

**NRC LICENSE TERMINATION REPORT  
SENECA ARMY DEPOT ACTIVITY  
ROMULUS, NEW YORK**

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## **REFERENCES**

10 CFR 835. Department of Energy: Occupational Radiation Protection.

Argonne National Laboratory, 2003. Seneca Army Depot Activity License Termination and License Release Plan, January 2003.

Argonne National Laboratory, 2001. Assessment of the Contamination Status of the E0800 Row Storage Bunkers at the SEAD, November 2001.

BEIR, 1988. BEIR IV, *Health Risks of Radon and Other Internally Deposited Alpha-Emitters*, National Academy of Science, National Research Council, Committee on the Biological Effects of Ionizing Radiation, National Academy Press.

Crouthamel, 1960. *Applied Gamma-Ray Spectrometry*, Pergamon Press, New York.

Ford, Bacon & Davis Utah, Inc., 1981. Preliminary Engineering and Environmental Evaluation of the Remedial Action Alternatives for the Seneca Army Depot Site, Romulus, New York, FUSRAP, Final Report, FBDU 409-315, prepared for Bechtel National, Inc, November, 1981.

NCRP, 1987. *Exposure of the Population in the United States and Canada from Natural Radiation*, NCRP Report 94, National Council on Radiation Protection and Measurements, Bethesda, Maryland.

New York State Department of Health (NYSDOH), 1993. Interoffice Memorandum for Gary Baker, Principal Radiological Health Specialist, Bureau of Environmental Radiation Protection (BERP), to William Condon, Chief, Environmental Radiation Section, BERP, September 1993.

NRC, 1987. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material.

NRC, 1992. Residual Radioactive Contamination From Decommissioning, Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent. Final Report, NUREG/CR-5512, PNL-7994, Vol. 1.

NRC, 1998. Draft Regulatory Guide. Demonstrating Compliance with the Radiological Criteria for License Termination. Residual Radioactive Contamination from Decommissioning, DG-4006, August 1998.

NRC, 2000. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, September, 2000.

### **REFERENCES (continued)**

- Parsons, 2003. E0800 Row Pitchblende Ore Storage Igloos (SEAD-48) Workplan- Final, Revision 1, Seneca Army Depot Activity, March 2003.
- Parsons, 2002. Remedial Investigation at SEAD 12, Seneca Army Depot Activity, Final, August.
- Parsons, 2003. Radiological Survey Report - SEAD-12, Phase I and Phase II Surveys, Final, March.
- Parsons, 1995. Generic Installation RI/FS Work Plan, June 1995.
- Parsons, 1995. Project Scoping Plan for Performing a CERCLA Remedial Investigation/Feasibility Study (RI/FS) at the Pitchblende Storage Igloos, Seneca Army Depot Activity, August 1995.
- Parsons, 1998. Project Scoping Plan for Building 804 and Associated Radioactive Waste Burial Sites (SEAD-12), June 1998.
- Seneca Army Depot (SEDA), 1985. Proposed Action: Pitchblende Residues Remedial Action Project.
- StatSoft, 2001. Statistica, Version 6.0.
- U.S. Army, 1985. Preparation for Health Physics Support to Seneca Army Depot (SEAD) for the Cleanup of Radioactive Contaminated Real Estate, by Ramachandra K. Bhat, Radiation Research Group, Belvoir R&D Center, Fort Belvoir, VA, June 1985.
- U.S. Army, 1985. Radiation Protection Study No. 28-43-0025-86, Closeout Survey of Bunkers EO801- EO811, Seneca Army Depot, Romulous, New York, 29-31 July 1985, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, December, 1985.
- U.S. Army, 1986. Radiological Survey of Seneca Army Depot, J.A. Morrissey, C. Crisco and J.C. Maloney, authors, U.S. Army Ballistic Research Laboratory, Special Publication BRL-SP-51, Aberdeen Proving Ground, MD, January, 1986.
- U.S. EPA, 1993c. A Manual for Implementing Residual Radioactive Material Guidelines, Using RESRAD. Version 5.0.
- U.S. DOE, 1979. Formerly Utilized MED/AEC Sites Remedial Action Program, Radiological Survey of the Seneca Army Depot, Romulous, New York, DOE/EV-0005/11, Final Report, February 1979.

### **REFERENCES (continued)**

U.S. NRC, 1988. Inspection Report No. 040-08526/87-002, Closeout Inspection on October 29, 1987, License No. SUC-1275, U.S. Department of the Army, Seneca Army Depot, NRC, Region I, King of Prussia, PA, May 1088.

WHO, 2001. Depleted Uranium: Sources, Exposure, and Health Effects, WHO/SDE/PHE/01.1, Department of Protection of the Human Environment, World Health Organization, April.

## **LIST OF ACRONYMS**

Ac	Actinium
AEC	Atomic Energy Commission
AEHA	Army Environmental Hygiene Agency
ALARA	As Low As Reasonably Achievable
AMC	U. S. Army Material Command
ANL	Argonne National Laboratory
ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
Bi	Bismuth
BRAC	Base Realignment and Closure
BRDC	U. S. Army Belvoir Research & Development Center
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Ci	Curie
cm	Centimeters
cm/sec	Centimeters per second
cpm	counts per minute
DCGL	Derived Concentration Guideline Level
DCGL <sub>w</sub>	Derived Concentration Guideline Level- wide area
DCGL <sub>EMC</sub>	Derived Concentration Guideline Level- elevated measurement comparison
DOA	Department of the Army
DOD	Department of Defense
DOE	Department of Energy
dpm	Disintegrations Per Minute
DQO	Data Quality Objective
ELAP	Environmental Laboratory Approval Program
EMC	Elevated Measurement Comparison
EPA	U. S. Environmental Protection Agency
ESI	Expanded Site Inspections
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FB&DU	Ford Bacon & Davis Utah
FSS	Final Status Survey
ft	Feet
ft/sec	Feet per second
g	Gram

GEL	General Engineering Laboratories, Inc.
HASP	Health and Safety Plan
HAZWOPPER	Hazardous Waste Operations and Emergency Response
HP	Health Physicist
HSA	Historic Site Assessment
IAG	Interagency Agreement
keV	kiloelectron volt
L	Liter
LCS	Laboratory Controlled Sample
LTP	License Termination Plan
m	Meter
MARSSIM	Multi-Agency Radiological Survey and Site Investigation Manual
MCA	Multi Channel Analyzer
MDA	Minimum Detection Amount
MDC	Minimum Detectable Concentration
mg/l	Milligram per liter
mg/kg	Milligrams per kilogram
mL	Milliliter
mrem	milli-Roentgen equivalent man
mR	Milli-Roentgen
MSL	Mean Sea level
MW	Monitoring Well
NA	Not analyzed or not available
NaI	Sodium Iodide
No.	Number
NIST	National Institute of Standards and Technology
NCRP	National Council on Radiation Protection and Measurements
NPL	National Priority List
NRC	Nuclear Regulatory Commission
NUREG/CR	Stands for a series of NRC formal reports
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDEL	New York State Department of Labor
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
Pa	Protactinium
Pb	Lead

PCi	pico Curies
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
R&D	Research and Development
Ra	Radium
RADCON	Radiation Control
Rn	Radon
ROC	Radionuclide of Concern
RSA	Radiation Safety Associates, Inc.
RSO	Radiation Safety Officer
SEDA	Seneca Army Depot Activity
SEAD	Seneca Army Depot Activity
SOP	Standard Operating Procedure
TAGM	New York State Technical and Administrative Guidance Memorandum
TEDE	Total Effective Dose Equivalent
Th	Thorium
TLD	Thermoluminescent Dosimeter
U	Uranium
uR	Micro Roentgen
uRem	micro- Roentgen Equivalent Man
URSA	Universal Radiation Spectrum Analyzer
USACOE	United States Army Core of Engineers
USAMC	United States Army Material Command
USEPA	United States Environmental Protection Agency
WRS	Wilcoxon Rank Sum

## 1.0 INTRODUCTION

### 1.1 PURPOSE OF REPORT

Parsons is pleased to submit this License Termination Report in support of terminating Nuclear Regulatory Commission (NRC) licenses and permits held by the Seneca Army Depot Activity (SEDA) in Romulus, New York. This work was performed in accordance with the Scope of Work (SOW) for Delivery Order 31 to the Parsons contract DACA87-95-D-0031.

The work completed for this License Termination Report has been performed following the requirements set forth in the *Seneca Army Depot Activity License Termination and License Release Plan* (LTP; Argonne National Laboratory [ANL], 2003; reprinted as **Appendix 1.A**), which was approved by the NRC in a letter dated June 11, 2003 (**Appendix 1.B**).

Final status surveys were performed in accordance with the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM; NRC, 2000) and other applicable guidance to meet the license termination requirements for NRC license SUC-1275 (NRC Docket No. 040-08526; documentation in **Appendix 1.B**) and to remove SEDA from the following licenses:

- a) License SUC-1380;
- b) License 45-16023-01NA;
- c) License SUB-834;
- d) License BML 12-00722-07; and
- e) License STC-133.

Descriptions of these licenses are provided in **Section 1.4** of this report.

### 1.2 REPORT ORGANIZATION

A description and history of SEDA and a summary of the history of NRC licensed activities are presented in the remainder of **Section 1.0** of this report. **Section 2.0** presents the release criteria and a description of the process used to determine compliance with the release criteria. **Sections 3.0** through **6.0** present the discussions of each of the areas under the NRC licenses listed above. **Section 7.0** presents the discussion of areas where radiological activities unrelated to licensed commodities were performed at SEDA. The conclusions of this report and the recommendation for the license termination are presented in **Section 8.0**.

### 1.3 SITE DESCRIPTION

SEDA is located about 40 miles south of Lake Ontario, near Romulus, Seneca County, New York (**Figure 1-1**). Seneca County is located in the center of the state, in the Finger Lakes Region. The facility is located in an uplands area, at an elevation of approximately 600 feet above mean sea level (MSL) that forms a divide separating two of the Finger Lakes, with Cayuga Lake on the east and Seneca Lake on the west. New York State Highways 96 and 96A adjoin SEDA on the east and west boundaries, respectively. The surrounding area is sparsely-populated farmland.



The 10,587-acre SEDA facility was constructed in 1941 and has been owned by the U.S. government and operated by the Department of the Army (DOA) since that date. From its inception in 1941 until 1995, SEDA's primary mission was the receipt, storage, maintenance, and supply of military items, including munitions and equipment. The Depot's mission changed in 1995 when the Department of Defense (DOD) recommended closure of the SEDA under the Base Realignment and Closure (BRAC) process.

SEDA is currently in the process of completing the process to close the base and transfer the property. In accordance with the requirements of the BRAC process, the Seneca County Board of Supervisors established the Seneca Army Depot Local Redevelopment Authority (LRA) in October 1995. The primary responsibility assigned to the LRA was to plan and oversee the redevelopment of the Depot. The Reuse Plan and Implementation Strategy for Seneca Army Depot was adopted by the LRA and approved by the Seneca County Board of Supervisors on October 22, 1996. Under this plan and subsequent amendment, areas within the Depot were classified as to their most likely future use. These areas included: housing, institutional, industrial, an area for the existing navigational LORAN transmitter, recreational/conservation and an area designated for a prison. The future land use plan and the location of areas discussed in this license termination plan are presented in **Figure 1-2**. In September 2003, 7325 acres of land were transferred to the Seneca County Industrial Development Agency for use as conservation/recreation areas. There are plans to transfer an additional 1000 acres of land within the Planned Industrial/Warehouse Area by the end of 2004.

#### **1.4 HISTORY OF LICENSED ACTIVITIES**

As indicated in **Section 1.1**, there are a total of six NRC licenses or permits held by or listing SEDA that are included in this license termination effort. Below is a description of each.

*License SUC-1275:* SUC-1275 is held by SEDA (NRC Docket No. 040-08526) for the possession and storage of depleted uranium (DU) commodities. According to Army records, the facilities at SEDA that conducted activities under this license included 120 storage igloos, Building 5, Building 306, Building 2073, Building S-2084, and Building 612. After NRC approval of the LTP (ANL, 2003), license SUC-1275 was amended to allow for decommissioning activities only. Available documentation for SUC-1275 is reprinted in **Appendix 1.B**.

