. The nearest neighboring towns are Mt Vernon, three miles to the east, and Accotink one mile west. Four miles away to the southeast is Marshall Hall, Maryland, across the Potomac River. U.S. Route 1 crosses the north boundary of the Ft. Belvoir Reservation, with Accotink Bay and Gunston Cove to the west and southwest. The Potomac River borders south and Dogue Creek the east.

The Vault lies within the Ft. Belvoir Military Reservation near Gunston Point at the southern end of a peninsula (see Figure 3-2). The peninsula is relatively level across the center with gently contoured hills sloping toward the river and bays. The elevation within the Reservation ranges from 140 ft above mean sea level (MSL) to sea level at the shores. The elevation of the Vault site is 52 ft above MSL. The area is wooded along the shores of the peninsula, and between the areas where the man-made structures are built. The peninsula is approximately 50 % wooded.

The man-made features within Ft. Belvoir consist of roads, buildings, docks, and a rail spur. While most roads are paved, a relative few are gravel. The buildings range from research facilities, a nuclear reactor facility, administrative buildings, and warehouses, to single and multiple family residences and barracks. The Vault is adjacent to Building 7363 at the CECOM R&D Facility.

There are no offsite wells used directly as potable water sources by nearby communities or individuals. The Fairfax County Water Authority supplies potable water to Ft. Belvoir. There are two major sources for the Fairfax County Water Authority, one is a pipeline from the Potomac River above Great Falls, Virginia, about 30 miles upstream, the other is the Occoquan Reservoir, approximately ten miles due west. (MWCOG 2003)

3.2 Population Distribution

Ft. Belvoir is an 8,656-acre facility located within Fairfax County, Virginia. Ft. Belvoir itself has a population of 7,176 persons as of the 2000 census and a "working" population of 22,244 persons (FTB 2003). It has a mean age of 22.5 and a median household income of $39,592. Fairfax County, Virginia has a population of 969,749 persons per the 2000 census with a median family income of $103,000 (FCV 2003). The closest major city to Ft. Belvoir is Alexandria, Virginia, which has a population of 128,283. Alexandria, Virginia has a median age of 34.4 and

a mean household income of $56,054. Washington D. C. and Arlington, Virginia are also located within 20 miles of Ft. Belvoir (USCB 2003).

3.3 Current/Future Land Use

With the increase in population after World War II, areas outside the boundaries of Ft. Belvoir have evolved from farming to rural residence and urban development areas. In addition, other military establishments occupy some of the area outside and adjoining the reservation (USAEPG 1972).

3.4 Meteorology and Climatology

Meteorological data for Ft. Belvoir is derived from references to Washington DC area data (Table 3-1).

Table 3-1 Average Meteorological Data for Washington, D.C. Area

	January	February	March	April	May	June	July	August	September	October	November	December
High Temperature °F	42	46	56	67	76	85	89	87	80	69	58	47
Low Temperature °F	27	29	38	46	57	67	71	70	62	50	41	32
Precipitation inches	3	3	3	3	4	3	4	4	3	3	3	3
Snow inches	4	4	Trace	-	-	-	-	-	-	-	Trace	1
Wind Speed miles per hour (mph)	10	11	11	11	10	9	9	9	9	9	10	10
Wind Direction	NW	NW	NW	S	S	S	S	S	S	S	S	NW

The humid continental climate for the area allows for a large variance in weather conditions and temperatures. There is a difference of 42.8 °F from the coldest month of the year, January, to the warmest month of the year, July. Ft. Belvoir receives an average of 39.54 inches of rain per year, with an average of 12 inches of snow per year (WUI 2003). No wet and dry seasons exist since precipitation is well distributed throughout the year. The greatest rainfall recorded for a 24-hour period was 7.31 inches, on August 11-12, 1928. The greatest snowfall ever recorded in the area was 28 inches, which occurred in January of 1922. The average annual relative humidity for the area is 63% and the average annual wind speed is 9.4 mph (NWA 2002).

3.5 Geology and Seismology

Ft. Belvoir is located at the junction of the Atlantic Coastal Plain and the Piedmont Plateau. This line of demarcation between these two physiographic provinces separates the region of granites and other hard rocks of ancient origin to the west from the sands, gravels, and clays of recent deposition to the east.

Rivers such as the Potomac and large estuaries have drowned the submerged landscapes of the northern coastal plain region. Glacio-fluvial outwash channels have created numerous terraced regions on the body of the Coastal Plain. One such terrace, the Columbia Formation, which covers most of the area presently occupied by Ft. Belvoir, was formed as a thin veneer of stream-laid material and presently occupies the higher elevations in the area. Directly underlying the Columbia Formation are the unconsolidated deposits of the Potomac Group, which occupy the lower elevations and the exposed shoreline at Ft. Belvoir. This group of sandstone, clay and conglomerate has a thickness of 450 to 500 ft and has a slight southeasterly dip. Below the Potomac Group lies bedrock of granites and schists (USAEPG 1972).

The history of this area shows a low probability of an earthquake of sufficient magnitude to cause damage to structures. Only one earthquake of moderate intensity has ever been reported in the area. This incident occurred on August 31, 1861, with the epicenter located at 38.8 degrees north latitude and 77 degrees west longitude, which is 12 miles from Ft. Belvoir. The intensity of this shock was listed as a 5 on the Rossi-Forel scale. The U.S. Geological Survey reports that no seismic shocks have occurred in the Ft. Belvoir area since the above-mentioned earthquake (USAEPG 1972).

3.6 Surface Water Hydrology

The Ft. Belvoir Reservation borders on Accotink Bay, part of the Potomac River tidal estuary. The depth varies from 3 ft in the northern region to 7 ft in the center. A submerged sandbar blocks about 80 percent of the mouth of the Gunston Cove. At Ft. Belvoir, the Potomac River is approximately one mile wide with the center of the navigational channel 600 ft from the Virginia Shore. The navigational channel is about 600 ft wide and ranges from 30 to 60 ft deep. The normal flow of the Potomac River is 25,000 cubic feet (ft^3) per second during winter months and 5,000 ft^3 per second during the summer. The mean tidal range in this area is 2 ft (USAEPG 1972). Two streams drain into the Potomac in the vicinity of Ft. Belvoir, Pohick Creek and Accotink Creek. The Virginia Department of Environmental Quality lists these two streams, the Potomac River and the Accotink Bay, as Impaired Waters. This rating is chiefly due to the presence of fecal coliform, PCBs, and other organic chemicals (VDEQ 2003).

An annual migration up the river and creeks exists of spawning of such fish as shad, menhaden and herring, although silting and pollution have reduced their number. Planktonic and attached algae are present in local waters and are the primary food source of shad and shad-like fishes. The algae are either eaten directly by the fish or through copepod intermediaries (USAEPG 1970). Presently, the majority of the fishes living in the Potomac and adjacent coves and creeks are pollution tolerant species (VDEQ 2003).

None of the cities or communities south of Washington, D.C. use the Potomac River below Great Falls, Virginia as a source of potable water. The Potomac River is a source of industrial water. The City of Washington uses water for sewage treatment, while the Virginia Electric and Power Company uses water for cooling in power plants both north and south of Ft. Belvoir.

The Potomac River is navigable for 106 miles from its entrance on Chesapeake Bay to Washington, D.C. River traffic consists of excursion trips, oil tankers, small military vessels, and commercial cargo ships. There are numerous small craft engaged in fishing and oystering in the lower Potomac, but no commercial fishing is practiced in the Ft. Belvoir area.

Due to the impairment of surface waters by human influence, recreational use of the Potomac River is limited chiefly to boating; however, there is some private swimming. The nearest major recreational facility is Colonial Beach, Virginia, 51 miles south of the Ft. Belvoir Reservation.

3.7 Ground Water Hydrology

The subsurface hydrology of the area is greatly affected by the underlying rock formations. The Columbia formations in general are not satisfactory as aquifers owing to their slight thickness, their high topographic position and the extent of dissection by streams, which make them susceptible to the effects of drought. They do, however, furnish small domestic water supplies to many thousands of shallow dug or driven wells throughout the Coastal Plain in Virginia (USAEPG 1972).

The Potomac group sands are good aquifers and contain many wells of large yield. In the Ft. Belvoir area, these beds are the thickest near the Potomac River and receive recharge from the saturated alluvium of recent age along the river valley.

Ground water is not used directly for human consumption on the Ft. Belvoir Reservation, or in the immediate surrounding areas. The Fairfax County Water Authority supplies potable water to Ft. Belvoir through two major sources, one is a pipeline from the Potomac River above Great Falls, Virginia, about 30 miles upstream, the other is the Occoquan Reservoir, approximately ten miles due west. (MWCOG 2003).

3.8 Natural Resources

There are no known significant mineral deposits, water resources, coal deposits or other natural resources which, if exploited would affect the licensee.

4.0 RADIOLOGICAL STATUS OF FACILITY

Characterization surveys have identified radioactive contamination on Vault interior/exterior surfaces, in soils beneath the floor, and within the wall vaults.

Radioactive and solid wastes formerly stored in the Vault were removed and disposed of at appropriate facilities in 2002. Sources have been removed from the vault and are in an approved storage location awaiting coordination for disposal.

Since that time, the Vault has been essentially empty, has not been used to support work with licensed radioactive materials, and SBCCOM has decided to permanently cease operations with licensed materials in the Vault. Based on the results of the Characterization Survey Report (see Appendix B), residual radioactivity in the Vault exceeds NRC screening criteria and, without performance of a site-specific dose assessment, the Vault is not suitable for release for unrestricted use, (i.e., the Vault does not meet the 10 CFR 20 Subpart E unrestricted Radiological Criteria for License Termination). Thus, based on the criteria above, SBCCOM is required to initiate the NRC decommissioning process in accordance with 10 CFR 30.36(d).

4.1 Contaminated Structures

The Vault is the only contaminated structure addressed within this decommissioning plan. The Vault is a 16 ft long by 12 ft wide by 8 ft tall concrete structure. The Vault was constructed on a hillside such that the entranceway is at street level. The structure is enclosed within an earthen covering approximately three ft thick. A security fence abuts the rear of the structure. Diagrams of the Vault are presented as Attachment 1.

The structure is comprised of the Vault proper, an external walkway and doorway enclosed by a shield wall. The shield wall is approximately eight ft tall, and does not have a roof. Within the building is a 10 ft by 14 ft single room containing a series of shielded wall and floor containments (wall storage vaults and floor storage vaults). The wall vaults are housed within a 7.5 ft wide by 5.6 ft high by 13.3 ft wide poured concrete and steel structure along the west wall. There are 33 wall vaults within the structure. The dimensions of each wall vault are six inches in diameter and 36 inches deep. Four floor vaults are at the rear of the room, opposite the door. The floor vaults are constructed of cylindrical tile, poured into the concrete floor. The bottoms of the floor vaults are gravel and are not sealed (i.e., soil is beneath the gravel). The dimensions of each floor vault are 24 inches in diameter and 48 inches deep.

Direct radioactivity measurements and smears were performed during the Characterization Survey on the interior walls, floor, ceiling, wall vaults, floor vaults, outside walkway, and outside shield wall. Alphanumeric grids were created, and surface scans were performed over 100% of the grids. The location of the highest activity was located within each grid, and biased integrated alpha and beta measurements and smears analyzed for alpha and beta activity were taken in this location. Table 4-1 provides a summary of the maximum and average measurements of direct radiation readings and surface smears for each survey area. Detailed results are included in the Characterization Survey Report (Appendix B).

Direct radiation measurement action levels were exceeded at the following areas: interior vault floor, wall vaults, wall vault plugs, floor vaults and the exterior floor.

Regarding the interior vault floor, the fixed alpha action level of the interior vault floor was exceeded in three of 140 measurement locations, and the fixed beta action level was exceeded in three of 140 measurement locations. The integrated fixed low-energy beta activity measurements were not exceeded in any of the 140 interior vault floor measurement locations.

The fixed alpha action level was exceeded at all 74 measurement locations in the wall storage vaults, floor storage vaults, and on the wall storage vault plugs. The fixed beta action level was exceeded at one of 74 measurement locations.

The fixed alpha action level was exceeded at six of 125 outside floor measurement locations. These locations are concentrated around the entrance to the Vault.

Transferable radioactivity action levels were exceeded at the following areas: interior vault floor, wall vaults, and wall vault plugs. Regarding the interior vault floor, two alpha smear results exceeded the transferable alpha activity action level, and no beta smear results exceeded the transferable beta radioactivity action level. One smear was collected from each of 33 wall storage vaults and plugs. Of these smears, 17 alpha smear results exceeded the transferable alpha radioactivity action level, and no beta smear results exceeded the transferable beta radioactivity action level.

Table 4-1 Summary of Action Levels and Maximum and Average Radioactivity and Contamination Results in the Vault Structure

	Direct Radiation Survey Integrated Measurements (disintegrations per minute [dpm]/100 square centimeters [cm^2])						Smears (dpm/100 cm^2)			
Area	Alpha (maximum)	Alpha (average)	Beta (maximum)	Beta (average)	Low Energy Beta (maximum)	Low Energy Beta (average)	Alpha	Beta	H-3	C-14
Background										
Action Level	27		28,000		1.8 E6		3	2,800	1.7 E7	4 E5
Interior Vault Floor	43	7.4	291,122	5,167	< 1.8 E6	< 1.8 E6	4	< 2,800	< 1.7 E7	< 4 E5
Interior Vault North Wall	< 27	< 27	< 28,000	< 28,000	< 1.8 E6	< 1.8 E6	< 3	< 2,800	< 1.7 E7	< 4 E5
Interior Vault South Wall	< 27	< 27	< 28,000	< 28,000	< 1.8 E6	< 1.8 E6	< 3	< 2,800	< 1.7 E7	< 4 E5
Interior Vault East Wall	< 27	< 27	< 28,000	< 28,000	< 1.8 E6	< 1.8 E6	< 3	< 2,800	< 1.7 E7	< 4 E5
Interior Vault West Wall	< 27	< 27	< 28,000	< 28,000	< 1.8 E6	< 1.8 E6	< 3	< 2,800	< 1.7 E7	< 4 E5
Interior Vault Ceiling	< 27	< 27	< 28,000	< 28,000	--	--	< 3	< 2,800	< 1.7 E7	< 4 E5
Roof Vent	< 27	< 27	< 28,000	< 28,000	--	--	< 3	< 2,800	< 1.7 E7	< 4 E5
Floor Drain	< 27	< 27	< 28,000	< 28,000	< 1.8 E6	< 1.8 E6	< 3	< 2,800	< 1.7 E7	< 4 E5
Wall Vaults	2,320	371	597,607	20,280	--	--	117	< 2,800	--	--
Wall Vault Plugs	3,503	518	< 28,000	< 28,000	--	--	117	< 2,800	--	--
Floor vaults	158	88	< 28,000	< 28,000	--	--	< 3	< 2,800	--	--
Exterior North Wall	< 27	< 27	56,835	5,794	--	--	< 3	< 2,800	< 1.7 E7	< 4 E5
Exterior South Wall	< 27	< 27	< 28,000	< 28,000	--	--	< 3	< 2,800	< 1.7 E7	< 4 E5
Exterior East Wall	< 27	< 27	< 28,000	< 28,000	--	--	< 3	< 2,800	< 1.7 E7	< 4 E5
Exterior Floor	35	9.7	< 28,000	< 28,000	--	--	< 3	< 2,800	< 1.7 E7	< 4 E5

Note: Blank tabular information indicates that samples were not taken at these locations.

Three volumetric composite samples were collected and submitted to the offsite laboratory for gamma spectroscopy and H-3/C-14 analysis for the purpose of identifying radionuclide contaminants inside the Vault. One composite sample was collected from the wall vault, one from the interior vault floor and a third from the soil beneath the floor vaults. The wall vault composite sample consisted of loose material and chipped concrete from inside the wall storage vaults. The wall vault composite sample results were clearly elevated for H-3 and C-14. The interior floor composite sample consisted of scrapings and loose material collected from the interior floor. The interior floor composite results were elevated for Cs-137, Pm-147, and Th-232 via Actinium-228 (Ac-228) progeny, Am-241 was slightly elevated. The floor vault soil sample was collected from the soil beneath the gravel at the bottom of the floor vaults. The floor vault soil sample was elevated for H-3, C-14, and Cs-137. Table 4-2 provides a summary of the radionuclides and activities present in the composite samples. A table of complete volumetric composite sample results is presented in the Characterization Survey Report presented as Appendix B.

Table 4-2 Summary of Volumetric Composite Sample Nuclides and Activity

Sample	Nuclide	Activity (pCi/g)
Wall Vault	H-3	50,800
	C-14	41
Floor Vault	Cs-137	940
	Pm-147	8.1
	Th-232	23
	Am-241	0.08
Floor Vault Soil	H-3	123
	C-14	22
	Cs-137	63

4.2 Contaminated Systems and Equipment

There are two systems present in the Vault: a roof duct and a drainage system. The roof duct serves as an air vent and a penetration for two drainpipe vent stacks. According to the building plans, the drainage system is comprised of a floor drain connected to an exterior foundation drain. The floor drain lies near the center of the interior floor. CABRERA conducted multiple smoke tests from the floor drain to determine the outfall location, but the tests were unsuccessful. It is possible that the floor drain does not connect to the exterior building drain, and therefore possible that the floor drain does not exit the Vault horizontal boundaries but discharges into the gravel beneath the structure.

The interior and exterior of the roof duct were surveyed. No direct activity results above background and no removable contamination was found.

The floor drain was smear surveyed for H-3/C-14. No results exceeded the transferable activity action levels. Because efforts to locate the floor drain outfall were unsuccessful, no surveys (grid setup, collection of soil samples, direct radiation measurements, smears, gamma walkover survey [GWS]) were performed at the location of the floor drain/exterior building drain outfall.

The exterior of the floor drain was surveyed at the same time as, and in the same manner as the rest of the Vault floor. No direct readings or smear results exceeded action levels on the exterior of the floor drain.

The floor/exterior building drain remains as the only potentially contaminated system onsite. Initial surveys around the drain entry indicate no contamination, but the remainder of the floor drain pipe and the exterior foundation drain will be surveyed upon building demolition and excavation.

4.3 Surface Soil Contamination

The surface soil within the Vault area is a small hill comprised of the earthen covering for the bunker structure. The soil covering is approximately three ft thick. A GWS and volumetric soil sampling was performed in this area. Neither the GWS nor the volumetric soil sampling indicated any radioactivity above action levels.

The GWS was conducted outside the Vault over the hill above the bunker. Individual traverses were completed in a north-south orientation and were spaced one meter apart. The gamma activity was recorded using a sodium iodide (NaI) detector coupled to a Ludlum 2221 rate meter. The GWS survey did not identify any areas of elevated radioactivity. Global Positioning System (GPS) coordinates were reported in U.S. State Plane 1983, Virginia North, meters.

Three shallow soil samples were collected from the top of the hill above the bunker at 0 to six inches depth for analysis. Two samples were collected from the soil just around the opening of the roof duct penetrating through the soil from the top of the Vault, and one sample from the location of the most elevated GWS result. Samples were submitted to the offsite laboratory for analysis. Results reported by the offsite laboratory were well below the soil action levels. These results are presented in the Characterization Survey Report presented as Appendix B.

5.0 DOSE MODELING EVALUATIONS

SBCCOM is proposing the decommissioning and unrestricted release of the Vault from their NRC license, number 45-00953-01. This section describes the establishment of DCGLs to be used for site decommissioning activities. DCGLs represent the acceptable limits of residual radioactivity concentrations, above background, allowed to exist following decommissioning activities while still being protective against risks to human health associated with potential exposure to residual radioactivity originating from the site. The NRC has established an annual radiation dose limit of 25 millirem per year (mrem/yr), over background, to an average member of the critical group as the allowable maximum dose to the public contributed by residual radioactivity at a site released for unrestricted use. The excavation and removal of radioactive material currently remaining at the Vault will reduce the potential radiation exposure to less than 25 mrem/yr over background to present and future site populations. In addition, concentrations of radioactivity will be reduced to concentrations that are ALARA, while considering factors specific to the site.

5.1 Unrestricted Release Using Screening Criteria

On June 21, 1997, the NRC published the final rule on "Radiological Criteria for License Termination", the License Termination Rule (LTR), as Subpart E to 10 CFR Part 20. The criteria for termination with unrestricted release are

1) Residual radioactivity that is distinguishable from background, and results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem/yr, including that from groundwater sources of drinking water; and

2) 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 excavation and waste disposal activities. For the decommissioning of the Vault, a dose objective of 25 mrem/yr above background is applicable and is therefore used as the basis for demonstrating that the Vault should be released for unrestricted use. The method for evaluating the dose objective is provided below.