The 120 storage igloos were used for the storage of packaged DU ammunition. During storage operations at these igloos, radiation surveys were regularly conducted in accordance with the license, according to the Army. There were no elevated levels of radioactivity detected in these surveys. In September 1999, the last of the DU ammunition stored in these igloos was shipped offsite. Parsons conducted surveys of these igloos in 2002 as described in **Section 3**.

Buildings 5, 306, 2074, and S-2083 were used as staging points to prepare DU ammunition for shipment. Parsons conducted radiological surveys of these buildings in 2002 as described in **Section 4**. These buildings are located within the secured ammunition area at SEDA and are not currently in use.

DU ammunition was unpackaged, inspected, and repackaged at Building 612. Under license SUC-1275, demilitarization of munitions was permitted, including the mechanical separation of the munitions; however, this operation was never performed at SEDA. In 1999, clearance surveys were conducted by Army personnel (refer to **Section 5**), and the land surrounding Building 612 was subsequently transferred to the State for use as a State Prison. However, Building 612 has remained locked, unoccupied, and under Licensee control pending its release for unrestricted use by the NRC.

*License SUC-1380:* SUC-1380, which is currently held by the US Army Field Support Command, Rock Island, IL (NRC Docket No. 040-08767), is for the possession and storage of DU commodities. SEDA is currently listed on license SUC-1380 as a bulk quantity storage facility. Available records indicate that DU commodities such as 25 millimeter (mm), 105 mm, and 120 mm cartridge penetrators were stored at SEDA under this license. Activities under this license were the same as for SUC-1275 and were conducted in the same locations that are listed above. The most recent available version SUC-1380 (October, 2003; **Appendix 1.C**) lists SEDA as an authorized storage facility. The intention is to amend this license so that SEDA is no longer listed. As indicated under License SUC-1275, all DU commodities stored at SEDA were shipped off site by September 1999.

*License 45-16023-01NA:* 45-16023-01NA is a U.S. Navy license that controlled DU commodities (20 and 25 mm cartridges) that were stored at SEDA, as described in Supplement 1 to the January and October 1992 license renewal applications for SUC-1275 (**Appendix 1.B**). A current version of this license is not available. It is not known if SEDA is listed on this license as an approved storage facility, but if so, the intention is to amend this license so that SEDA is no longer listed since all DU commodities have been off site since September 1999.

*License SUB-834:* SUB-834 is currently held by the U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD (NRC Docket No. 040-07354), for the possession of natural uranium, natural thorium, and DU, for the purposes of evaluating and testing munitions and projectiles. Supplement 1 to the January 1992 license renewal application for SUC-1275 indicates that 7.62 mm and 50 caliber cartridges controlled by license SUB-834 would be among the commodities stored at SEDA. However, the October 1992 license renewal application for SUC-1275 does not list these commodities or SUB-834, so it is unlikely that they were actually stored at SEDA. The most recent available copy of SUB-834 (June, 2000; **Appendix 1.D**) lists Aberdeen Proving Ground as the only authorized location for the use of licensed materials. It is not known if SEDA was listed on earlier versions of SUB-834. The discussion of SUB-834 is intended to verify that materials controlled by this license are no longer present at SEDA, and to confirm that SEDA is no longer an authorized storage facility for commodities covered by the license.

*License BML 12-00722-07:* BML 12-00722-07 is currently held by the U.S. Army Field Support Command, Rock Island, IL (NRC Docket No. 030-14796), for the possession of Pm-147 to be used with military rocket sighting systems. Army records indicate that only one igloo at SEDA, Igloo A0701, stored material controlled by this license. According to the 1997 license application for BML 12-00722-07 (**Appendix 1.E**), the Pm-147 was contained in ceramic microspheres, mixed with luminous paint, and laminated between plastic sheet to provide illumination of the 100- and 150- yard

markings in the rocket sights. Unless the rocket site was crushed, melted, or otherwise broken (all unlikely scenarios), the Pm-147 would not be able to escape. The 1997 license application also includes documentation from 1995 that lists SEDA as a potential storage facility. However, the same application has an inventory of Pm-147 commodities that dated from 1997, and SEDA is not listed. The most recent available copy of BML 12-00722-07 (January, 2004; **Appendix 1.E**) does not specifically list SEDA on the license. The discussion of BML 12-00722-07 is intended to verify that materials controlled by this license are no longer present at SEDA, and to confirm that SEDA is no longer an authorized storage facility for Pm-147 commodities.

License STC-133: STC-133, which is currently held by the Defense Logistics Agency (DLA), Fort Belvoir, VA (NRC Docket No. 040-00341), is for the possession of uranium and thorium ores, including columbium and tantalum minerals, for use with the National Defense Stockpile. According to Army records, activities at SEDA under this license occurred at Warehouse 356, Section D. In 1992, a portion of the ore was sold and shipped to Cabot Performance Materials Company. The remaining material was transferred to another DLA facility in Binghamton, New York, in May, 1993. SEDA was removed from this license in 1994, following Army, NYSDEC/NYSDOH, and NRC confirmatory surveys (refer to **Section 6**). The supporting documentation for the removal of SEDA as a storage facility under STC-133 is presented in **Appendix 1.F**. The discussion of STC-133 in this report is intended to confirm that the current license termination criteria are met at the locations that were included under the license.

## 2.0 LICENSE TERMINATION PLAN

The Seneca Army Depot Activity License Termination and License Release Plan (LTP; ANL, 2003; **Appendix 1.A**) was approved by the NRC in 2003 (**Appendix 1.B**). Outlined in the LTP are the release criteria for the site, along with the documentation of how the release criteria were derived. This section provides a summary of the selection and development of release criteria at SEDA and an overview of the process used to determine compliance with those criteria.

### 2.1 APPROPRIATE RELEASE CRITERIA

As stated in the LTP (ANL, 2003), the total effective dose equivalent (TEDE) selected for development of Derived Concentration Guideline Levels (DCGLs) at SEDA was the New York State Department of Environmental Conservation (NYSDEC) TAGM-4003 of 10 millirem per year (mrem/yr). DCGLs are defined in MARSSIM as residual levels of radioactive material that correspond to allowable radiation dose standards (NRC, 2000). Although the U.S. Environmental Protection Agency (USEPA) allows a TEDE of 15 mrem/yr and the NRC allows a TEDE of 25 mrem/yr, the NYSDEC TAGM-4003 TEDE was selected since it is the most conservative. Compliance with the DCGLs is used to determine if and where the release criteria are met. This report will demonstrate that the areas under the NRC license meet the NRC release criterion of 25 mrem/yr, as well as the more conservative release criterion set in the LTP (ANL, 2003) of 10 mrem/yr.

Two types of DCGLs were used in the license termination evaluation:

1. The  $DCGL_W$  (derived concentration guideline level, wide area) is defined as the concentration of residual radioactivity distinguishable from background that, if uniformly distributed throughout a survey unit, would result in a defined TEDE to an average member of a critical group.
2. The  $DCGL_{EMC}$  (derived concentration guideline level, elevated measurement comparison) is the concentration of residual radioactivity limited to a small, localized area that is equivalent to the TEDE.

The Environmental Assessment Division at ANL derived the radionuclide-specific DCGLs used in this license termination in Section 6 of the LTP (ANL, 2003).

In addition to the use of DCGLs as guideline values, the concept of As Low As Reasonably Achievable (ALARA) was also employed. Residual radioactivity being ALARA is supported in MARSSIM and 10 CFR 20. In terms of implementation, the objective of being ALARA is to maintain all exposures as far below the applicable dose limits as is reasonably achievable. In the license termination process, although a survey unit may pass the site-wide release criteria (i.e., the  $DCGL_W$ ), it may still have measurements that exceed the localized release criteria (i.e., the  $DCGL_{EMC}$ ) or that are indicative of residual contamination. In evaluating survey results, it is necessary to consider if all levels of residual radioactivity are ALARA.

## 2.2 CONCEPTUAL DOSE MODEL/EXPOSURE PATHWAY

In the development of the DCGLs by ANL, as presented in the LTP (ANL, 2003), two dose model scenarios were assumed:

- 1) The resident farmer for the exterior soil DCGLs; and
- 2) The building occupancy scenario for the interior surface DCGLs.

For the modeling of the resident farmer scenario, the RESRAD (Version 6.21) computer code was used. This scenario assumes that a hypothetical farmer, who lives on the site after the site is released for unrestricted use, is the average member of the critical group. The hypothetical farmer drinks water from a well that is located downgradient from the study area, ingests plant food that was grown in a garden located in the study area, ingests fish from a pond that is downgradient to the study area, and ingests meat and milk from livestock raised in the study area.

For the modeling of the building occupancy scenario, the RESRAD-BUILD (Version 3.21) computer code was used. This scenario assumes that a hypothetical person who lives in an onsite building is the average member of the critical group. The hypothetical resident spends 16.3 hours a day in the building and is exposed to external radiation (from the source, the floor, and airborne dust) and internal radiation (from inhalation and ingestion).

These scenarios were chosen because they were the most conservative of all potentially reasonable scenarios. It is recognized, however, that the resident farmer and the building resident scenarios may be too conservative based on the future land use plans. Currently, the buildings and igloos associated with this license termination are located in the area designated for conservation/recreation, the planned industrial development area, or the warehouse area, as designated by the future use plans for SEDA, not for residential use; refer to **Figure 1-2** to see the location of each area included in this license termination. If either of the scenarios were changed to an industrial or commercial activity scenario, occupancy and exposure pathways would be greatly reduced. Regardless, per the approved LTP, the DCGLs based on the conservative scenarios are used to demonstrate compliance with the release criteria. The input parameters for the DCGL derivation using the dose modeling from the RESRAD and RESRAD-BUILD computer code are presented in Section 6 of the LTP (ANL, 2003)

## 2.3 DCGL DEVELOPMENT

As described in **Section 2.2**,  $DCGL_W$  values and  $DCGL_{EMC}$  values developed in the LTP (ANL, 2003) were used to determine compliance with the release criterion of 10 mrem/yr. Selection of the applicable DCGLs for a site from those that were calculated is based on the radionuclides of concern (ROCs) at the site. At SEDA, three groups of DCGLs were used:

- a) Depleted Uranium (DU) Gross Activity DCGL;
- b) Individual Radionuclide Surface or Soil DCGLs; and
- c) Pitchblende Ore Gross Activity DCGL.

The DU DCGLs were used to demonstrate compliance with the sites under NRC license SUC-1275 where the primary ROC was DU with components U-234, U-235, and U-238. These sites are

discussed in **Sections 3, 4, and 5**. The individual surface or soil DCGLs were used to evaluate the radionuclide-specific analytical results from the material and soil samples that were collected. The pitchblende ore DCGL was calculated for use at SEAD-48, where residual uranium ore was the ROC, (SEAD-48 is discussed in **Section 7**).

The final DCGLs developed by ANL (LTP, 2003) are listed in **Table 2-1**. To allow for use with survey data, the surface DCGLs in decays per minute per 100 square centimeters (dpm/100cm<sup>2</sup>) were converted to an instrument-specific number in units of counts per minute (cpm) using the instrument probe area and efficiency.

## **2.4 SIGNIFICANCE OF AREAS WHERE LICENSED AND NON-LICENSED COMMODITIES WERE USED**

The intent of the LTP is primarily to terminate license SUC-1275, thereby releasing any area where materials under this license were used. However, the NRC stated in a letter dated July 26, 2000 (**Appendix 2.A**):

“...because you plan to terminate the license and release the entire facility for unrestricted use, confirm that you will evaluate the entire site (including Building 612, [the 120 storage igloos], and any other facilities remaining at your site that were previously released for unrestricted use) to determine if the site meets the Radiological Criteria for License Termination specified in 10 CFR 20.1402, that any residual radioactivity from all facilities at your site does not result in a total effective dose equivalent (TEDE) greater than 25 millirem per year to an average member of a critical group”.

In response to the request from the NRC to evaluate the entire facility, discussion of all radiological areas at SEDA have been included in this license termination report. The areas included in this report, as discussed in **Section 1.4**, consist of the following:

- 120 DU Storage Igloos
- Building 5;
- Building 306;
- Building 612;
- Building 2073;
- Building S-2084;
- Warehouse 356; and
- Non-licensed areas (including SEAD-12 and SEAD-48).

Each of these areas has been investigated because of past known or suspected activities using licensed or non-licensed, radiological activities. A non-licensed area is defined in this context as a location where radionuclides may have been present but were not licensed commodities. In order to comply with the release criteria, all radiological areas are addressed in this report. **Table 2-2** outlines each area, and, if applicable, the associated licenses and additional investigation being performed at the area. Both SEAD-12 and SEAD-48 (presented in **Section 7**) are being investigated under the CERCLA process in coordination with the USEPA, and NYSDEC, and as such, the primary reporting for the work at SEAD-12 and SEAD-48 has been with those agencies. In this report, the survey results for SEAD-12 and SEAD-48 are summarized with the information necessary to determine the

contribution of survey units within those areas to a site dose. Integration into the license termination of each of the radiological sites at SEDA is intended to support and demonstrate a facility-wide compliance with the site-specific release criterion of 10 mrem/yr and the Radiological Criteria for License Termination specified in 10 CFR 20.1402.

## 2.5 BACKGROUND REFERENCE AREAS

To represent background radiological conditions at the site and to provide reference areas for conducting statistical comparisons of study areas, measurements were made in areas that were not affected by site radiological operations. The selection of background areas was based upon documentation that the area was not used in the handling or storage of radioactive commodities and that the area is of similar construction to the site survey unit to which it is compared. Various background datasets have been collected on an assortment of building materials so that the variability in measurements due to material type could be taken into account. Summary statistics of the background datasets collected at the areas listed below are presented in **Table 2-3**, comprehensive background data sets are provided in **Appendix 2.B**.

For the DU Storage Igloo surveys (presented in **Section 3**), several unaffected igloos were used as background areas. One unaffected igloo from each geographical “block” was selected. Measurements from Igloos A1107, B0806, C0912, D0405, and E0403 were combined into a large background dataset. According to Army records, these igloos were not used for any radiological activities. As with the affected igloos, the background igloos are earth-covered, ground-level, and are of concrete construction. Background measurements at Igloos A1107, B0806, C0912, D0405, and E0403 were collected in 2002.

Individually, Igloo C0912 was used as the background reference area for the SEAD-48 surveys and for Building 803 of the SEAD-12 surveys (presented in **Section 7**). Igloo C0912 is located in the approximate center of the ammunition area at SEDA, near the east end of Igloo Road 23. Background data were collected at Igloo C0912 in 2000 and 2003.

Background datasets were collected from Building 722 in 1999 and were used for comparison with the DU Storage Buildings (Buildings 5, 306, 2073, S-2084, and 612) and the buildings included in the SEAD-12 radiological surveys (presented in **Sections 4, 5, and 7**, respectively). Building 722 was located in the administrative area north-northwest of SEAD-12. This building was chosen as a background reference area because of its construction of reinforced concrete, cinder block, and mortar. In addition, Building 722 had similar wall and floor coverings to those found in the DU Storage and SEAD-12 buildings (including painted concrete block, wallboard, paneling, and porcelain). The property where Building 722 was located was transferred in 2000 to the KidsPeace organization; subsequently, the Building 722 has been demolished, (KidsPeace is a private residential treatment facility for children, preadolescents, and teens).

Data from Building 2078 were used for background data for the survey of Building 612 that was conducted by Army personnel in 1999 (presented in **Section 5**). Alpha and beta measurements were

collected at various locations using a hand-held gas proportional detector and a gas proportional floor monitor. Background gamma measurements from Building 2078 were not available.

## 2.6 COMPLIANCE APPROACH

To demonstrate the facility-wide compliance with the Radiological Criteria for License Termination specified in 10 CFR 20.1402A and the site-specific release criterion of 10 mrem/yr, a MARSSIM-based approach was developed. The approach was designed to evaluate the collected survey data to determine if residual radioactivity is present at the affected sites at SEDA, and if so, to calculate the corresponding dose to the hypothetical receptor. This process is discussed below and is summarized in **Figure 2-1**.

### 2.6.1 Grouping of Survey Units

The initial step in the process is the grouping of survey units. For the calculation of dose to the receptor, survey units were grouped into larger sites; a *site* is defined in this context as a logical grouping of survey units, such as those within a building or an igloo. It is assumed that each site is independent of other sites, and the potential dose contributions between each site are not additive (i.e., the receptor is exposed to only one site at a time). Survey data from each survey unit within a site are evaluated separately and the resultant dose contribution is added together for all survey units for that site. The sites and grouping of survey units at SEDA are listed in **Table 2-4**.

***Example:***

*For example, consider a hypothetical building, Building 1234, which has three rooms, labeled X, Y, and Z. Building 1234 would be considered the site and would be evaluated with the 10 mrem/yr release criterion. Survey data from each room (X, Y, and Z) would be evaluated separately, but any dose contribution from those survey units would be added to determine a total dose for the site (Building 1234). Because the assumption is that each site is independent, the dose for Building 1234 would not be added to the dose from any other buildings.*

### 2.6.2 Background Area Selection

The next step in the process is the selection of an appropriate background area. As discussed in **Section 2.5**, background areas used during this evaluation include the group of five background igloos (Igloos A1107, B0806, C0912, D0405, and E0403), Building 722, and Building 2078. The selection of background is based on similarities in building construction and expected ambient radiation levels.

***Example:***

*Continuing the example from **Section 2.6.1**, Building 722 is selected as the appropriate background area for hypothetical Building 1234, based on similar room size and construction materials, such as tile and concrete block.*



### 2.6.3 Comparison with Background

In order to determine if residual radioactivity is present within a survey unit, it is necessary to conduct a statistical comparison between survey unit and background data. Per MARSSIM, the Wilcoxon Rank Sum (WRS) statistical test is used to compare each dataset from a survey unit with the appropriate background dataset. The WRS analysis is performed using the Statistica (StatSoft, 2001) software package. The rank-sum analysis performed by Statistica is also known as the Mann-Whitney U test, and there are three primary outputs:

- 1) The U-statistic (the result of the comparison of the two datasets);
- 2) The Z-statistic (an approximation of the deviation of one dataset from another); and
- 3) A p-value corresponding to the U- and Z-statistics.

If the p-value is less than 0.05 (corresponding to a Type I error [ $\alpha$ ] of 0.05), the null hypothesis that states that the two datasets (i.e., survey unit data and background data) are similar is rejected. A p-value of 0.05 or greater indicates that the null hypothesis is correct, and that the datasets are similar.

If the survey unit dataset fails the initial WRS test (i.e., the p-value is less than 0.05), then the average rank of each dataset and box-and-whisker plots visually depicting the survey unit data and background data are generated and compared.

If the WRS test indicates that a survey unit dataset is equivalent to or below background, it is concluded that the survey unit does not contribute to the total dose for the site (although individual measurement locations may contribute to dose, as described in **Section 2.6.5**).

If the WRS test indicated that a survey unit dataset is greater than background, it is concluded that the survey unit will contribute to the total dose for the site. The dose that the survey unit will contribute is calculated, as explained in **Section 2.6.6**.

***Example:***

*In the example case, the WRS test is used to compared direct alpha floor monitor (FM), direct beta FM, and direct gamma FIDLER measurements from Rooms X, Y, and Z in hypothetical Building 1234 with background measurements taken with the same types of instruments from Building 722. For the purposes of the example, the WRS test results indicate that only the Room X alpha FM, Room Y beta FM, and Room Z gamma measurements are different than background; all other datasets are at background levels and do not contribute to the site dose. A comparison of the average ranks and of the box-and-whisker plots for Room Y and Building 722 beta FM measurements indicate that the Room Y beta FM data is below background; therefore it is assumed that there is no contribution to site dose from beta radiation in Room Y. Box-and-whisker plots for Room X alpha FM and Room Z gamma data and background indicate that the survey unit data is elevated above background. The dose contribution as a result of the Room X alpha FM and Room Z gamma measurements is calculated per **Section 2.6.5**.*

#### 2.6.4 Comparison with DCGL<sub>W</sub>

After the above-background datasets are determined for each survey unit, it is necessary to compare the data to the DCGLs. As discussed in **Section 2.3**, the appropriate DCGL<sub>W</sub> is identified for the survey units that are determined to be above background based on the ROCs for the site. For direct measurement data, the DCGL<sub>W</sub> is converted to units of cpm and added to each measurement in the background dataset (referred to as the *DCGL<sub>W</sub>-adjusted background* dataset).

The WRS test is used to compare each above-background survey unit dataset to the appropriate DCGL<sub>W</sub>-adjusted background dataset. If the survey unit dataset fails the WRS comparison with the DCGL<sub>W</sub>-adjusted background dataset (i.e., the null hypothesis that states that the survey and DCGL<sub>W</sub>-adjusted background datasets are the same is rejected), then the average rank of each dataset and the box-and-whisker plots of survey and DCGL<sub>W</sub>-adjusted background data are generated and compared. A survey unit is said to **not** meet the release criterion of 10 mrem/yr when it is determined to be elevated above the DCGL<sub>W</sub>-adjusted background. If the survey unit fails the DCGL<sub>W</sub> adjusted-background comparison, the cause for the failure is investigated.

***Example:***

*From the example, the above-background datasets are Room X alpha FM and Room Z gamma. Hypothetical Building 1234 was used for temporary storage of DU ammunition under SUC-1275, so the only expected contaminant is DU. Using **Table 2-1**, the DU gross activity DCGL<sub>W</sub> of 31,800 dpm/100cm<sup>2</sup> for surface contamination is applicable. In order to create the DCGL<sub>W</sub>-adjusted background, the value of 31,800 dpm/100cm<sup>2</sup> is converted to cpm for the alpha FM (using a probe area of 425 cm<sup>2</sup> and observed efficiency of 20%) and the FIDLER (using a probe area of 126 cm<sup>2</sup> and observed efficiency of 15%). The instrument equivalent DCGL<sub>W</sub> values that are calculated (27,030 and 6,020 cpm for alpha FM and FIDLER, respectively) are added to each background measurement for those instruments, and the survey unit datasets and the DCGL<sub>W</sub>-adjusted background are compared using the WRS test. Results from the WRS test indicate that neither datasets exceed the DCGL<sub>W</sub>-adjusted background; consequently, both survey units with above-background datasets (Room X and Room Z) meet the release criterion of 10 mrem/yr.*

#### 2.6.5 Elevated Measurement Comparison

Per MARSSIM, it is necessary to evaluate survey data to determine the presence of hotspots, or areas of localized contamination. Each individual measurement (i.e., direct and scanning) within a survey unit is compared to the DCGL<sub>EMC</sub> value if the survey unit has been classified as Class 1, and to the DCGL<sub>W</sub> if the survey unit has been classified as Class 2 or 3 (survey unit classification at SEDA is specified in the LTP [ANL, 2003]). The DCGL<sub>EMC</sub> is calculated using area factors from the LTP (ANL, 2003) for the appropriate survey grid size, and converted to an instrument-specific value in units of cpm using the methodology described above. If the measurement exceeds the DCGL<sub>EMC</sub> or DCGL<sub>W</sub>, the measurement location is potentially a hotspot and should be evaluated further to determine if the location is ALARA.

**Example:**

Continuing the example, all scanning and direct measurements from hypothetical Building 1234 Rooms X and Y (Class 2 survey units) are compared with the instrument equivalent  $DCGL_W$ . All scanning and direct measurements from Room Z (Class 1 survey unit) are compared with the instrument-specific  $DCGL_{EMC}$ , which is calculated using the U-235 area factor ( $AF = 11.9$ ) for a  $4\text{ m}^2$  sampling grid size. One gamma FIDLER scanning measurement at a floor location from Room Z (75,000 cpm) is above the FIDLER  $DCGL_{EMC}$  (71,638 cpm). The location is marked and will be evaluated to determine if remediation is necessary. All measurements from Rooms X and Y are below the  $DCGL_W$ .