Supplemental information regarding the implementation of the LTR, including screening criteria for building surfaces and soil, was published by NRC in the Federal Register Volume 63, Number 222, November 18, 1998 (NRC 1998); the Federal Register Volume 64, Number 234, December 7, 1999 (NRC 1999); and also the Federal Register Volume 65, Number 114, June 13, 2000 (NRC 2000). Soil screening criteria required for Vault radionuclides of concern (ROCs) not presented in the preceding Federal Register documents have been referenced from Table 6.91 of NUREG/CR-5512, Volume 3, October 1999 (NRC 1999b). These screening criteria have been used to establish Vault decommissioning DCGLs and to establish instrument/analysis sensitivity requirements for this survey.

Following excavation activities, the Vault building will no longer be present. Remaining soils expected to contain very small levels of residual radioactivity will be the area of study for

unrestricted release surveys. As described in the guidance presented in Federal Register Volume 65, June 13, 2000 (NRC 2000b), the use of the soil screening values presented in Federal Register Volume 64, December 7, 1999 may be used to demonstrate compliance with the LTR for soils under specific guidelines. The four guidelines by which soils may be deemed acceptable for release for unrestricted use are as follows:

1) The residual radioactivity has been reduced to levels that are ALARA

2) The residual radioactivity is contained in the top layer of the surface soil (i.e., within approximately 30 centimeters [cm] from surface in accordance with NUREG-1757 Volume 2 [NRC 2003b])

3) The unsaturated zone and the groundwater are initially free of radiological contamination; and

4) The vertical saturated hydraulic conductivity at the specific site is greater than the infiltration rate.

The four guidelines presented above are expected to be met by soils remaining in the former Vault area following excavation activities. The Final Status Survey (FSS) study area source term is expected to be comparable to the general source term assumed in NRC inputs to the DandD program for establishing the release criteria. Therefore, under the guidance presented in the above mentioned Federal Register documents and also in NUREG-1757 Volume 1, the soil screening criteria presented in the December 7, 1999 Federal Register document will be used to develop DCGLs for the Vault decommissioning survey to demonstrate compliance with the 25 mrem/yr dose criteria.

6.0 PLANNED DECOMMISSIONING ACTIVITIES

The scope of decommissioning activities on the site will include the deconstruction and removal of the Vault structure, concrete foundation, subsurface drainage system associated with the Vault (including the exterior building drains, floor drains, and piping), and soils impacted above the radiological screening guidelines. The licensee assumes the combined drain line is not connected to any other system(s) and that the drain outfall is either under the Vault slab or in close proximity to the Vault. The licensee assumes that the removal of the drain line will not require activities in excess of shallow trenching. The scope of decommissioning activities also includes the proper packaging and transportation of LLRW in IP-1 or IP-2 containers and non-radioactive industrial waste by truck to licensed burial and industrial landfill facilities, respectively. LLRW will be shipped to Envirocare of Utah for disposal. Radiological FSSs will be performed using MARSSIM (NRC 2000) guidance following decommissioning activities.

Several decommissioning tasks will be performed under this decommissioning plan. The tasks are listed below in the general order of performance, however some tasks may be performed concurrently:

1. Scabble the interior painted surfaces of the Vault to remove lead based paint, as necessary.

2. Excavate the non-impacted earthworks that serve as a covering for the Vault. Place the waste material in a temporary storage area separate from LLRW for future packaging and shipment.

3. Remove the non-impacted soil from the site. Place the waste material in an area separate from LLRW waste.

4. Demolish the Vault structure, while sizing the rubble to conform to the LLRW acceptance criteria for the disposal facility.

5. Excavate the floor drain and exterior building drains.

6. Package wastes, prepare shipping papers, and transport the removed LLRW to the Envirocare of Utah disposal facility.

7. Excavate the impacted soil beneath the Vault structure. The soil beneath the Vault structure will undergo radiological surveys as the area is excavated. The licensee will conduct surveys of sufficient sensitivity as the material is excavated to serve as portions of the FSS.

8. Perform a FSS of the Vault site to support release for unrestricted use.

The contractor, CABRERA, or their subcontractor will perform the tasks listed above.

6.1 Contaminated Structures

The first task to be performed within the Vault structure will be the scabbling of lead-based paint on surfaces of the structure where it occurs. Scabbling is the removal of surface material through mechanical means. Hand-held air or electric tools such as needle guns and power chisels will be used to remove the paint from concrete and metal surfaces. As necessary, high efficiency particulate air (HEPA) filter vacuum cleaners and air exchangers will be used in conjunction with the power tools to minimize airborne contamination. Breathing zone air samples will be collected during airborne contaminant generating work and whenever respirators are worn. General area air samples will be collected during work activities that generate dust. All lead paint waste will be collected, segregated, and stored separately from the remainder of the LLRW. The lead paint waste will be sampled and if necessary, classified as mixed waste. IF mixed waste is identified, it will be treated prior to disposal.

The second task to be performed on the Vault will be the excavation and removal of the earthworks serving as a covering for the Vault structure. Characterization surveys performed on this soil indicate that it is non-impacted. As the soil is excavated, it will be subject to additional sampling for radioactive material. The soil will be placed into a staging area, and upon receipt of the sample results, will be either placed into a yard truck for reuse if below the DCGLw or packaged as LLRW and shipped to Envirocare of Utah (if exceeding the DCGLw).

Demolition of the Vault structure will be accomplished using an excavator with a jackhammer attachment. As the building is deconstructed, the debris will be sized to meet the LLRW acceptance criteria for the disposal facility. As the rubble is sized, it will be placed into intermodal containers in preparation for shipment.

Personal protective equipment (PPE) will consist of Level C dress for work on lead paint removal. Level D and Modified Level D dress requirements will be required for the remainder of the decommissioning tasks. Dress requirements will be determined and monitored by the Radiation Safety Officer (RSO) as decommissioning tasks progress. All PPE requirements will adhere to the Ft. Belvoir Building 7304 Health and Safety Plan (HASP) presented as Appendix C.

6.2 Contaminated Systems and Equipment

The contamination levels within the building drainage system are not yet known, but are expected not to exceed levels within the Vault structure. Prior to and/or during excavation of the drainage system, measurements will be performed and the system evaluated to delineate the survey unit area. Excavation of the floor drains will be accomplished either concurrently with or after the removal of the remainder of the Vault structure. As with the rest of the structure, the rubble will be sized, and placed into intermodal containers in preparation for shipment.

Level D and Modified Level D dress requirements will be required for the removal of the building drainage system. Dress requirements will be determined and monitored by the RSO as decommissioning tasks progress. PPE requirements will adhere to the Ft. Belvoir Building 7304 HASP (see Appendix C).

6.3 Soil

Surveys of sufficient sensitivity will be performed on the soil below the Vault structure in support of the FSS. Areas of elevated readings will be excavated, and the surveys will be re-performed. Any soil with elevated readings above the DCGL will be placed into intermodal containers and packaged as LLRW.

Level D and Modified Level D dress requirements will be required for the removal of the building drainage system. Dress requirements will be determined and monitored by the RSO as decommissioning tasks progress. All PPE requirements will adhere to the Ft. Belvoir Building 7304 HASP (see Appendix C).

6.4 Surface and Ground Water

The licensee expects that no groundwater will be encountered during demolition and excavation activities. Accordingly, no decommissioning activities are planned that include the dewatering, storage or handling of liquid waste.

6.5 Schedule

The proposed schedule to accomplish the decommissioning activities, as outlined in this plan is as follows:

- Decommissioning Plan Review/NRC Approval 26 April – 28 May 2004 (30 days)
- Final Plan Submittal – 14 June 2004 (10 days after receipt of comments)
- Decommissioning Activities (including FSS, mob/demob) – 15 June – 11 August 2004 (45 days)
- Submit Draft Final Status Survey Report – 7 October 2004 (45 days)

A detailed schedule of planned decommissioning activities will be provided to NRC, SBCCOM, and Ft. Belvoir representatives, once this plan has been approved.

7.0 PROJECT MANAGEMENT AND ORGANIZATION

This project has been initiated by, and all decommissioning activities will be performed under the management of the authorized representative of the license holder for this facility:

Ms. Joyce Kuykendall
U.S. Army Soldier, Biological and Chemical Command
5183 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5424
joyce.kuykendall@us.army.mil

Cabrera Services, Inc. has been contracted by SBCCOM, with technical support from and as contracted through the US AFSC to develop this plan, as well as conduct all decommissioning, disposal, and final status survey activities as outlined herein.

7.1 Decommissioning Task Management

Safety guidelines for work in radiologically controlled areas have been established in the RSP. These guidelines will be amended by RWPs, as necessary, to provide administrative control of all activity within areas that may have radiological hazards, in order to maintain exposure ALARA. The radiation work described in this Decommissioning Plan will be considered when specific procedures are developed for work in radiologically controlled areas.

These RWPs will be reviewed and approved by the CABRERA RSO and prior to implementation. The RSO will ensure that ambient radiation, surface radioactivity, and airborne radioactivity surveys are performed, as required to define and document the radiological conditions for each job. RWPs will describe the job to be performed, outline tasks with elevated dose potentials and significant radiological hazards, define protective clothing and equipment to be used, and identify personnel monitoring requirements. RWPs will also specify any special instructions or precautions pertinent to radiation hazards in the area, including listing the radiological hazards present; the area dose rates, and the presence and intensity of hot spots; removable surface radioactivity; and other hazards as appropriate.

The subsections below describe CABRERA oversight of the decommissioning operations. This arrangement serves to minimize administrative functions, keep overhead costs to a practical minimum, and provide maximum flexibility for resource allocation.

7.2 Decommissioning Personnel and Qualifications

Qualified personnel will implement site decommissioning. The following is a description of the key positions in this organization.

7.2.1 Contractor Radiation Safety Officer

The RSO will serve as the Site Safety and Health Officer and will provide direct supervision of field staff ensuring that personnel adhere to the requirements of this HASP. The RSO will have the following additional responsibilities:

- Coordinate with the Project Manager (PM) and Safety and Occupational Health Manager (SOHM) in developing the HASP for additional site-specific project modifications.
- Coordinate with the SOHM for field implementation and enforcement of the HASP.
- Ensure compliance with applicable regulations concerning the handling and transportation of radioactive material.
- Provide training to on-site personnel who may be exposed to ionizing radiation, and for other site-specific hazards.
- Verify that subcontractors (as on-site personnel) implement the requirements of the RSP in an acceptable manner.
- Implement the RSP for the Vault.
- Review the results of surveys, sampling, and environmental monitoring to identify trends and potential for personnel exposure
- Recognize potential radiological hazards and modifying the RSP to protect against these hazards.
- Specify proper levels of PPE and resources necessary for full implementation of the RSP.
- Develop additional health and safety procedures, as required.
- Conduct daily safety briefings.
- Observe work in progress to verify adherence to day-to-day radiation safety operations.
- Assist the SOHM in the investigation of accidents/incidents and "near misses".
- Conduct weekly safety audits and complete required documentation.
- Termination of any work activities that could or do violate regulatory requirements for radiological protection pursuant to "Stop Work Authority."
- Coordinate with the PM and SOHM regarding the control of existing and potential industrial, chemical, and radiological hazards.