## 2.6.6 Dose Contribution

The final step in the process is to calculate the dose contribution from both the above-background datasets within a survey unit and any hotspot locations within a survey unit. The calculated doses for each survey unit are added to determine a total above-background dose contribution for the site. It is assumed that survey units that are at background levels do not contribute to an above-background dose.

For datasets that failed the background comparison (as described in **Section 2.6.3**), the maximum measurement for the survey unit is used to calculate the resultant dose, per the following equation:

$$\frac{\text{Instrument Equivalent} - DCGL_W \text{ (cpm)}}{10\text{ mrem/yr}} = \frac{\text{Maximum Direct Measurement (cpm)}}{\text{Survey Unit Dose (mrem/yr)}} \quad (\text{Equation 2-1})$$

If a measurement exceeds the  $DCGL_{EMC}$  or  $DCGL_W$  (depending on survey unit classification) as a result of the elevated measurement comparison (**Section 2.6.5**), that measurement is used to calculate the dose to a receptor at that location, per the following equation:

$$\frac{\text{Instrument Equivalent} - DCGL_{EMC} \text{ (or } DCGL_W \text{) (cpm)}}{10\text{ mrem/yr}} = \frac{\text{Individual Measurement (cpm)}}{\text{Location Dose (mrem/yr)}} \quad (\text{Equation 2-2})$$

For each site, the dose contributions as a result of above-background datasets and hotspots from each survey unit are added to determine a total dose. The total dose from each site is compared with the 10 mrem/yr release criterion, and one of the following conclusions is made:

**Conclusion A:** The site does not contain residual radioactivity above background; consequently, *the release criterion is met*. This conclusion is made because each survey unit within a site is at or below background levels and all individual measurements are below the appropriate  $DCGL_{EMC}$  or  $DCGL_W$ .

**Conclusion B:** The site does not contain residual radioactivity above the release criterion of 10 mrem/yr; consequently, *the release criterion is met*. This conclusion is made because the total dose from the above-background datasets within a site and/or hotspots that are identified within a site is less than 10 mrem/yr.

**Conclusion C:** The site contains residual radioactivity above the release criterion of 10 mrem/yr; consequently, *the release criterion is not met*. This conclusion is made because the total dose from the above-background datasets within a site and/or hotspots that are identified within a site is greater than 10 mrem/yr.

Finishing the example, as a result of the WRS comparison the Room X alpha FM and the Room Z gamma were determined to be above background. The hypothetical maximum direct measurements within these datasets were 100 cpm (Room X alpha FM) and 5,000 cpm (Room Z gamma), which correspond to 0.04 and 8.3 mrem/yr, respectively, using Equation 2-1. The remainder of the datasets were at background levels and do not contribute to an above-background dose. The hotspot gamma measurement from Room Z (75,000 cpm) corresponds to a dose of 10.5 mrem/yr, using Equation 2-2. The total dose to a receptor in hypothetical Building 1234 as a result of residual radioactivity would be equal to  $0.04 + 8.3 + 10.5$  mrem/yr, or 18.84 mrem/yr. Since this dose exceeds the release criterion of 10 mrem/yr, hypothetical Building 1234 would not be suitable to release for unrestricted use. However, if the Room Z hotspot was remediated, or it was shown to be the result of something other than contamination (e.g., naturally-occurring background, instrument fluctuation or malfunction, etc.), the dose contribution from that location could be removed from the Building 1234 total dose. The resulting dose ( $0.04 + 8.3$ , or 8.34 mrem/yr) would then be below the 10 mrem/yr release criterion, and hypothetical Building 1234 would be suitable to release for unrestricted use.

### 3.0 SURVEYS OF DEPLETED URANIUM STORAGE IGLOOS

As discussed in **Section 1**, Parsons conducted radiological surveys between May and August of 2002 at 120 storage igloos located within the secured ammunition storage area at SEDA.

#### 3.1 SITE DESCRIPTION

Army records identified 120 igloos that were used for the storage of depleted uranium ammunition under NRC licenses SUC-1275 and SUC-1380 (**Table 3-1**). One of the 120 igloos (Igloo A0701) was also identified as having stored weaponry containing Pm-147 sights (under BML 12-00722-07). Four of the 120 igloos (Igloos A0201, A0316, A0317, and A0508) were identified as potentially having stored special weapons. Five unaffected igloos (A1107, B0806, C0912, D0405, and E0403) were selected as background reference areas (**Section 2.5**). The locations of the affected and background igloos are shown in **Figure 3-1**; the igloos are shown by section in a larger scale in **Figures 3-1a** through **3-1b**.

The storage igloos are earth-covered, ground-level, and are of concrete construction. They range in length from 20 to 25 meters (m), with a typical height at the center of approximately 4 m (**Figure 3-2**). In addition to the primary door, each igloo has two approximately 1" deep drainage troughs along each wall leading to outlets at the front of the igloo, and an air vent leading to the top of the igloo located along the upper back wall (**Figure 3-3**).

Based on historical evidence and the sealed, packaged, and nondispersible nature of the stored commodities, the interior of each igloo was determined to be a separate Class 3 survey unit. Exterior grounds surrounding the storage igloos were considered to be unaffected and were not surveyed. A gross activity  $DCGL_W$  for depleted uranium was calculated using the DCGLs from the LTP (ANL, 2003) and expected activity fractions for U-234, U-235, and U-238 in typical DU (**Table 3-2**).

#### 3.2 RADIOLOGICAL SURVEY

##### 3.2.1 Survey Instrumentation

Surveys for alpha, beta, and gamma radiation were performed using the instruments listed in **Table 3-3**. Flag values based on background and the gross  $DCGL_W$  were calculated and used to identify any areas of potentially elevated activity in the field. Minimum detectable activities (MDAs) that are listed in **Table 3-3** were calculated per MARSSIM.

Additional measurements were collected to further characterize the site or provide health and safety data. These additional measurements consisted of in-situ gamma spectroscopy, smear and material samples, radon measurements, exposure rate measurements, and personnel dosimetry.

All field instrumentation was calibrated prior to the field effort by an approved laboratory using NIST-traceable sources. Instrument function checks were performed using appropriate and dedicated check sources at a minimum frequency of twice per day each instrument was used. The procedure for instrument function checks typically consisted of a source measurement and a background measurement collected in the morning, at midday, and at the end of the workday. Instrument function check data and a list of the check sources used are presented as **Appendix 3.A**.

### 3.2.2 Number and Locations of Measurements

For the evaluation of the DU igloos, each igloo was considered to be a site that consisted of one interior survey unit. Since each igloo/survey unit was classified as Class 3, 30 direct measurements and a limited number of scanning measurements were collected from each survey unit, per MARSSIM and the LTP (ANL, 2003). One-minute direct measurements for alpha, beta, and low-energy gamma radiation were taken at both random and biased locations (**Figure 3-4**). In addition, alpha/beta and low-energy gamma scanning measurements were collected at areas where accumulation of residual radioactivity would be most likely, such as along the drainage troughs, in the corners, and along the air vents. Measurement locations were kept consistent for each igloo. A post-survey evaluation indicated that an appropriate number of measurements were collected (**Table 3-4**).

Thirty direct alpha/beta/gamma radiation measurements were collected at each background igloo at the locations indicated in **Figure 3-4**. Alpha/beta/gamma radiation scanning measurements were collected at the same locations at each background igloo in the same manner as with the affected igloos. Data from the five background igloos were combined to create a background dataset of 150 measurements for each data type.

## 3.3 **SURVEY RESULTS AND ANALYSIS**

### 3.3.1 Survey Data Evaluation

The evaluation of survey data collected at the DU storage igloos was performed in the following manner:

- Direct measurement datasets were compared with the background and DCGL<sub>W</sub>-adjusted background datasets to determine if the survey unit met the release criteria.
- Individual direct and scanning measurements were compared with the DCGL<sub>W</sub> to determine if elevated areas of radioactivity were present in the survey units.
- In-situ gamma spectroscopy measurements were used to identify the presence of and the relative radioactivity levels at potentially elevated scanning locations.
- Gross alpha/beta/gamma dry smear samples were used to determine if removable contamination was present within the survey units.
- Analytical results from the material samples were used to determine approximate activity concentrations of ROCs.
- Radon testing was used to determine potential radon production from residual contamination and to assess potential worker exposure.

### 3.3.2 Direct Measurement Evaluation

Per MARSSIM, the comparison of survey direct measurement data to background data was performed using the WRS nonparametric two-sample test. Direct measurements from each survey unit were first compared to an instrument-specific background dataset using the WRS test. If the

survey unit dataset failed the initial WRS test (i.e., the null hypothesis that states that the survey and background datasets are the same was rejected), then box-and-whisker plots visually depicting the survey unit data and background data were compared. If it was determined that the survey unit dataset was elevated above background, the WRS test was repeated comparing the survey unit dataset to the DCGL<sub>W</sub>-adjusted background dataset. If the survey unit dataset failed the WRS comparison using the DCGL<sub>W</sub>-adjusted background dataset, (i.e., the null hypothesis that states that the survey and DCGL<sub>W</sub>-adjusted background datasets are the same was rejected), then box-and-whisker plots of survey and DCGL<sub>W</sub>-adjusted background data were inspected to determine which dataset was elevated. A survey unit dataset was said to not meet the site-wide release criterion when it was determined to be elevated above the DCGL<sub>W</sub>-adjusted background. This evaluation process is explained in full detail in **Section 2.6**. Data collected during the DU storage igloo surveys are tabulated in **Appendix 3.B**.

The alpha, beta, and gamma direct measurements from each igloo were compared to the alpha, beta, and gamma background datasets using the WRS test, per MARSSIM. Datasets found to exceed background were compared to a DCGL<sub>W</sub>-adjusted background dataset with the WRS test. Summary statistics of the direct measurements and results of the WRS tests with background are presented in **Table 3-5** through **Table 3-9**. Box-and-whisker plots of selected site and background data are presented in **Appendix 3.C**. Forty-one datasets from 38 igloos (out a total of 360 datasets) were above background and were compared to the DCGL<sub>W</sub>-adjusted background. None of those datasets were elevated above the DCGL<sub>W</sub>-adjusted background (**Table 3-10**). The remaining datasets were at or below background levels.

### 3.3.3 Elevated Measurement Comparison

Per MARSSIM for Class 3 survey units, all direct and scanning measurements from each igloo were compared directly with the DCGL<sub>W</sub> for DU. All of the alpha, beta, and gamma direct measurements were below the DCGL<sub>W</sub>. In addition, all of the maximum scanning results listed in **Table 3-11** were below the DCGL<sub>W</sub>. The rear air vent consistently had direct alpha (and to some extent, beta) measurements that were above background, but not above the DCGL<sub>W</sub>. From in-situ gamma spectroscopy and smear sampling results, it was determined that the measurements were due to the deposition of naturally-occurring radon decay progeny on the mesh screen of the vent. It was concluded that there were no localized areas of elevated contamination within the DU storage igloos.

### 3.3.4 In-Situ Gamma Spectroscopy

In-situ gamma spectroscopy measurements were collected at two floor locations (B0909-21 and C0909-21) and five air vent locations (C0303-29, C0603-29, C0906-29, E0602-29, and E0609-29). Identified and quantified radionuclides detected at these locations are listed in **Table 3-12**. None of the DU ROCs were identified at levels above the DCGL<sub>W</sub>.

### 3.3.5 Smear and Material Sampling

Dry smear samples were collected over a 100-cm<sup>2</sup> area at each direct measurement location and analyzed for gross alpha, beta, and gamma radiation. A summary of the results for each igloo is

presented in **Table 3-13**. The maximum detected gross alpha, beta, and gamma results for the affected igloos were 22, 130, and 77 dpm/100cm<sup>2</sup>, respectively. These results are below both the DCGL<sub>w</sub> and the limits for surface contamination from 10 CFR 835, Appendix D (listed in the footnote to **Table 3-13**).

Wet smear samples were collected at the four igloos potentially used to store special weapons (Igloos A0201, A0316, A0317, and A0508) and analyzed for beta emissions from tritium. Results from this analysis are presented in **Table 3-13**. The maximum result was 10 dpm/100cm<sup>2</sup>, which is below the DCGL<sub>w</sub> and surface contamination limit for tritium from 10 CFR 835, Appendix D.

Material samples were collected from a floor location at Igloo B0909 (B0909-21) and an air vent location at Igloo E0602 (E0602-29). Isotope-specific analyses were performed to detect U-234, U-235, U-238, Th-230, Th-232, Ra-226, and Cs-137. Results from the material sample analysis are presented in **Table 3-14**. None of the isotopic results were above the individual volumetric DCGL<sub>w</sub>'s (**Table 2-1**).

#### 3.3.6 Radon Measurements

Radon measurements were collected using E-perm electrets (Rad-Elec, Inc.) that were placed in the center of 12 affected igloos (at 1.5-2 feet in height). Measurements were also taken in the five background igloos. Duplicate E-perms were deployed in four affected igloos and one background igloo. Measured radon concentrations in the affected igloos and the background igloos were similar - an average of 4.7 picocuries per liter (pCi/L) and maximum of 8.5 pCi/L for the affected igloos, and an average of 4.4 pCi/L and maximum of 9.3 pCi/L for the background igloos. The upper estimate worker dose resulting from radon exposure over the course of the DU storage igloo surveys was calculated to be 2.3 mrem/yr.

#### 3.3.7 Personnel Dosimetry

All site personnel were issued thermoluminescent dosimeters (TLDs) from Landauer, Inc., that were worn at all times onsite. The TLDs measured whole body exposure to gamma and beta radiation. The exposure limit for members of the general public (the applicable standard to the workers on this project) was 100 mrem/yr. All of the results from the dosimeters worn over the course of the project were below the minimum dose equivalent reported (1 mrem). In addition, exposure rate measurements were taken at all direct measurement locations. The stop work limit of 500 uRem/hr was not exceeded at any location.

### 3.4 CONCLUSIONS

No datasets from the DU storage igloo surveys exceeded the DCGL<sub>w</sub> for DU. The doses from the DU storage igloo datasets that were determined to be above background were calculated as described in **Section 2**. Although the 10 mrem/yr dose limit was applied to each igloo survey unit individually, the igloos are grouped by geographic "block" (i.e., A-Block through E-Block) in the discussion below.



- Nine of the datasets collected from the 13 A-Block igloos exceeded background, as indicated by the WRS test (**Table 3-5**). The highest calculated above-background dose occurred at Igloos A0508 (based on gamma measurements) and A0706 (based on alpha and gamma measurements) and is approximately 6.5 mrem/yr, which is below the 10 mrem/yr release criterion.
- Three of the datasets collected from the 20 B-Block igloos exceeded background, as indicated by the WRS test (**Table 3-6**). The highest calculated above-background dose occurred at Igloo B0909 (based on gamma measurements) and is approximately 6.7 mrem/yr, which is below the 10 mrem/yr release criterion.
- Seven of the datasets collected from the 37 C-Block igloos exceeded background, as indicated by the WRS test (**Table 3-7**). The highest calculated above-background dose occurred at Igloo C0901 (based on gamma measurements) and is approximately 6.3 mrem/yr, which is below the 10 mrem/yr release criterion.
- Twelve of the datasets collected from the 24 D-Block igloos exceeded background, as indicated by the WRS test (**Table 3-8**). The highest calculated above-background dose occurred at Igloo D0604 (based on beta and gamma measurements) and is approximately 7.7 mrem/yr, which is below the 10 mrem/yr release criterion.
- Nine of the datasets collected from the 26 E-Block igloos exceeded background, as indicated by the WRS test (**Table 3-9**). The highest calculated above-background dose occurred at Igloo E0103 (based on gamma measurements) and is approximately 6.4 mrem/yr, which is below the 10 mrem/yr release criterion.

Calculated doses from the above-background igloos are summarized in **Table 3-16**. Based on these calculations, it is concluded that the 120 DU storage igloos meet the release criterion for unrestricted use.

## **4 SURVEYS OF DEPLETED URANIUM STORAGE BUILDINGS**

As discussed in **Section 1**, Parsons conducted radiological surveys in between May and August of 2002 at four buildings (Buildings 5, 306, 2073, and S-2084) that were used to receive and store packaged DU ammunition.

### **4.1 SITE DESCRIPTION**

Army records identified five buildings (Buildings 5, 306, 2073, S-2084, and 612) that were used for the receipt and storage of DU ammunition under NRC licenses SUC-1275 and SUC-1380 (**Figure 3-1**). Army personnel surveyed Building 612 in 1999 (presented in **Section 5**). Floor plans of the four remaining buildings that were surveyed by Parsons are shown in **Figure 4-2** through **Figure 4-5**.

Based on the potential presence of contamination and known activities within the buildings, each interior room within each building was classified as either a Class 2 or Class 3 survey unit (**Table 4-1**). Exterior grounds surrounding the buildings were considered to be unaffected and were not surveyed. A gross activity  $DCGL_W$  for depleted uranium was calculated using the DCGLs from the LTP (ANL, 2003) and expected activity fractions for U-234, U-235, and U-238 in typical DU (**Table 4-2**). No other radionuclides of concern were considered for the building survey.

### **4.2 RADIOLOGICAL SURVEY**

#### **4.2.1 Survey Instrumentation**

Surveys for alpha, beta, and gamma radiation were performed using the instruments listed in **Table 4-3**. Flag values based on background and the gross  $DCGL_W$  were calculated and used to identify any areas of potentially elevated activity in the field. MDAs that are listed in **Table 4-3** were calculated per MARSSIM.

Additional measurements were collected to further characterize the site or provide health and safety data. These additional measurements consisted of in-situ gamma spectroscopy, smear and material samples, exposure rate measurements, and personnel dosimetry.

All field instrumentation was calibrated prior to the field effort by an approved laboratory using NIST-traceable sources. Instrument function checks were performed using appropriate and dedicated check sources a minimum frequency of twice per day each instrument was used. The procedure for instrument function checks typically consisted of a source measurement and a background measurement collected in the morning, at midday, and at the end of the workday. Instrument function check data for the DU building surveys and a list of the check sources used are presented as **Appendix 4.A**.

#### **4.2.2 Number and Locations of Measurements**

Within each Class 2 survey unit, a 2 m by 2 m sampling grid was established on the floors and on walls below 2 m in height. A 1 m by 1 m sampling grid was established on the walls above 2 m in height and on the ceiling. Per MARSSIM, 50% of the grids below 2 meters and 10% of the grids above 2 m were included in the surveys of Class 2 survey units. At each Class 2 sampling grid, one-

minute direct measurements and scanning measurements for alpha, beta, and low-energy gamma radiation were performed. In addition, smear samples and exposure rate measurements were also collected. A minimum of 10 measurements per survey unit were collected. A post-survey evaluation of all DU building data indicated that an appropriate number of measurements were collected within the Class 2 survey units (**Table 4-4**). Smear samples and exposure rate measurements were also collected at each direct measurement location. Measurement locations for each Class 2 survey unit are provided in **Appendix 4.B**.

For the Class 3 survey units, 30 direct measurements and a limited number of scanning measurements were collected from each survey unit, per MARSSIM and the LTP (ANL, 2003). One-minute direct measurements for alpha, beta, and low-energy gamma radiation were taken at both random and biased locations. Alpha/beta and low-energy gamma scanning measurements were collected around the entrances and exits to the Class 3 rooms. A post-survey evaluation indicated that an appropriate number of measurements were collected within the Class 3 survey units (**Table 4-4**). Smear samples and exposure rate measurements were also collected at each direct measurement location. Measurement locations for each Class 3 survey unit are provided in **Appendix 4.B**.

For the DU building surveys, Building 722 was selected as a representative background area. Background measurements for all instruments used in the DU building surveys were collected in 1999 on a variety of building materials. Refer to **Section 2.5** for a discussion of the background areas at SEDA.

### 4.3 SURVEY RESULTS AND ANALYSIS

#### 4.3.1 Survey Data Evaluation

The evaluation of survey data collected at the DU buildings was performed in the following manner:

- Direct measurement datasets were compared with the background and DCGL<sub>W</sub>-adjusted background datasets to determine if the survey unit met the release criteria.
- Individual direct and scanning measurements were compared with the DCGL<sub>W</sub> to determine if elevated areas of radioactivity were present in the survey units.
- In-situ gamma spectroscopy measurements were used to identify the presence of and the relative radioactivity levels at potentially elevated scanning locations.
- Smear samples were used to determine if removable contamination was present within the survey units.
- Analytical results from the material samples were used to determine approximate activity concentrations of ROCs.

#### 4.3.2 Direct Measurement Evaluation

Per MARSSIM, the comparison of survey direct measurement data to background data was performed using the Wilcoxon Rank Sum (WRS) nonparametric two-sample test. Direct measurements from each survey unit were first compared to an instrument-specific background

dataset using the WRS test. If the survey unit dataset failed the initial WRS test (i.e., the null hypothesis that states that the survey and background datasets are the same was rejected), then box-and-whisker plots visually depicting the survey unit data and background data were compared. If it was determined that the survey unit dataset was elevated above background, the WRS test was repeated comparing the survey unit dataset to the DCGL<sub>W</sub>-adjusted background dataset. If the survey unit dataset failed the WRS comparison using the DCGL<sub>W</sub>-adjusted background dataset, (i.e., the null hypothesis that states that the survey and DCGL<sub>W</sub>-adjusted background datasets are the same was rejected), then box-and-whisker plots of survey and DCGL<sub>W</sub>-adjusted background data were inspected to determine which dataset was elevated. A survey unit dataset was said to not meet the site-wide release criterion when it was determined to be elevated above the DCGL<sub>W</sub>-adjusted background. Data collected during the DU building surveys are tabulated in **Appendix 4.C**.

The alpha, beta, and gamma direct measurements from each igloo were compared to the alpha, beta, and gamma background datasets using the WRS test, per MARSSIM. Datasets found to exceed background were compared to a DCGL<sub>W</sub>-adjusted background dataset with the WRS test. Summary statistics of the direct measurements from each building and results of the WRS tests with background are presented in **Table 4-5** through **Table 4-8**. Box-and-whisker plots of selected site and background data are presented in **Appendix 4.D**. A total of five datasets from the four buildings (out of a total of 148 datasets) were above background and were compared to the DCGL<sub>W</sub>-adjusted background. None of the above-background datasets were elevated above the DCGL<sub>W</sub>-adjusted background (**Table 4-9**). The remaining datasets were at or below background levels.

#### 4.3.3 Elevated Measurement Comparison

Per MARSSIM for Class 2 and 3 survey units, all direct and scanning measurements from each building were compared directly with the DCGL<sub>W</sub> for DU. All of the alpha, beta, and gamma direct measurements were below the DCGL<sub>W</sub>. In addition, all of the maximum scanning results listed in **Table 4-10** were below the DCGL<sub>W</sub>. It was concluded that there were no localized areas of elevated contamination within the DU buildings.

#### 4.3.4 In-Situ Gamma Spectroscopy

In-situ gamma spectroscopy measurements were collected at four locations from each building included in the survey. The measurement locations were based on the highest field measurements. Identified and quantified radionuclides detected at these locations are listed in **Table 4-11**. None of the DU radionuclides of concern were identified at levels above the DCGL<sub>W</sub>.

#### 4.3.5 Smear and Material Sampling

Dry smear samples were collected over a 100 cm<sup>2</sup> area at each direct measurement location and analyzed for gross alpha, beta, and gamma radiation. A summary of the results for each igloo is presented in **Table 4-12**. The maximum detected gross alpha, beta, and gamma results for the surveyed buildings were 15, 28, and 179 dpm/100cm<sup>2</sup>, respectively. These results are below both the DCGL<sub>W</sub> and the limits for surface contamination from 10 CFR 835, Appendix D (listed in the footnote to **Table 4-12**).