7.2.2 Project Manager

CABRERA will designate an individual to serve as the Project Manager (PM) for the Vault decommissioning.

- Establish and execute program administrative matters, program controls, program-related policy matters, and program levels of authority, responsibility, and communication.
- Ensure that the necessary project health and safety personnel have been assigned to the project team and that the required health and safety documents have been reviewed and notification has been performed before the commencement of site related activities.
- Establish and maintain a records management system to verify that project documents, such as correspondence, procedures, drawings, specifications, contract documents, changes to documents, and inspection records, are controlled.

7.2.3 Safety and Occupational Health Manager

The SOHM will be responsible for the acceptance of all HASPs. No hazardous, toxic or radioactive waste (HTRW) project shall commence without written acceptance of the HASP by the SOHM. Additionally, the SOHM shall:

- Ensure that the HASP complies with Federal, State, and local health and safety requirements. If necessary, modify specific aspects of the HASP to adjust for on-site changes that affect safety.
- Evaluate and authorize any changes to the HASP.
- Provide limited implementation and oversight of the HASP during on-site activities.
- Coordinate with the CABRERA RSO for field implementation of the HASP.
- Audit key aspects of the HASP.
- Assist the CABRERA RSO in training of site personnel in the site-specific hazards as applicable.
- Work with CABRERA RSO to develop the skills with respect to use and interpretation of air monitoring instruments/results, identification and remediation of hazards, PPE levels, decontamination, and emergency/spill response.
- Evaluate the effectiveness of engineering and administrative control, including the requirements for PPE.

7.2.4 Project Engineer

The Project Engineer will serve the role of the on-site lead for the project and provide Quality Assurance (QA) oversight. The Project Engineer will be responsible for the following:

- Provide technical assistance and peer review of all deliverables.
- Prepare and review the Quality Assurance Project Plan (QAPP).
- Oversight of subcontractor quality control activities to ensure compliance with the QAPP.
- Conduct on-site project management and site-specific health and safety support (radiological, industrial hygiene, and industrial safety) during the construction phase.
- Monitor the performance of CABRERA and any subcontractor personnel, and other on-site activities.
- Document the FSSs and facilitate communications with federal and state regulatory authorities.
- Coordinate with the analytical laboratories, tracking laboratory submittals and sample analyses, and verifying delivery of data, as necessary.
- Coordinate validation of analytical data.
- Prepare and submit QA reports, as required.
- Facilitate communications with federal and state regulatory authorities.

7.2.5 Personnel Assigned to the Project

Each site person is ultimately responsible for his or her own health and safety, including radiological safety, while working on this project. Taking reasonable precautions to prevent injury to themselves and to their fellow employees and being alert to potentially harmful situations are primary responsibilities. Site personnel shall be responsible for the following:

- Read and becoming familiar with the HASP.
- Perform only tasks that they can do safely and in which they have been trained.
- Notify the CABRERA RSO of special medical conditions (i.e. allergies, contact lenses, etc.).
- Notify the CABRERA RSO of prescription and/or non-prescription medication the worker may be taking that might cause drowsiness, anxiety or other unfavorable affects.
- Prevent spillage and splashing of materials to the greatest extent possible.
- Prevent the spread of contamination to the greatest extent possible.
- Maintain interaction with radioactive material to ALARA

- Practice good housekeeping by keeping the work area neat, clean, and orderly.
- Immediately report all injuries to the CABRERA RSO.
- Comply with the HASP and all health and safety recommendations and precautions, and properly using the PPE as determined by this HASP and/or the RSO.

7.3 Training

Personnel working on Vault decommissioning activities with unescorted access to the facility will be trained in regard to the type and magnitude of the radiological, chemical, and physical hazards they might face (all visitors to the site will be escorted). The following subsections briefly describe the various training programs that will be implemented by the RSO or his/her designee as part of this Decommissioning Plan.

7.3.1 Visitor Training

Visitors to the work zone will be escorted while in the Vault work area. Visitors shall not be allowed to enter airborne areas where exposure to internal dosage may occur without proper training.

7.3.2 General Employee Training

General Employee Training (GET) in radiation protection will be administered to project personnel who will provide support during implementation of this Plan. GET, to be provided at the start of fieldwork, will consist of an oral presentation by the RSO, handout materials, and completion of a form acknowledging receipt of training. GET will address the following topics:

- The type and form of radioactive material present at the facility.
- The location of the CABRERA's radiation protection policies and procedures.
- Employee and management responsibilities for radiation safety.
- Identification of radiation postings and barriers.
- Protective equipment and procedures.
- Work zone setup and decontamination procedures.
- Emergency procedures.
- How to contact CABRERA representatives and project radiation safety staff.

7.3.3 Radiation Worker Training

Project personnel who will work in radiologically controlled areas are required to undergo Radiation Worker Training (RWT) prior to arrival at the site. CABRERA RWT includes the following topics at a minimum:

- Radioactivity and radioactive decay,
- Characteristics of ionizing radiation,
- Manmade radiation sources,
- Effects of exposure to radiation,
- Risks associated with occupational radiation exposures,
- Special considerations with respect to exposure of women of reproductive age,
- Dose-equivalent limits,
- Modes of exposure (internal and external),
- Dose-equivalent determinations,
- Basic protective measures (time, distance, and shielding),
- Specific procedures for maintaining exposures ALARA,
- Radiation survey instrumentation (calibration, use, and limitations),
- Radiation monitoring programs and procedures,
- Contamination control, including protective clothing, equipment, and workplace design,
- Personnel decontamination,
- Emergency procedures,
- Warning signs, labels, and alarms, and
- Responsibilities of employees and management.

RWT will consist of a classroom lecture and procedure review, a 2-hour practical demonstration, a question/answer period, and a handout. The duration of training is approximately 4 hours. A graded exam to test employee proficiency in the class subject matter shall be administered. A passing score of 80 percent is required. A challenge test may be administered in lieu of a formal classroom training session for individuals previously trained by CABRERA or demonstrating knowledge regarding radiological hazards expected to be present on-site.

7.3.4 Tailgate Safety Training

A tailgate safety meeting will be conducted at the beginning of each work shift, whenever significant changes in job scope are made, whenever significant changes in site conditions (physical or radiological) occur, or whenever new personnel arrive at the job site. Health and safety procedures and issues for the day, any unique hazards associated with an activity, and a review of any significant topics from previous activities will be presented at this meeting. The information discussed will be recorded, which will serve as confirmation that the information was presented to those persons whose signatures are on the form. There will be at least one signed form for each work shift. Tailgate safety training forms will be incorporated into the decommissioning records.

7.3.5 Training Records

A form will be developed to demonstrate that training commitments have been met. This form will include the following information: the facility name; the date; the time; the task number; the type of work; the hazardous/radioactive materials used; the protective clothing/equipment used; the chemical, radiological, and physical hazards; emergency procedures; the hospital's/clinic's telephone numbers; the paramedic's telephone number; the hospital's address; any special equipment needed; and any other safety topics that may be relevant. All training records will be incorporated into the decommissioning records. A CABRERA Notice to Employees, a copy of the NRC Form 3 Notice to Employees, and a copy of the SBCCOM NRC Materials License will be posted in plain view at the worksite.

An NRC Form 4 will be requested for all individuals requiring radiation-monitoring dosimetry.

7.4 Contractor Support

CABRERA efforts will be focused on nuclear, health and safety, regulatory compliance, and project management matters. Specialty services necessary to complete certain aspects of the Plan (e.g., disposal, treatment, transportation, and laboratory analyses) may be subcontracted to firms with the appropriate skills and experience.

Each subcontractor will designate a Task Manager and, as necessary, a health and safety and/or quality control contact, who will report to the Task Manager. At all times, however, CABRERA will remain responsible for the scope, quality, and timeliness of services provided by all subcontractors. The RSO will verify that the subcontractor personnel are adequately informed of the hazards, the preventive measures, and the procedures associated with performing each decommissioning task. The RSO will verify that subcontractor personnel perform decommissioning activities in accordance with all license commitments and NRC requirements.

8.0 RADIATION SAFETY AND HEALTH PROGRAM

CABRERA will complete decommissioning activities in a manner that is protective to workers, the environment, and the public. It is CABRERA's policy to maintain minimal human and environmental exposure to known or suspected radioactive and/or hazardous material by following the guidance of standard operating procedures (SOPs), encompassing both administrative procedures (APs) and operating procedures (OPs) presented in CABRERA's NRC approved RSP. The purpose and philosophy of CABRERA's RSP is set forth in the CABRERA Radiation Safety Manual. CABRERA's RSP includes the following APs directly related to decommissioning activities: AP-001 Record Retention, AP-003 Radiological Conditions Awareness Reports, AP-004 Radiological Compliance Audits, AP-012 RWPs, AP-005 ALARA, AP-007 Bioassay, AP-008 Dosimetry Program, and AP-009 Radiological Training. The RSP also includes additional administrative and operational procedures that will be used by CABRERA management to guide the conduct of all relevant decommissioning activities. CABRERA's RSP procedures meet the requirements in 10 CFR Parts 10 and 20. Copies of procedures pertinent to decommissioning activities will be maintained onsite for reference and regulatory review. Deviations from procedures must have prior approval of the CABRERA RSO.

CABRERA will provide a workplace in which employees, visitors, and contractors are adequately protected from hazards, including the hazards associated with exposure to radiation and radioactive material. While the expected exposures associated with the planned decommissioning operations are low, all exposures are assumed to entail some risk to employees, visitors, and contractors. The ALARA requirement will be communicated to all subcontractors at the outset of this project. All individuals must understand their responsibilities to reduce their radiation exposure. Methods to be used to reduce exposure will be reviewed during initial site-specific training and tailgate meetings. Monitoring and surveillance information will be summarized and reviewed by the workforce on a planned and periodic basis.

A site-specific HASP has been developed to describe the practices to reduce employee exposure to potentially present radioactive materials and hazardous chemicals, as well as construction safety concerns. The HASP will remain in effect during all on-site decommissioning activities. CABRERA will maintain documentation sufficient to demonstrate the effectiveness of the health and safety program. The Health and Safety Officer (HSO), or designee, operating under the direction of the CABRERA RSO, and pursuant to the requirements of the license, will monitor on-site health and safety. As necessary, the RSO, or designee, will conduct tailgate safety training, implement the surveillance and individual monitoring programs, perform release surveys for personnel and equipment during decommissioning operations, and maintain all health and safety records generated during the decommissioning efforts.