Material samples were collected from two locations with each building. The sampling locations were based on the highest field measurements. Isotope-specific analyses were performed to detect U-234, U-235, U-238, Th-230, Th-232, Ra-226, and Cs-137. Results from the material sample analysis are presented in **Table 4-13**. None of the isotopic results were above the individual volumetric DCGL<sub>w</sub>'s (**Table 2-1**).

#### 4.3.6 Personnel Dosimetry

All site personnel were issued TLDs from Landauer, Inc., that were worn at all times onsite. The TLDs measured whole body exposure to gamma and beta radiation. The exposure limit for members of the general public (the applicable standard to the workers on this project) was 100 mrem/yr. All of the results from the dosimeters worn over the course of the project were below the minimum dose equivalent reported (1 mrem). In addition, exposure rate measurements were taken at all direct measurement locations. The stop work limit of 500 uRem/hr was not exceeded at any location.

## 4.4 CONCLUSIONS

No datasets from the DU building surveys exceeded the DCGL<sub>w</sub> for DU. The doses from the DU building datasets that were determined to be above background were calculated as described in **Section 2**. Although each building consists of several survey units, each building in its entirety was evaluated with the 10 mrem/yr dose limit (i.e., the hypothetical receptor would likely be exposed to residual radioactivity in all of rooms rather than only one). The following is a discussion of the release criteria evaluation by building:

- Building 5 contains eleven Class 2 survey units and five Class 3 survey units. No datasets were determined to be above background using the WRS test (**Table 4-5**). Therefore, there is no residual contamination present at Building 5 that would contribute to an above-background dose to a receptor.
- Building 306 contains four Class 2 survey units and eight Class 3 survey units. Three datasets (306 Room 10 - alpha FM; 306 Room 11 - alpha FM; and 306 Room 13 - alpha FM) were determined to be above background using the WRS test (**Table 4-6**). None of the datasets exceeded the DCGL for DU. The calculated above-background dose to a receptor is approximately 0.06 mrem/year, which is below the 10 mrem/year release criterion.
- Building 2073 contains three Class 2 survey units. One dataset (2073 Room 3 - alpha FM) was determined to be above background using the WRS test (**Table 4-7**). That dataset did not exceed the DCGL for DU. The calculated above-background dose from Building 2073 Room 3 to a receptor is approximately 0.02 mrem/year, which is below the 10 mrem/year release criterion.
- Building S-2084 contains three Class 2 survey units. One dataset (S-2084 Room 3 - alpha FM) was determined to be above background using the WRS test (**Table 4-8**). That dataset did not exceed the DCGL for DU. The calculated above-background dose from residual alpha

radiation in Building S-2084 Room 3 to a receptor is approximately 0.02 mrem/year, which is below the 10 mrem/year release criterion.

Calculated doses from the above-background igloos are summarized in **Table 4-14**. Based on these calculations, it is concluded that Buildings 5, 306, 2073, and S-2084 meet the release criterion for unrestricted use.

## 5.0 SURVEY OF BUILDING 612

As discussed in **Section 1**, Army personnel conducted radiological surveys between March and May of 1999 at Building 612, which was used to receive and store packaged DU ammunition under SUC-1275 and SUC-1380. Building 612 survey data were obtained from the Army and evaluated by Parsons for this report.

### 5.1 SITE DESCRIPTION

Army records identified Building 612 as one of the five buildings that were used for the receipt and storage of DU ammunition under NRC licenses SUC-1275 and SUC-1380 at SEDA (**Figure 1-2**). A floor plan of the Building 612 is shown in **Figure 5-1**.

Army personnel conducted a radiological survey of Building 612 in 1999 (see **Section 5.2**). The purpose of the radiological survey was to demonstrate compliance with the release criteria so that the building and the surrounding grounds could be released for unrestricted use so that the property could be transferred to the State of New York Department of Corrections. The Army concluded from the survey that there was no residual radiological contamination and recommended that the building be released for unrestricted use. A characterization survey and analysis report was submitted on behalf of the Army to serve as the basis of releasing Building 612 for unrestricted use prior to the termination of the License SUC-1275 (Parsons 2000). The NRC did not find the DCGL value for depleted uranium used in the March 2000 report acceptable; consequently, Building 612 was not released for unrestricted use (refer to letter from NRC dated July 26, 2000 in **Appendix 1.B**). However, the property around Building 612 was transferred in 2001 and Building 612 remains locked and unoccupied on the property. Based on the statement made by the NRC in the July 26, 2000 letter (**Appendix 1.B**) that “even if Building 612 is release prior to the termination of the license, Building 612 and the surrounding grounds that are transferred to the State of New York must be included in the evaluation to determine if the entire site meets the Radiological Criteria for License Termination,” Building 612 has been included in this evaluation.

Based on the potential presence of contamination and known activities within the buildings, each of the 28 interior rooms within Building 612 was classified as a Class 1 survey unit (ANL, 2003; **Table 5-1**). Exterior grounds surrounding the buildings were considered to be unaffected and were not surveyed. A gross activity  $DCGL_W$  for DU was calculated using the DCGLs from the LTP (ANL, 2003) and expected activity fractions for U-234, U-235, and U-238 in typical depleted uranium (**Table 5-2**). A  $DCGL_{EMC}$  based on the area factor for the survey grid size ( $4m^2$ ) and the worst-case component of DU (U-235) was calculated and is also listed in **Table 5-2**. No other radionuclides of concern were considered for the Building 612 survey.

### 5.2 RADIOLOGICAL SURVEY

#### 5.2.1 Survey Instrumentation

Surveys for alpha, beta, and gamma radiation were performed using the instruments listed in **Table 5-3**. Alpha and beta flag values based on background were calculated on a daily basis and used to

identify any areas of potentially elevated activity in the field. Minimum detectable activities (MDAs) that are listed in **Table 5-3** were calculated per MARSSIM.

All field instrumentation was calibrated prior to the field effort by an approved laboratory using NIST-traceable sources. Instrument function checks were performed using appropriate and dedicated check sources a minimum frequency of twice per day each instrument was used. The procedure for instrument function checks typically consisted of a source measurement and a background measurement collected in the morning, and additional source measurements at midday and at the end of the workday. Available instrument function check data for the Building 612 survey and a list of the check sources used are presented as **Appendix 5.A**.

#### 5.2.2 Number and Locations of Measurements

Within each Building 612 survey unit, a 2 m by 2 m sampling grid was established on the floors and on walls below 2 m in height. A 1 m by 1 m sampling grid was established on the walls above 2 m in height and the ceiling. Per MARSSIM, 100% of the grids below 2 meters and 10% of the grids above 2 m were included in the surveys of Building 612. At each Class 1 sampling grid, one-minute direct measurements and scanning measurements for alpha, beta, and low-energy gamma radiation were performed. In addition, smear samples were also collected and analyzed for gross alpha, beta, and gamma radiation. A post-survey evaluation of all DU building data indicated that an appropriate number of alpha and beta measurements were collected within the Class 1 survey units (**Table 5-4**). Smear samples were also collected at each direct measurement location.

For the Building 612 surveys, Building 2078 was selected as a representative background area. According to Army records, no radiological activities took place at Building 2078. Alpha and beta floor monitor and hand-held gas proportional background datasets were collected from Building 2078. The background FIDLER data collected from Building 2078 was not available to use for comparison; consequently, the gamma field measurements collected with the FIDLER from each survey unit within Building 612 were qualitatively compared with all other available background datasets, including background measurements from Igloo C0912 (collected with both closed and open energy window settings), Building 722, and the daily instrument function checks from the Building 612 survey.

### 5.3 **SURVEY RESULTS AND ANALYSIS**

#### 5.3.1 Survey Data Evaluation

The evaluation of survey data collected at Building 612 was performed in the following manner:

- Direct alpha and beta measurement datasets were compared with the background and  $DCGL_W$ -adjusted background datasets to determine if the survey unit met the release criteria.
- Direct gamma measurement datasets were compared with all available background datasets to determine if the survey unit met the release criteria.
- Individual direct measurements were compared with the  $DCGL_{EMC}$  to determine if elevated areas of radioactivity were present in the survey units.



- Smear samples were used to determine if removable contamination was present within the survey units.

### 5.3.2 Direct Measurement Evaluation

Per MARSSIM, the comparison of survey direct measurement data to background data was performed using the WRS nonparametric two-sample test. Direct measurements from each survey unit were first compared to an instrument-specific background dataset using the WRS test. If the survey unit dataset failed the initial WRS test (i.e., the null hypothesis that states that the survey and background datasets are the same was rejected), then box-and-whisker plots visually depicting the survey unit data and background data were compared. If it was determined that the survey unit dataset was elevated above background, the WRS test was repeated comparing the survey unit dataset to the DCGL<sub>W</sub>-adjusted background dataset. If the survey unit dataset failed the WRS comparison using the DCGL<sub>W</sub>-adjusted background dataset, (i.e., the null hypothesis that states that the survey and DCGL<sub>W</sub>-adjusted background datasets are the same was rejected), then box-and-whisker plots of survey and DCGL<sub>W</sub>-adjusted background data were inspected to determine which dataset was elevated. A survey unit dataset was said to not meet the site-wide release criterion when it was determined to be elevated above the DCGL<sub>W</sub>-adjusted background. Available data collected during the Building 612 surveys are tabulated in **Appendix 5.B**.

The alpha and beta direct measurements from each survey unit within Building 612 were compared to the alpha and beta background datasets using the WRS test, per MARSSIM. Datasets found to exceed background were compared to a DCGL<sub>W</sub>-adjusted background dataset with the WRS test. Summary statistics of the alpha and beta direct measurements from each survey unit, and results of the WRS tests with background, are presented in **Table 5-5**. Box-and-whisker plots of selected site and background data are presented in **Appendix 5.C**. One dataset, 612-B beta hand-held, from the 28 survey units (out of a total of 102 alpha or beta datasets) was above background and were compared to the DCGL<sub>W</sub>-adjusted background. The 612-B beta hand-held dataset was not elevated above the DCGL<sub>W</sub>-adjusted background (**Table 5-6**). The remaining alpha and beta datasets were at or below background levels.

As discussed in **Section 5.2.2**, the gamma field measurements collected from each survey unit within Building 612 were qualitatively compared to the combined FIDLER background dataset. Summary statistics for the gamma measurements from the Building 612 survey units are presented in **Table 5-7**. Box-and-whisker plots were generated for each survey unit from Building 612 and each available background dataset (**Figure 5-2**). Based on comparison of the Building 612 box-and-whisker plots with the available background, it was concluded that none of the gamma measurements are above background.

### 5.3.3 Elevated Measurement Comparison

Per MARSSIM for Class 1 survey units, all direct and scanning measurements from each building were compared directly with the DCGL<sub>EMC</sub> for DU. All alpha and beta direct measurements were below the DCGL<sub>EMC</sub>. Scanning measurements from Building 612 were not available to perform the

DCGL<sub>EMC</sub> comparison. Six survey units in Building 612 had at least one gamma measurement greater than the DCGL<sub>EMC</sub> (**Table 5-8**); however, additional information supports that these gamma measurements that were greater than the DCGL<sub>EMC</sub> are not residual radiological contamination. Each of the gamma measurements that were greater than the DCGL<sub>EMC</sub> exceed the DCGL<sub>EMC</sub> by less than 500 cpm, and there were no elevated alpha or beta measurements at these locations. It was concluded that there were no localized areas of elevated contamination within the DU buildings.

#### 5.3.4 Smear Sampling

Dry smear samples were collected over a 100 cm<sup>2</sup> area at each direct measurement location and analyzed for gross alpha, beta, and gamma radiation. A summary of the results for each igloo is presented in **Table 5-9**. The maximum detected gross alpha, beta, and gamma results for the survey units in Building 612 were 1.8, 4.7, and 75 dpm/100cm<sup>2</sup>, respectively. These results are below both the DCGL<sub>W</sub> and the limits for surface contamination from 10 CFR 835, Appendix D (listed in the footnote to **Table 5-9**).