8.1 Radiation Safety Controls and Monitoring for Workers

CABRERA's RSP shall be implemented to control exposure to ionizing radiation through approved SOPs. The SOPs reference and provide instructions to ensure compliance with applicable federal regulatory documents including 10 CFR Parts 19 and 20, and ensure that no occupational exposure limits set forth in 10 CFR Part 20 are exceeded. Radioactive materials and sources of radiation will be controlled in such a manner that radiation exposures to workers do not exceed limits specified in 10 CFR Part 20, Subpart C.

Radiation safety personnel assigned to the project will assess the effectiveness of posted warning signs during the conduct of these surveys. Surveys will be conducted using survey instrumentation and equipment suitable for the nature and range of hazards anticipated. Equipment and instrumentation will be calibrated, and where applicable, operationally tested prior to use in accordance with procedural requirements. Routine surveys will be conducted at a specified frequency to ensure that contamination and radiation levels in unrestricted areas do not exceed license, or federal, state, or site limits. The RSO or designee will also perform surveys during decommissioning whenever work activities create a potential to impact radiological conditions.

As required in 10 CFR 20.1502, the need for individual monitoring for internal and external exposures will be determined and documented prior to the start of work based on existing data. Potential exposures to personnel working at the site during decommissioning include direct contact (e.g., ingestion exposure pathway) and airborne dusts that may be contaminated (inhalation exposure pathway). Personnel will perform routine monitoring for radioactive contamination to minimize the spread of contamination and consequently the ingestion pathway.

Radiation monitoring (external and/or internal) shall be conducted continuously when it is likely that any individual will exceed 10 percent of the annual limit. If air samples detect the presence of radiation in excess of 10 percent of the derived air concentration (DAC), the RSO will evaluate the need for a bioassay program. Occupationally exposed workers who have received radiation exposure prior to employment with CABRERA are required to provide their radiation exposure history records or names and addresses of previous employers and locations where they have received exposures. Copies of this letter will be sent to the individual, and maintained in the individual's personnel radiological exposure file by CABRERA.

8.1.1 Workplace Air Sampling Program

CABRERA will perform radiological air sampling surveys and monitoring in accordance with CABRERA OP-002 Air Sampling and Analysis and OP-021 Alpha/Beta Counting Instrumentation, and in compliance with 10 CFR Parts 20.1204 and 20.1501(a)-(b). Air samples will be collected under known physical conditions (e.g., sample time, flow rate). The flow meters of CABRERA air samplers are calibrated prior to each mobilization and following repair and/or modification.

Both breathing zone and general area air samples will be collected from areas where there is the potential for generation of airborne radioactive material. Breathing zone air samples will be the primary method of monitoring the worker's intake of radioactive material and will be collected from the workers' breathing zones at work locations most expected to be known or suspected release points. General area air samples will also be collected from general and localized areas, especially concentrated on areas downwind from excavation and other areas with the greatest likelihood of the presence of airborne dust. Appropriate air sampling equipment will be selected. The type of sampling that is desired will determine the appropriate collection media required to collect the contaminant. The frequency at which air filters will be changed will be determined based on the radiological and physical condition of the work location, worker stay times, and the type of air sampling performed.

Air sampling will be performed prior to initiating construction activities in order to document background radioactive airborne particulate activities. Air sampling will be performed to monitor airborne particulate activity when excavation activities commence, routinely during decommissioning activities, and after any significant changes in operating conditions. Sampling durations will be determined prior to the commencement of sample collection based on required action levels, counting instrument sensitivities, and other conditions as warranted.

Following air sample collection, the filter media will be stored for at least 24 hours in order for short-lived radon progeny to be allowed to decay. Air samples will then be counted with sufficient time to achieve required minimum detectable concentration (MDC) goals for each specific radionuclide. Air sample analysis results will be compared with the DAC for radionuclides. Breathing zone air samples are collected using personal lapel (or equivalent) air samplers or grab samplers. If the breathing zone concentration exceeds 10% of DAC values, the RSO should be notified so appropriate actions can be taken and exposures received by workers evaluated and included in their personal exposure file.

If gross alpha activity significantly in excess of (i.e., three times greater than) background is identified, then the air samples will be shipped to an accredited offsite analytical laboratory for determination of the presence of thorium and uranium isotopes.

8.1.2 Respiratory Protection Program

It is CABRERA's policy to maintain personnel exposure to known or suspected airborne radioactive and/or hazardous material to ALARA with regulatory guidance. Respiratory protection shall be maintained by the application of practicable engineering controls such as process, containment, and ventilation equipment and the concurrent monitoring of airborne dusts. Maximum dust loading will be assumed for H-3 and other low-energy beta emitting radionuclides.

The management of CABRERA does not consider protection of workers from airborne radioactive materials through the use of respirators to be a routine operation, and for this reason their use, except for emergencies, is not expected during Vault decommissioning activities. Emergency conditions are unplanned events characterized by the need for rapid and aggressive actions to prevent or mitigate the effects of rapidly deteriorating conditions. The use of respirators during such is often a reasonable substitute for engineering controls that must be assumed to be nonfunctional or ineffective. There exists an extremely low probability of the occurrence of an emergency event of this nature during Vault decommissioning activities.

8.1.3 Internal and External Exposure Determination

Internal exposure determination will be determined through analysis of breathing zone air samples in compliance with CABRERA OP-002 Air Sampling and Analysis and, as necessary, bioassay results in compliance with CABRERA AP-007 Bioassay Program. The assessment of a workers' Committed Effective Dose Equivalent (CEDE) will be limited to less than 10% of the allowable limit on intake (ALI) as specified in Table I, Columns 1 and 2, of Appendix B of 10 CFR Part 20, providing the total effective dose to the individual is maintained ALARA. The

RSO will determine the validity of bioassay and air monitoring results prior to their inclusion in the internal dose assessment process.

External exposure will be routinely monitored through the use of microR, or equivalent meters to assess the level of external exposures to ionizing radiation. If it is determined that personnel may likely receive within one year, a dose in excess of 10% of the applicable limits from radiation sources external to the body, will be monitored by personnel dosimetry in compliance with CABRERA AP-008 Dosimetry Program. The personnel dosimetry devices will indicate the amount of ionizing radiation to which the wearer was exposed. The personnel dosimeter will normally be worn on the upper front torso. Personnel are responsible to wear dosimetry as directed by the RSO. If a personnel dosimeter is lost, misplaced, or indicates an off-scale reading, the employee is required to notify their supervisor, health physics and/or the RSO immediately.

All reasonable efforts will be made to keep ionizing radiation exposure to the unborn child to the lowest practical level, as prescribed in 10 CFR 20.1208. Once a female employee determines that she is pregnant, she is encouraged to notify CABRERA in writing of her pregnancy. CABRERA will then institute radiation control measures that will limit radiation exposure to the unborn fetus to less than 500 millirem (mrem) for the term of the pregnancy and below 50 mrem per month in any month after declaration.

8.1.4 Contamination Control Program

Radioactive material will be controlled as specified in the project HASP and in such a manner that the surface contamination does not exceed the levels specified in NRC guidelines for the decontamination of facilities and equipment prior to release for unrestricted use as presented in the NRC's Policy and Guidance Directive FC 83-23 (NRC 1983).

Routine surveys will be performed throughout the decommissioning process, with each survey being planned in advance with regard to the specific radiation type, the predetermined radiation levels, the location where radiation is expected, and any special condition warranting a survey. The initial level of protection for the intrusive tasks of this decommissioning operation (i.e., where residual radioactivity may be encountered) will be Level D modified PPE, including hard hats, Tyvek© coveralls, safety glasses with side shields, steel-toed boots, and gloves. Upgrading or downgrading the level of protection will be based on ambient conditions as work proceeds. The RSO will determine if it is necessary to upgrade to a higher level of protection.

To ensure that radioactive materials remain under the control of CABRERA, each worker involved in this decommissioning effort and working in a contaminated area will be frisked using calibrated, hand-held instruments prior to leaving the contaminated work area. Equipment and materials will be frisked and decontaminated, as necessary, prior to exiting the controlled area. Records of release surveys will be maintained on standardized forms and maps and will be placed in the decommissioning records. Release criteria will be consistent with those contained in the RSP. In the event that a sealed radioactive source is used at the site, the RSO will verify the conditions of the license, which regulates the use of the sealed source. This will include verifying the training of the operators and the frequency of wipe tests.

(A) Exposure Control:

Application of engineering, administrative, and personnel protection provisions will control personnel exposure to radioactive material. The priority of application will be descending with respect to their order of description below.

1. Engineering - Engineering controls will be used, as practicable, to minimize or prevent the presence of uncontained radioactive material. Engineering controls will predominantly be comprised of containment, isolation, ventilation, and decontamination.

2. Administrative - Administrative controls will be used to control work conditions and work practices. Administrative controls will predominantly be comprised of the following:

    - Access Control: Routine access to work areas will be limited to personnel necessary to accomplish tasks or activities. Access will also be controlled with respect to training and use of specified personnel protection equipment.

    - Postings and Barriers: Postings will be used to inform personnel of relevant hazards or conditions and associated access requirements. Barriers may be used to prevent unauthorized access.

    - Procedures: Written procedures may be used to describe specific radiation protection requirements necessary for tasks that involve radioactive material.

    - Radiation Work Permits: RWPs will be used to describe specific or special worker protection requirements for activities involving radioactive material and not covered by a procedure. RWPs may also be used in conjunction with a procedure.

    - Contamination Control: Action levels and limits for radiation surveys, described later in this section, will be used to control the levels of radioactivity on equipment and in areas.

3. Personal Protective Equipment - PPE will be used to control personnel exposure to radioactive material when administrative controls are not sufficient and engineering controls are not practicable. PPE may include head covering, eye protection, respiratory protection, impervious outerwear, gloves, and/or protective shoes or shoe covers.

(B) Radiation Surveys:

Radiation surveys will be performed to describe the radiation types and levels in an area or during a task, to identify or quantify radioactive material, and to evaluate potential and known radiological hazards.

The types of radiation surveys and their frequency are described in the following subsections.

1. Contamination Measurements - Measurements will be made of removable alpha, beta, and beta-gamma radiation, as applicable. The measurements will be made by wiping an

area with cloth, paper, or tape. The radiation levels will be measured on the wipe. Contamination surveys shall be performed at the end of each workday where invasive demolition of contaminated surfaces was performed.