### 5.4 CONCLUSIONS

No datasets from the Building 612 survey exceeded the DCGL<sub>W</sub> for DU. The dose from the one Building 612 dataset that was determined to be above background was calculated as described in **Section 2**. As shown in **Table 5-10**, the above-background dose from the 612-B beta handheld dataset was determined to be approximately 0.6 mrem/yr. Based on this calculation, it is concluded that Building 612 meets the release criterion for unrestricted use.

## **6 SURVEY OF WAREHOUSE 356**

As discussed in **Section 1**, Army personnel conducted radiological surveys of Warehouse 356 in June and July of 1993. Under License STC-133, Warehouse 356 was used to receive and store columbite and tantalum ore containing elevated amounts of naturally-occurring thorium and uranium. The original survey report from the Army is presented as **Appendix 6.A**. NYSDEC and NYSDOH personnel conducted a confirmatory survey of Warehouse 356 in June 1993 (**Appendix 6.B**). NRC personnel conducted a Closeout Inspection Survey of Warehouse 356 in November 1994 (**Appendix 6.C**). As a result, in December 1994, SEDA was removed from NRC License STC-133.

### **6.1 SITE DESCRIPTION**

Warehouse 356 is located in the southeast corner of SEDA (**Figure 1-2**). The warehouse is divided into five 200-foot by 200-foot sections labeled Sections A through E, as illustrated in **Figure 6-1**. Section D of the warehouse was the only section used to store the columbite and tantalum ore. Some of the ore was sold and shipped to Cabot Performance Materials Company in 1992. The remaining material was transferred in May 1993 to another Defense Logistics Agency (DLA) facility in Binghamton, New York. All material was removed from Warehouse 356 prior to the radiological survey conducted by the Army in 1993.

Because the surveys were conducted prior to the implementation of the MARSSIM guidance, a MARSSIM-based classification was not assigned to individual survey units within Section D. The other sections within, and the exterior grounds surrounding, Warehouse 356 were considered to be unaffected and were not surveyed since the licensed material was received and stored in Section D only. The original survey report prepared by the Army identified Th-232, U-238, and associated decay progeny as the radionuclides of concern (**Appendix 6.A**). Contamination limits for the survey were based on “Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material” (Guidelines; NRC 1987). The contamination limits from that document are presented along with the DCGLs for Th-232 and U-238 from the License Termination Plan (ANL, 2003) in **Table 6-1**. No other radionuclides of concern were considered for the building survey.

### **6.2 ARMY RADIOLOGICAL SURVEY**

#### **6.2.1 Survey Instrumentation**

The Army performed gamma radiation surveys using a Ludlum Model 19 MicroR meter, as listed in **Table 6-2**. Measurements were collected at a height of 1 m. Per the original survey report (**Appendix 6.A**), the MicroR meter was appropriately calibrated and checked before survey measurements were collected.

Two sets of 100 cm<sup>2</sup> smear samples were collected. One set was collected and sent offsite for gross alpha and beta analysis at the Army analytical laboratory at Fort Belvoir, Virginia. The second set of smear samples were collected and analyzed onsite for gross alpha and beta radiation using two Nuclear Measurement PC-5 gas proportional counters (**Table 6-2**). The original survey report

indicates that the onsite smear analysis results should be interpreted qualitatively due to a U-238 standard that had lost its calibration (**Appendix 6.A**).

#### 6.2.2 Number and Locations of Measurements

The floor of Section D of Warehouse 356 was divided into 25-foot by 25-foot sections. One exposure rate (i.e., gamma) measurement was collected at each 25 foot by 25-foot section at a height of one meter. For the smear samples, these sections were divided further into 5 foot by 5-foot subsections. For the smear samples sent offsite to Fort Belvoir, a smear was collected in one randomly selected 5-foot by 5-foot subsection per 25-foot by 25-foot section. For the smear samples analyzed onsite, a smear was collected in five randomly selected subsections per 25-foot by 25-foot section. In addition, one smear sample was collected along the wall adjoining each floor section, at approximately 3 feet in height. Figures showing the sampling locations are presented in **Appendix 6.A**.

Five background exposure rate measurements were collected at Warehouse 357, Section C. This area is of the same construction as Warehouse 356 and was not used for radiological activities.

#### 6.2.3 Survey Results and Analysis

The exposure rate measurements that were collected during the Warehouse 356 survey are listed in **Table 6-3**. The maximum measurement collected during the survey (24  $\mu\text{R/hr}$ ) was collected at a background location in Warehouse 357. The average and maximum measurements within Warehouse 356 were 16 and 22  $\mu\text{R/hr}$ , respectively. The average and maximum measurements for the unaffected area within Warehouse 357 were 16 and 24  $\mu\text{R/hr}$ , respectively.

Results from the smear samples that were analyzed offsite at Fort Belvoir are listed in **Table 6-4**. The maximum reported alpha and beta net count rates were 0.2 and 0.7 dpm/100cm<sup>2</sup>, respectively. Results from the smears counted onsite are listed in **Table 6-5**. The maximum gross alpha plus beta result was 8.7 dpm/100cm<sup>2</sup>. All of the smear results are below the limit of 200 dpm/100cm<sup>2</sup> for natural thorium from the Guidelines (NRC, 1987) and 10 CFR 835.

Based on the survey results it was concluded that Warehouse 356 had no residual contamination after the removal of the columbite and tantalum ores and that it could be released for unrestricted use.

### 6.3 NYSDEC/NYSDOH CONFIRMATORY SURVEY

The letter report recommending Warehouse 356 be considered a No Action SWMU is presented in **Appendix 6.B**. Three smear samples were collected by NYSDEC/NYSDOH personnel and analyzed for gross alpha and beta radiation. Neither the specific locations of the smear samples nor the instrument used to count the smears were identified. Results for all three samples were reported as “< 20” dpm for both gross alpha and gross beta. It is assumed that field measurements were also taken during this survey, but no instruments or results were reported.

## 6.4 NRC CLOSEOUT INSPECTION SURVEY

### 6.4.1 Survey Instrumentation

NRC personnel performed three types of measurements during the Closeout Inspection Survey. An Eberline 2" x 2" NaI was used to measure gamma radiation from floor and wall surfaces. Exposure rate measurements were collected with a Ludlum Model 19 MicroR meter. Direct radiation measurements were collected at both a height of 1 m and on contact with floor and wall surfaces.

### 6.4.2 Number and Locations of Measurements

Per the Closeout Inspection Report (**Appendix 6.C**), NRC personnel surveyed approximately 50% of the floor surfaces and 10% of the wall surfaces at Warehouse 356, Section D. For the closeout inspection, the NRC collected both scanning and direct measurements. However, the final number of measurements collected was not reported.

The NRC collected smear samples at 42 locations. The selection of these locations was based on areas where radioactive material was stored, where contamination was suspected, and where survey instruments indicated elevated readings.

### 6.4.3 Survey Results and Analysis

Individual gamma and exposure rate measurements were not reported in the Closeout Inspection Report. A range of 0 dpm/100cm<sup>2</sup> to 500 dpm/100cm<sup>2</sup> above background was reported for radiation levels on the floor and wall surfaces that were surveyed. Based on the field measurements, the Closeout Inspection Report concluded that surface contamination levels were below the limits for natural thorium from the Guidelines (NRC, 1987; **Table 6-1**).

Results from the smear samples collected during the NRC Closeout Inspection Survey are listed in **Table 6-6**. The smear samples were analyzed for gross alpha radiation only. The maximum reported measurement was 3.9 dpm/100cm<sup>2</sup>. It was concluded in the Closeout Inspection Report that the levels of removable contamination met the criteria for natural thorium in the Guidelines (NRC, 1987; **Table 6-1**).

## 6.5 CONCLUSIONS

Surveys conducted by the Army, the State of New York, and the NRC each concluded that Warehouse 356 met the requirements for release for unrestricted use. The criteria used in 1993-1994 to remove SEDA from license STC-133 were more stringent than the current DCGL values for Th-232 and U-238 that correspond to the 10 mrem/yr dose limit (**Table 6-1**). If the maximum reported survey measurement is used with the Th-232 DCGL<sub>w</sub> to calculate the above-background dose to a receptor, an above-background dose of

$$\frac{500 \text{ dpm}/100\text{cm}^2}{3090 \text{ dpm}/100\text{cm}^2} \times 10 \text{ mrem}/\text{yr} = 1.62 \text{ mrem}/\text{yr}$$

is calculated. Based on the available survey results, it is concluded that Warehouse 356 meets the current 10 mrem/yr release criterion and is suitable for unrestricted use.

## 7.0 SURVEYS OF NON-LICENSED AREAS

As discussed in Section 2.4, there are two additional areas at SEDA (SEAD-12 and SEAD-48) where radiological activities were performed that are included in this report. SEAD-12 is the former Weapons Storage Area (WSA; also known as the “Q” area), located at the northern end of SEDA (Figure 1-2). SEAD-48 is a row of 11 storage igloos at the southern end of SEDA that were used to temporarily store uranium pitchblende ore. SEDA became listed on the National Priorities List (NPL) on August 30, 1990 (CERCLIS and EPA ID No. NY0213820830). Both SEAD-12 and SEAD-48 are being investigated under the CERCLA program at SEDA, in accordance with the Federal Facilities Agreement (FFA) signed by the Army, NYSDEC, and the USEPA on January 21, 1993. Although SEAD-12 and SEAD-48 are not NRC sites, there is consistency between the USEPA and the NRC requirements and methodologies for evaluation of these areas using the 10 mrem/yr release criterion. Activities performed in these areas do not involve commodities licensed by the NRC; however, the areas have been included in the License Termination Report because radiological investigations have been performed at both locations. The two areas are summarized briefly in this section in order to determine their contribution to a site dose.

### 7.1 SEAD-12

As noted above, SEAD-12 is the former WSA, consisting of 20 buildings and approximately 400 acres of surrounding grounds, as shown in **Figure 7-1**. Each building performed a specific function in the process of receiving, storing, maintaining, or shipping special weapons at the site (Parsons, 2003). MARSSIM protocols were implemented in the design and execution of the surveys at SEAD-12. Survey units were classified according to known activities within the buildings or grounds that were surveyed. **Table 7-1** summarizes the historical uses and MARSSIM classification of the SEAD-12 buildings.

Parsons conducted radiological surveys of both the interior and the exterior surfaces at SEAD-12. Exterior surveys and sampling at SEAD-12 were performed in 1997 and 1998 (Parsons, 2002). The interior surveys were conducted in two phases (**Table 7-1**). Phase I of the interior surveys, which consisted of Class 1 survey units, was performed between October 1999 and January 2000. Phase II of the interior surveys, which consisted of Class 2 and 3 survey units, was performed between June and August 2001 (Parsons, 2003).

Site-specific DCGLs for soils and building surfaces were developed in 1999 to correspond to the New York State 10 mrem/yr dose limit and were approved by USEPA, NYSDEC, and NYSDOH (Parsons, 2000). The DCGLs that were developed for SEAD-12 were more conservative than those developed in the LTP (ANL, 2003) for the same radionuclide (**Table 7-2**). Although the values of the DCGLs are different, both the SEAD-12 and LTP DCGLs are based on the release criterion of 10 mrem/yr.

As a result of the exterior surveys, none of the exterior areas at SEAD-12 were found to contribute to an above-background dose. One exterior area, EM-5, has been identified as having potentially-elevated concentrations of Pb-210 (Parsons, 2002). This is believed to be the result of naturally-occurring radiation and/or potential laboratory error, and the Army is currently pursuing additional

investigation of this site with NYSDEC and USEPA. No military activities have been reported at the EM-5 area (named after a subsurface anomaly designation) and no evidence of military debris was found during the RI investigation. Subsurface anomalies identified during the RI were identified as the foundation and remains of a 19<sup>th</sup> century farmstead. The location of EM-5 is shown on **Figure 7-1**.