2. Radiation - Exposure rate measurements will be performed using an ion chamber or equivalent. Measurements will be made at approximately 30 cm. Measurements may also be made at contact.
3. Personnel - Personnel will be frisked prior to leaving access-controlled areas.
4. Action Levels - Action levels are established to inform facility personnel when a situation needs to be evaluated so that corrective actions can be taken. Action levels are set so that corrective actions can be made before a regulatory limit is exceeded.

   Exceedance of action levels requires investigation including evaluation of preventative and/or corrective action. The investigation, and documentation of such, is completed commensurate with the significance of the condition.

8.1.5 Instrumentation Program

Instruments used for radiation detection and measurement will be operated in compliance with CABRERA RSP SOPs. SOPs contain instructions on the proper use of the instrument, as well as calibration instructions for those instruments, which are calibrated by a certified calibration facility. Radiation detection instruments are calibrated in manner and frequency as per license and manufacturer requirements and after each repair that would affect the accuracy of the instrument. Only personnel trained in accordance with CABRERA procedures will use radiation detection instruments. A calibration sticker shall be attached to the instrument to allow the operator to verify the instrument is within current calibration prior to use. Health physics instruments shall be visually inspected, battery checked, and source checked prior to use. Radiation survey equipment and instrumentation suitable for detecting and quantifying the radiological hazards to workers and the public will be present on-site throughout decommissioning activities. The selection of equipment and instrumentation to be utilized will be based upon knowledge of the radiological contaminants; concentrations, chemical forms, and chemical behaviors that are expected to exist as demonstrated during radiological characterization activities. Equipment and instrumentation selection will also take into account the working conditions, contamination levels, and source terms encountered during the performance of decommissioning work, as presented in this decommissioning plan. In all cases, the program will be consistent with the requirements set forth in the CABRERA RSP.

8.2 Nuclear Criticality Safety

The licensed radioactive materials identified at the Vault are not expected to meet the definition of Special Nuclear Material found in 10 CFR 70.4. The radioactive materials in the ratios that are currently known to exist at the Vault will not trigger or sustain a critical reaction and therefore nuclear criticality safety measures will not be necessary.

8.3 Health Physics Audits and Recordkeeping Program

The RSP shall be subject to an annual audit and periodic inspections. Each are performed to

determine if radiological operations are being conducted in accordance with regulations, license conditions, and written procedures.

An audit of the program shall be conducted annually. The audit shall be conducted by the RSO or designee, but shall not be a member of the contractor organization. The audit will consider the basic functional areas of the program; e.g. RWPs, Radiation Protection Procedures, radiological surveys and air monitoring, ALARA program, individual and area monitoring results, access controls, respiratory protection program, and training.

The audit shall be conducted in accordance with a specific audit plan developed by the auditor. A written report describing the results shall be generated upon completion of the audit. The report shall be distributed to site management. As necessary, a written corrective action plan shall be prepared to address non-compliance issues. All corrective actions shall be tracked to completion. Once corrective actions have been completed, a written closure report shall be distributed to management documenting the completion of corrective actions.

The Health and Safety staff shall conduct the periodic inspections. These inspections shall be routine reviews performed of operations and activities. The inspections shall normally be completed against a pre-established checklist. Checklists may be developed independently for differing periods; e.g. daily, weekly, monthly, etc. The checklist items shall usually be comprised of routine procedural requirements. Any findings discovered during the routine inspection shall be recorded on a tracking log. The log shall be maintained by the RSO. The log shall include a description of planned corrective action and date of completion of corrective action.

8.3.1 Personnel Records

A personnel file is maintained for each employee assigned work duties involving radioactive materials. The content of these files include:

- A record of radiation exposure received by the individual during previous employment is maintained by requesting personal exposure information from previous employers where the individual worked with radioactive materials.
- A record of personnel dosimeter measurements is recorded in the personnel file to provide a permanent record of radiation exposure received during the course of CABRERA work assignments.
- If a personal dosimeter is lost or damaged, an exposure investigation will be performed and an exposure will be assigned for the monitoring period. A report detailing the exposure estimate will be included in the personnel record.
- If the air concentration in the work area exceeds 10% of DAC values, air samples and bioassay samples will be used to estimate internal exposures received by the worker and included into their personal exposure file.
- If a worker finds contamination on their person above the limits specified in Table I, a report of the incident will be placed in the personnel file to determine exposure from the incident.
- The personnel records will be maintained indefinitely and personnel may review their file or request copies of information within their files. The licensee for which work is

performed will be provided individual exposure information as required by their license or applicable regulations.

8.3.2 Radiation and Contamination Records

Radiation and contamination survey records collected during site surveys, remediation/decontamination activities, and radiological characterization activities are stored in site-specific files at the East Hartford office. Duplicate copies of the records are also supplied to the licensee where the work was performed.

8.3.3 Records of Waste Disposal

Radiation Survey Records, contamination survey records, shipping manifests, and certifications generated for a licensee's shipment of radioactive materials to a licensed disposal site shall be stored in specific shipment files in the East Hartford office. Duplicate copies of the records are supplied to the licensee for the work performed.

9.0 ENVIRONMENTAL MONITORING PROGRAM

CABRERA management and personnel are committed to maintaining exposure of ionizing radiation to workers, the public, and to the environment at ALARA levels and will strive to conduct decommissioning activities in a manner that supports this commitment. CABRERA will ensure the minimization of the impact of ionizing radiation to human health and the environment through the use of CABRERA's NRC approved RSP SOPs. CABRERA will also ensure that environmental monitoring and control activities performed during decommissioning activities will comply with 10 CFR Part 20 regulatory requirements.

9.1 Effluent Monitoring Program

Concentrations of radionuclides in site effluents are not expected to change as a result of decommissioning activities. This is justified by the results presented in the characterization survey report of the Vault area attached as Appendix B.

The primary routes of contaminant transport during the on-site decommissioning activities are anticipated to be airborne dust from the excavation of the site, handling of the waste, covering operations, and from the movement of vehicles and equipment. Area air samples will be collected in locations that present the possibility of airborne effluent releases. In addition, samplers will be positioned downwind of work locations to ensure that the samples collected within the immediate work area are representative of actual releases. The positions of the air samplers will be evaluated frequently by the RSO to take into account any shifts in prevailing wind direction and any movement in the locations of dust-generating operations. Air samples will be collected as described in CABRERA OP-002 Air Sampling and Analysis and as described in Section 8.1.1. Worker lapel and general area air monitoring will be performed daily following CABRERA SOPs and air samples will be analyzed in order to estimate inhalation dose to the public and workers by airborne radioactive material. Consideration will be given to more frequent filter change-outs during high dust conditions, as determined using best professional judgment. Air samples will be analyzed onsite for gross alpha and gross beta emitters and sent to an accredited offsite laboratory to be analyzed for low-energy beta emitters. Releases will be maintained ALARA and below the limits in Table 2 of Appendix B to 10 CFR Part 20. Dust monitoring will be performed along with air sampling to provide immediate results for the airborne activity of low-energy beta emitters through the assumption of maximum dust loading.

Background samples will also be collected prior to the commencement of site activities in order to establish baseline background radionuclide concentrations.

Significant amounts of liquid effluents are not expected to be encountered or generated during decommissioning activities.

9.2 Effluent Control Program

Based on the results of the characterization survey, decommissioning activities are not expected to generate significant levels of airborne particulate contamination. If significant dust is generated during decommissioning activities, controls will be implemented to moisten excavation areas as necessary in order to reduce the potential for generating airborne

contamination. Any soil or similar material that is staged in piles, containers, or vehicles will be covered as practical to prevent dispersion by wind and precipitation.

If radiological air monitoring results indicate the presence of airborne contaminants exceeding project action levels, then work will be stopped, proper personnel including the RSO will be informed, corrective measures will be implemented, and dose evaluations performed, as necessary.

Significant amounts of liquid effluents are not expected to be encountered or generated during decommissioning activities. If potentially contaminated liquid effluents are encountered, CABRERA will control runoff through the use of berms, silt fencing, absorbent materials, solidifying agents, or by other means as necessary.

CABRERA will control the spread of potentially contaminated soil and silt materials through the use of silt fencing and berms, as necessary.

10.0 RADIOACTIVE WASTE MANAGEMENT PROGRAM

10.1 Solid Radioactive Waste

Materials requiring disposal will include reinforced concrete, clay piping, miscellaneous demolition debris, and soil. The estimated volume of material requiring disposal is 2,916 ft^3 (1,796 ft^3 of building debris and 1,120 ft^3 of soil).

Debris will be sized to less than 10 inches to meet the Envirocare of Utah LLRW acceptance criteria. Due to the physical constraints of the neighboring building and parking area, intermodal containers will be temporarily staged at Ft. Belvoir at a location away from the demolition site. Debris will be staged at the site, then placed into a yard truck and transported to the intermodal container staging area. Contamination containment devices such as intermodal liners and tarps in conjunction with good health physics practice will be used to control loose contaminated soil and solid radioactive waste from becoming disbursed after excavation and loading. CABRERA OP-014 Contamination Containment Devices will provide guidance to those workers performing these tasks.

LLRW meeting the proper acceptance criteria will be transferred to Envirocare of Utah for disposal. Non-hazardous waste will be shipped to a properly licensed industrial landfill facility.

Decommissioning activities are planned that may include the generation of mixed waste and subsequent need for treatment prior to disposal.

10.2 Liquid Radioactive Waste

No surface water exists within the Vault site and the licensee expects that no groundwater will be encountered during demolition and excavation activities. Steps will be taken during the excavation of the site (e.g. covering the excavated areas with tarps to keep rain water from collecting). Accordingly, no decommissioning activities are planned that include the dewatering, storage or handling of liquid waste.

11.0 QUALITY ASSURANCE PROGRAM

Activities associated with this work plan shall be performed in accordance with written procedures and/or protocols in order to ensure consistent, repeatable results. Topics covered in project procedures and protocols may include proper use of instrumentation, Quality Control (QC) requirements, equipment limitation, etc. Implementation of Quality Assurance (QA) measures for this characterization plan are described herein.

11.1 Organization

Only qualified and trained personnel will operate the equipment and instrumentation used in the field activities specified in this decommissioning plan. Personnel will be trained in the technical, quality control, and health and safety aspects of the project, as well as in the calibration, maintenance, and OPs for their assigned equipment.

Daily tailgate safety meetings will provide supplemental training and ensure that personnel are given clear direction and the proper tools for performing their respective tasks. These meetings will also provide a forum for the field personnel to relate any potential safety or quality concerns that may require attention from the CABRERA RSO or PM. Tailgate meeting notes and attendance sheets will be maintained onsite and included in the project file.

Persons responsible for ensuring that the QA Program has been established and for verifying that activities affecting quality are being correctly performed will have sufficient authority, access to work areas, and organizational freedom to accomplish the following:

- Identify quality concerns
- Ensure that further decommissioning activities are controlled until proper resolution of a non-conformance or deficiency has occurred
- Initiate, recommend, or provide solutions to quality problems through designated channels
- Verify implementation of solutions

The Project Engineer will serve as QA Officer for the project and will have direct access to responsible management at a level at which appropriate corrective actions can be implemented, as necessary. Therefore, the onsite quality control representative will report to the CABRERA PM, or designee, to ensure that required authority and organizational freedom are provided. The quality control representative may authorize others to implement specific elements of the QA Program.

11.2 Document Control

Data will be recorded and documented in a data management system. The radiation survey maps will designate the location being surveyed, as well as the name of the surveyor. To the extent practical, state plane coordinates will be used to define the location of a soil sample. If not available, site-specific references will be used to locate a sample. Data management personnel

will ensure that chain-of-custody (COC) and data management procedures are followed for samples related to the FSS. Procedures to properly handle, ship, and store samples after they are collected will follow established protocols.

Both direct radiation measurements and analytical results will be documented. The results-for each survey measurement and/or each sample will be listed in tabular form along with the corresponding grid block location or coordinate. Radiation survey data will be recorded in a verifiable manner and reviewed for accuracy and consistency. Each of the major phases of the decommissioning process will be documented in a manner that is suitable for audits or assessments.

Changes to the Decommissioning Plan and the proposed QAPP will be submitted to the NRC for review and approval before they are implemented. The records discussed in the preceding paragraphs will be maintained until the license termination.

11.3 Control of Measuring and Test Equipment

The CABRERA Project Engineer, or designee, is responsible for determining the instrumentation required to complete the requirements of this work plan. Only instrumentation approved by the CABRERA Project HP will be used to collect radiological data. The CABRERA Project HP is responsible for ensuring individuals are appropriately trained to use project instrumentation and other equipment, and that instrumentation meets the required detection sensitivities. Instrumentation shall be operated in accordance with either a written procedure or manufacturers' manual, as determined by the CABRERA Project HP. The procedure and/or manual will provide guidance to field personnel on the proper use and limitations of the instrument.

Instruments used during the characterization survey will have current calibration and maintenance records kept on site for review and inspection. The records will include, at a minimum, the following:

- Name of the equipment
- Equipment identification (model and serial number)
- Manufacturer
- Date of calibration
- Calibration due date

Instrumentation shall be maintained and calibrated to manufacturers' specifications to ensure that required traceability, sensitivity, accuracy and precision of the equipment/instruments are maintained. Instruments will be under current calibration, from a facility possessing appropriate NRC and/or Agreement State licenses for performing calibrations using National Institute of Standards and Technology (NIST) traceable sources.

Prior to daily use, project instrumentation will be QC checked by comparing instrument response to a benchmark response. Prior to the commencement of field operations, site reference locations shall be selected for performance of these checks; subsequent QC checks will be performed at these locations. QC source checks will consist of a one-minute integrated count, or other count time designated by the CABRERA Project HP, or designee, with the designated source positioned in a reproducible geometry, performed at the reference location. Prior to the start of initial surveys, this procedure will be repeated at least ten times to establish average instrument response. Equipment should also be inspected for physical damage, current calibration and erroneous readings in accordance with applicable procedures and/or protocols. Instrumentation that does not meet the specified requirements of calibration, inspection, or response check will be removed from operation.

11.4 Corrective Action

The QA Officer has overall responsibility for reporting all procedure and contract violations found. The RSO will determine if the deficiency requires work to be stopped or if notification is required to the NRC.

A deficiency or nonconforming condition is documented on a Corrective Action Request (CAR) Form. The form is completed by the individual who reported the nonconformance and submitted to the QA Officer who will review the CAR for completeness. The completed form will provide a detailed description of the nonconforming condition and reference the affected documents that apply.

The QA Officer will review the response and verify that the actions address the original concern and provide effective preventive actions. If satisfactory, the QA Officer will accept the response and close the CAR. The person writing the CAR will sign the document. The QA Officer will review the form and maintain a log of all CARs, indicting the current status of the CAR. After corrective action has been completed and verified by the QA Officer, the closed CAR (original) will be filed. If needed, a new CAR will be issued to address additional required corrective action.

11.5 Quality Assurance Records

QA records will be monitored by CABRERA. Data reduction, QC review, and reporting will be the responsibility of the analytical laboratory. Data reduction includes all automated and manual processes for reducing or organizing raw data generated by the laboratory. The laboratory will provide a data package for each set of analyses that will include a copy of the raw data in electronic format, and any other information needed to check and recalculate the analytical results. Once a data package is received from the laboratory, the analytical results and pertinent

QC data will be entered into a computer database. The data packages will serve as basic reference sheets for data validation, as well as for project data use.

The generation, handling, computations, evaluation, and reporting of final radiological survey data will be as specified in CABRERA procedures. Included in these procedures will be a system for data review and validation to ensure consistency, thoroughness, and acceptability of the data. Some data points will be chosen for evaluation will be examined to determine compliance with QA requirements and other factors that determine the quality of the data. Any rejected sample data or data omissions identified during the data validation will be evaluated to determine their impact on the project. Other corrective action may include resampling and reanalyzing, evaluating and amending sampling and analytical procedures, and accepting data acknowledging the level of uncertainty.

One of the most important aspects of sample management is to ensure that the integrity of the sample is maintained, that is, that there is an accurate record of sample collection, transport, analysis, and disposal. This ensures that samples are neither lost nor tampered with, and that the sample analyzed in the laboratory is actually and verifiably the sample taken from a specific location in the field. The individual(s) responsible for sample collection will initiate a COC record using a standard form provided by CABRERA. A copy of this form will accompany the samples throughout transportation and analyses; and any breach in custody or evidence of tampering will be documented.

11.6 Audits and Surveillance

Periodic audits will be performed by the Decommissioning PM, the RSO, the HSO, and/or persons so designated to verify that decommissioning activities comply with established procedures and other aspects of the QAPP (such as scope, status, adequacy, and compliance) and to evaluate the overall effectiveness of the QA Program. CABRERA and the QA Officer will verify that qualified personnel are employed to conduct audits to ensure that the applicable procedures are being properly implemented. The audits will be conducted on at least a quarterly basis, in accordance with written guidelines or checklists. Health and safety personnel will also conduct semiannual audits in their area of concern. External program audits may also be used at the discretion of CABRERA.

Audit results will be reported to CABRERA in writing, and actions to resolve identified deficiencies will be tracked and appropriately documented. The audit information will become part of the decommissioning record for the site.

12.0 FACILITY RADIATION SURVEY

A Characterization Survey has been performed previously to quantify ROC activities for the Vault areas. Characterization survey results are briefly summarized in Section 12.1 below. Refer to the full Characterization Survey Report (Appendix B) for additional detail.

Final Status Surveys, designed in accordance with MARSSIM guidance and applicable Federal and Virginia regulations and guidance, will be performed to support the release of the Vault for unrestricted use. A background reference area will be established in a non-impacted area.

12.1 Characterization Survey

CABRERA designed and performed a characterization survey of the Vault and areas outside of the Vault in the first half of 2003. Results of the characterization survey radiological analyses indicated the presence of potentially elevated tritium, Carbon-14, Cesium-137, Promethium-147, Americium-241, and Thorium-232. Elevated levels of radioactivity were detected at the interior Vault floor, at wall storage vaults, at floor storage vaults, and the soil beneath floor storage vaults. The highest contamination exceedance of action levels encompasses Cs-137 on the Vault floor and in the soil under the floor storage vaults and also H-3 inside the wall storage vaults. Contamination exceeding action levels outside the Vault is minimal and is concentrated on the north wall and floor just outside the Vault doorway.

12.2 In-Process Surveys

Radiological support surveys will be performed during the excavation to provide information related to the residual radioactivity remaining in the excavation area and in drainage systems.

12.3 Final Status Survey and Release Criteria

The design for the FSS and establishment of radiological release criteria are presented in the Final Status Survey Plan, presented as Appendix D.

13.0 FINANCIAL ASSURANCE

Financial assurance and funding of activities performed in support of the decommissioning and radiological release of the Vault is provided through the U.S. Government, specifically through the U.S. Army.

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Decommissioning Plan

Figures

CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	**Fort Belvoir** **Fort Belvoir County Location**	Date: 3-18-04 Project #: 01-3030-43 File Name: Prepared By: JTM	**Figure 3-1**

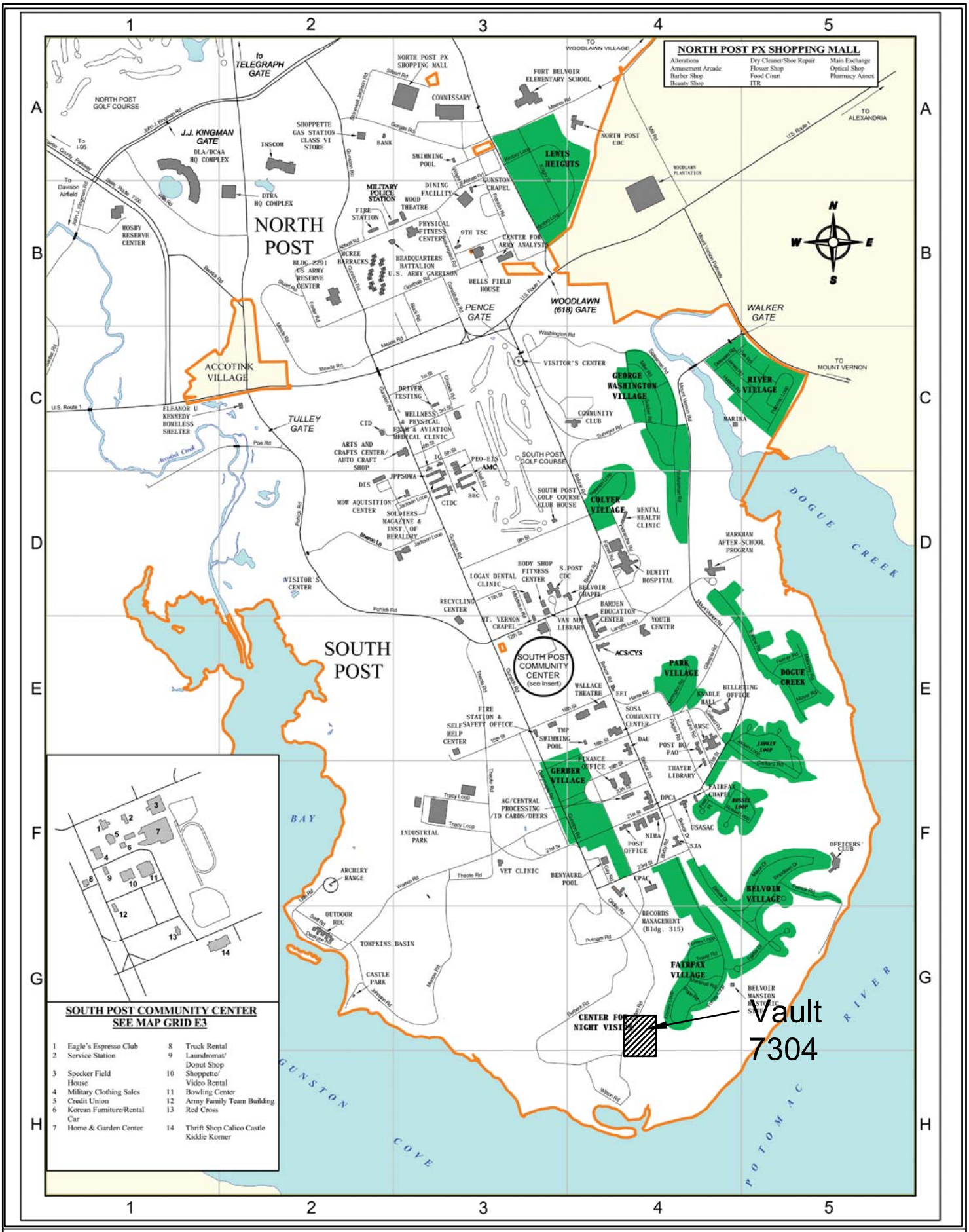
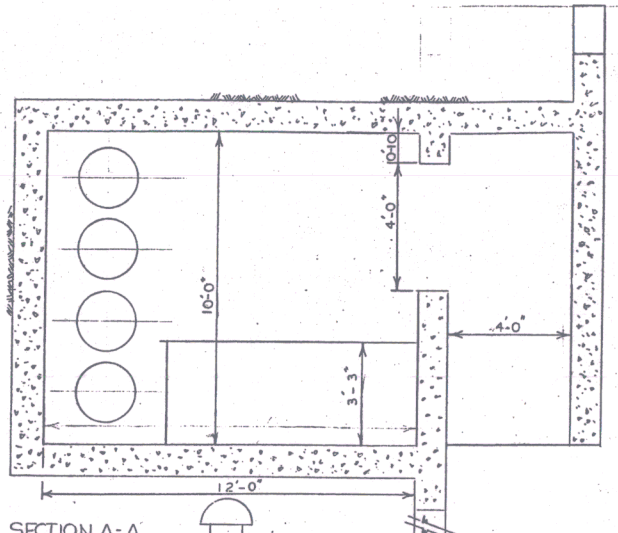


Figure: 3-2	Vault 7304 Site Specific Location	CABRERA SERVICES RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION WWW.CABRERASERVICES.COM	2/9/2004 Scale:	

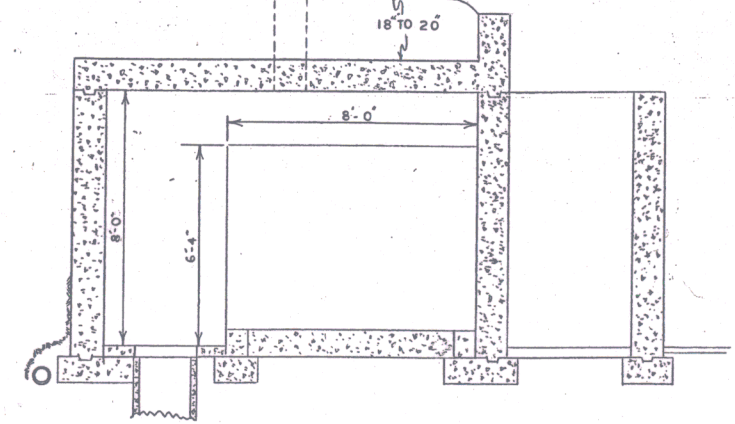
Decommissioning Plan

Attachments

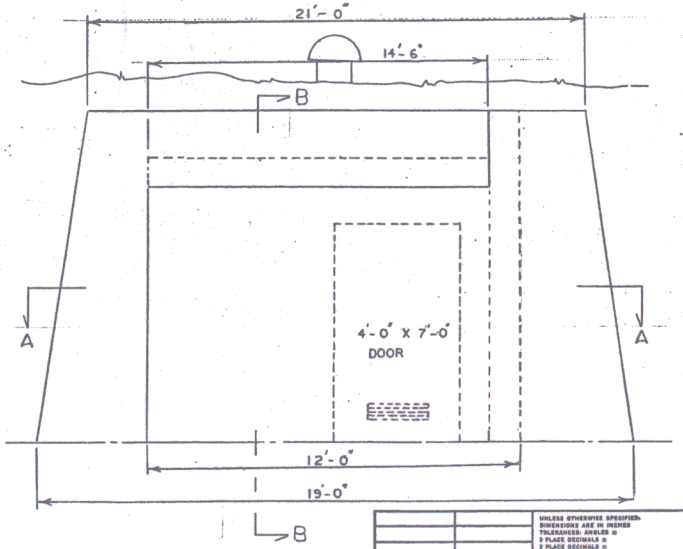
Building 7304 Diagrams



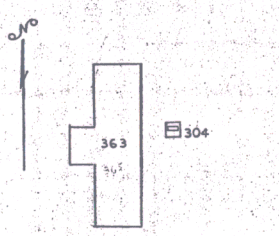
SECTION A-A



SECTION B-B



BUNKER
SCALE 1/2" = 1'-0"



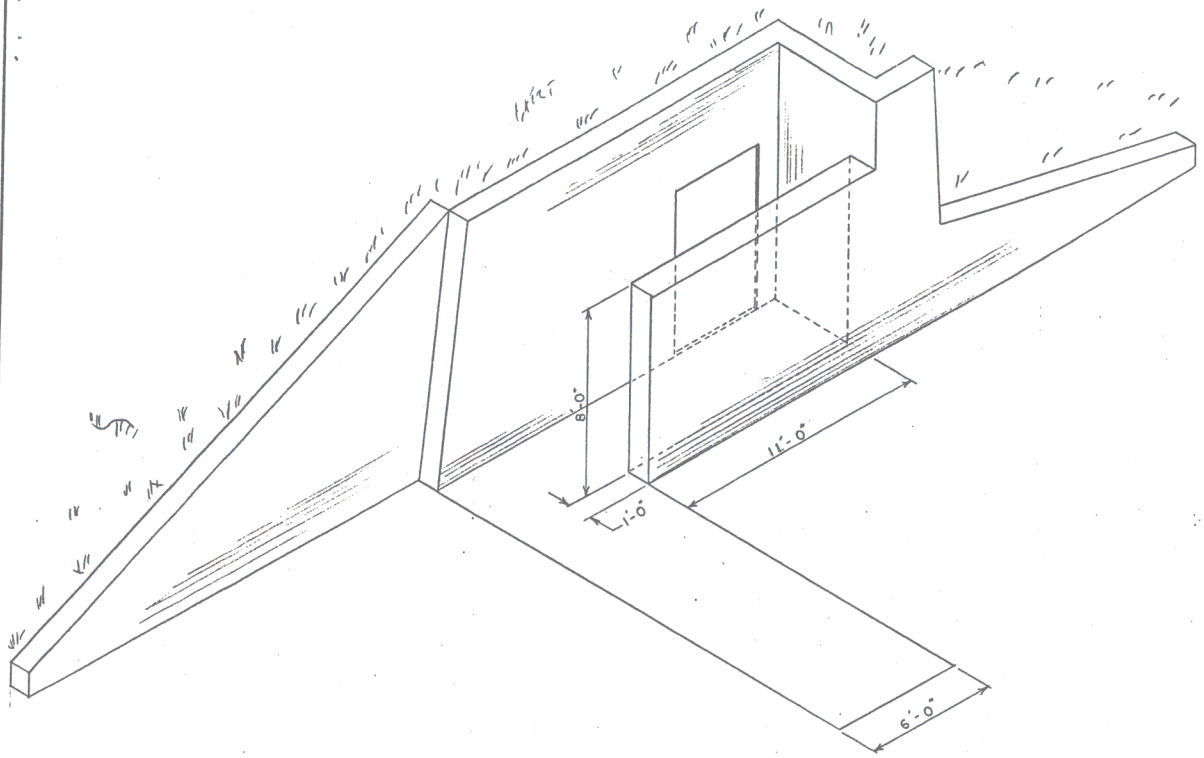
LOCATION OF STRUCTURE
IN MERDC

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 2 PLACE DECIMALS ± 3 PLACE DECIMALS ±	DRAWN C. J. S.	DATE	U.S. ARMY MOBILITY COMMAND MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER FORT BELVOIR, VIRGINIA 22060
DO NOT SCALE THIS DRAWING	CHECKED		BUNKER — BUILDING 304
REMOVE BURRS AND BREAK SHARP EDGES	DESIGN APPROVAL		
SHARP EDGES TO	COMMODITY ENGINEER		
FILLET RADII TO	APPROVED FOR PRODUCTION		
MATERIAL	CHIEF, PRODUCTION ENGINEERING		SIZE D · CODE IDENT NO. 97403 · 35-06-448
NEXT ASSY USED ON	RELEASED FOR PROCUREMENT		
APPLICATION	CHIEF, ENGINEERING DEPT.		SCALE · SHEET 1-4
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE MSAS 1143	DATE		

8 | 7 | 6 | 5 | 4 | 3 | 2 | 1

D C B A

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE



EXISTING STRUCTURE

BUNKER OF CONCRETE & EARTHEN CONSTRUCTED

FIND NO.	CODE IDENT.	DWG SIZE	PART OR IDENTIFYING NO.	QTY. REQD.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATER

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 2 PLACE DECIMALS ± 3 PLACE DECIMALS ±

DO NOT SCALE THIS DRAWING

REMOVE BURRS AND BREAK SHARP EDGES

SHARP EDGES TO

FILLET RADII TO

MATERIAL

NEXT ASSY | USED ON

APPLICATION

DRAWN C J S DATE

CHECKED

DESIGN APPROVAL

COMMODITY ENGINEER

APPROVED FOR PRODUCTION

CHIEF, PRODUCTION ENGINEERING

RELEASED FOR PRODUCTION

CHIEF, ENGINEERING DEPT.

U.S. ARMY MOBILITY COMMAND
MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER
FORT BELVOIR, VIRGINIA 22060

BUNKER BUILDING 304

SIZE	CODE IDENT NO.	
D	97403	35 - 06 - 48