The interior surveys performed at SEAD-12 identified potentially-elevated areas at two locations - a hotspot on a large overhead hoist/crane in Building 819, and a hotspot on a shelf in Building 803 (Parsons, 2003). Both hotspots are believed to be the result of radium paint contamination. The shelf was disposed of as low-level radioactive waste, and remediation and confirmation sampling of the spot on the crane is pending. These areas are being addressed in coordination with NYSDEC and USEPA. All interior areas at SEAD-12 meet the 10 mrem/yr release criterion based on comparison with the 1999 SEAD-12 DCGLs.

As noted in **Sections 1** and **2**, portions of SEAD-12 that were not associated with the storage of special weapons were transferred to the KidsPeace organization in 2001. Additional property within the SEAD-12 boundary was transferred in 2003.

## 7.2 SEAD-48

SEAD-48, which is located in the southern area of SEDA (**Figure 1-2**), consists of eleven ammunition storage igloos, Igloos E0801 through E0811 (**Figure 7-2**). The SEAD-48 igloos are located within the secured area along Igloo Road No. 39 (E0800 Row). The following provides a brief history of events at SEAD-48:

- During the 1940s, 1,823 barrels of pitchblende ore were stored in the Igloos E0804 through E0811 for approximately three months (ANL, 2001). Igloos E0801 through E0803 were not used for pitchblende ore storage.
- After removal of the pitchblende ore, Igloos E0804 through E0811 were used for storage of non-radioactive army munitions until the late 1970's (U.S. Army Belvoir Research Group, 1985). Igloo E0803 was also used for this purpose.
- Licensed DU commodities were stored in Igloos E0801 and E0802 under licenses SUC-1275 and SUC-1380 until the late 1970's (U.S. AMC, 1998; ANL, 2003). These igloos were included in the DU Storage Igloo surveys conducted in 2002 (**Section 3**).
- Expanded site investigations at SEAD-48 in 1976, 1980, and 1985 indicated that levels of Ra-226, U-234, U-235, and U-238 in the soil potentially presented risks to human health and to the environment (U.S. Army Belvoir Research Group, 1985; Ford, Bacon, and Davis, Utah [FB&DU], 1981; U.S. Army Ballistic Research Laboratory, 1986).
- In July 1985, decontamination/remediation activities were performed by the Army inside and around the entrance pads to the SEAD-48 igloos (U.S. Army Belvoir R&D Center, 1985).
- The NRC conducted a follow-up post-remediation inspection in October 1987 and subsequently released Igloos E0801-E0811 for unrestricted use in a May 2, 1988 letter

(**Appendix 7.A**; ANL, 2001). Additional radiological activities did not occur at these igloos after this date.

- Subsequent investigations conducted in 1993 by NYSDOH indicated that some areas within SEAD-48 potentially contained elevated levels of radioactive contamination (NYSDOH, 1993), particularly inside and around Igloo E0804 and Igloo E0808. This prompted the Army to plan further investigation of the area.
- USEPA and NYSDEC approved the SEAD-48 Work Plan submitted by the Army in March, 2003 (Parsons, 2003).

In order to demonstrate compliance with the current State of New York release criterion, Parsons conducted interior and exterior surveys of SEAD-48 in the summer of 2003 (Parsons, 2004). MARSSIM protocols were used in the design and execution of the SEAD-48 surveys. The DCGLs from the LTP (ANL, 2003) were used to determine a gross activity DCGL for pitchblende ore using expected activity fractions for naturally-occurring constituents (NCRP, 1987). The primary ROCs for SEAD-48 were Ra-226, Th-232, U-234, U-235, and U-238. Selected decay progeny of the ROCs (Th-230, Ra-228, Th-228, Pb-210, Pa-231, and Ac-227) are also included in the gross activity DCGL.

Interior surveys identified areas of residual contamination within Igloos E0804 and E0806. In-situ gamma spectroscopy and material sampling confirmed the contamination to be the result of elevated levels of uranium ore. Although these interior survey units meet the wide-area release criterion of 10 mrem/yr, these contaminated areas will likely be remediated prior to the site release to comply with ALARA requirements. All other interior surveys met the release criterion and had no hotspots (Parsons, 2004).

Four exterior survey units (Igloos E0804, E0805, E0806, and E0811) did not meet the wide-area release criterion of 10 mrem/yr. Each of these survey units had at least one identifiable area of residual contamination. In addition, Igloo E0810 met the wide-area release criterion, but had one hotspot. In order to meet the release criterion and/or ALARA, these areas will be remediated and the survey units resurveyed. All other exterior survey units met the release criterion of 10 mrem/yr and had no hotspots (Parsons, 2004).

The Draft SEAD-48 report is currently in the review cycle with USEPA, NYSDEC, and NYSDOH. Additional remediation and investigation activities will proceed pending the review of those agencies.

### **7.3 REMAINING AREAS**

Other than at the areas listed above, additional non-licensed radiological activities did not take place at SEDA. Therefore, it is concluded that the remainder of SEDA is unaffected and levels of radioactivity are at natural background levels.



## 8.0 CONCLUSIONS AND RECOMMENDATIONS

Following the evaluation process for determining if the SEDA facility is compliant with the release criteria as outlined in **Section 2**, and illustrated in **Figure 2-1**, each radiological area within SEDA has been investigated. Areas where activities were conducted under the NRC licenses listed in **Section 1** were divided into sites, and further divided into survey units. To determine if the release criterion of 10 mrem/yr has been met at each site, a contributing radiological dose at each survey unit was calculated and the doses within a site were added together. The results from these calculations are presented in **Sections 3** through **6** of this report, respective to the area associated with the licensed radiological activity. It was determined and reported in the corresponding tables that, although there were sites with datasets or measurements above background, there were no sites with a calculated dose that exceeded the release criteria of 10 mrem/yr. The doses calculated for each site where a licensed commodity was used is listed in **Table 8-1**.

In conclusion, there are no radiological sites where licensed commodities were used that exceed the release criteria. Sites impacted by activities involving non-licensed commodities and that exceeded the release criteria (i.e. area EM-5 within SEAD-12 and certain areas within SEAD-48) are being investigated and managed under the CERCLA program in conjunction with USEPA and NYSDEC. It is SEDA's position that these isolated areas should not impact the license termination since 1) site impacts do not appear to be connected to the use of licensed commodities and 2) management of these sites is being regulated under the CERCLA program. In meeting the USEPA/NYSDEC requirements, the areas at SEDA will also meet the NRC decommissioning requirements because these areas will be remediated and/or demonstrated to meet the same standard of release of 10 mrem/yr for unrestricted use as the sites where licensed activities occurred. Consequently, it is recommended that SEDA be released from all NRC licenses and sites where licensed commodities were stored or used be released for unrestricted use. Specifically, this includes:

- 120 storage igloos (see Table 3-1);
- Building 5;
- Building 306;
- Building 612;
- Building 2073;
- Building S-2084; and
- Warehouse 356.

The following is a list of the NRC licenses to terminate or to remove SEDA from, with the supporting conclusions for the license termination or release:

License SUC-1275: The main license being terminated involved activities related to the commodity DU at the 120 storage igloos, Building 5, Building 306, Building 2073, Building S-2084, Building 612, and Warehouse 356; these areas are presented in **Sections 3, 4, 5, and 6**. It was determined that each of the sites that comprises each of the areas was below the release criteria of 10 mrem/yr (**Table 8-1**). Consequently, it is recommended that License SUC-1275 be terminated and the associated areas be released for unrestricted use.

License SUC-1380: This license is currently held by the US Army Field Support Command, Rock Island, IL, and is for the possession and storage of DU commodities. SEDA is currently listed on License SUC-1380 as a bulk quantity storage facility. Activities under this license were the same as for SUC-1275 and were conducted in the same locations listed under SUC-1275, (120 storage igloos, Building 5, Building 306, Building 2073, Building S-2084, Building 612, and Warehouse 356). As indicated above, there were no calculated doses for the associated igloos and buildings that exceed the release criteria of 10 mrem/yr (**Table 8-1**). Consequently, it is recommended that SEDA be removed from License SUC-1380 and the associated areas be released for unrestricted use.

License 45-16023-01NA: The U.S. Navy holds this license for storage of DU commodities. Since all areas used for the storage of licensed DU commodities have been shown to meet the release criteria of 10 mrem/yr, SEDA would like to confirm that the SEDA facility is no longer listed on this license, as available records indicate.

License SUB-834: The U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, MD holds this license for the possession of natural uranium, natural thorium, and DU, for the purposes of evaluating and testing munitions and projectiles. Although it is believed that SEDA at one time was authorized to, did not actually store commodities under this license on the facility and has since been removed from the license. The locations known to have stored DU commodities under the other NRC licenses meet the release criteria. Consequently, it is recommended that SEDA be removed from this license, if still currently listed.

License BML 12-00722-07: The U.S. Army Field Support Command, Rock Island, IL currently holds this license for the possession of Pm-147 to be used with military rocket sighting systems. Army records indicate that only one igloo at SEDA, Igloo A0701, stored material controlled by this license. As indicated in **Table 3-5**, survey measurements from Igloo A0701 were below background. Consequently, it is recommended that Igloo A0701 be released for unrestricted use, and if not already done, SEDA be removed from the list of approved storage facilities for License BML 12-00722-07.

License STC-133: The DLA, Fort Belvoir, VA currently holds this license for the possession of uranium and thorium ores, including columbium and tantalum minerals, for use with the National Defense Stockpile. According to Army records, activities at SEDA under this license occurred at Warehouse 356, Section D. SEDA was removed from this license in 1994, following Army, NYSDEC/NYSDOH, and NRC confirmatory surveys (**Section 6**). The supporting documentation for the removal of SEDA as a storage facility under STC-133 is presented in **Appendix 1.F**. Review of the various surveys indicates that that contributing dose at Warehouse 356 would have not been greater than 1.62 mrem/yr. Consequently, Warehouse 356 meets the current release criterion of 10 mrem/yr, and no further investigation is necessary at this site.

In conclusion, the SEDA facility has performed the appropriate investigations for termination or release from the NRC licenses listed above and has demonstrated that any radiological doses above background are below the conservative 10 mrem/yr release criteria accepted by the NRC and based on the TAGM-4003 of 10 mrem/yr. It is recommended that the SEDA be removed from all related licenses and be released for unrestricted use.

**Table 2-1**  
**Derived Concentration Guideline Levels**  
**License Termination Report**  
**Seneca Army Depot Activity**

Radionuclide <sup>(1)</sup>	Soil DCGL <sub>w</sub> (pCi/g) <sup>(2)</sup>		Surface DCGL <sub>w</sub> (dpm/100 cm <sup>2</sup> ) <sup>(3)</sup>	
Ac-227	6.9		670	
H-3	5800		2.07E+08	
Pa-231	2.5		1360	
Pb-210	5.6		1790	
Pm-147	46000		1.69E+07	
Ra-226	1.7		2870	
Ra-228	2.2		3790	
Sm-147	240		57500	
Th-228	3.8		3950	
Th-230	54		16200	
Th-232	1.5		3090	
U-234	180		35100	
U-235	33		18200	
U-238	98		31600	
	Gross Soil DCGL <sub>w</sub>	Gross Soil DCGL <sub>EMC</sub>	Gross Surface DCGL <sub>w</sub>	Gross Surface DCGL <sub>EMC</sub>
Depleted Uranium <sup>(4)</sup>	102	1214 <sup>(5)</sup>	31800	378420 <sup>(5)</sup>
Pitchblende Ore <sup>(4)</sup>	3.3	4.3 <sup>(6)</sup>	4062	34119 <sup>(7)</sup>

Notes:

- (1) Soil and surface DCGLs for the listed radionuclides were developed in the Seneca Army Depot Activity License Termination and License Release Plan (ANL, 2003; **Appendix 1.A**)
- (2) pCi/g = picocuries per gram.
- (3) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters.
- (4) Gross activity DCGLs were calculated per MARSSIM for depleted uranium and pitchblende ore using expected activity fractions from WHO, 2001 (depleted uranium) and NCRP, 1987 (uranium ore).
- (5) The DCGL<sub>EMC</sub>'s for DU were calculated using the area factor for a 4m<sup>2</sup> survey grid for U-235 (11.9) from ANL, 2003.
- (6) The soil DCGL<sub>EMC</sub> for pitchblende was calculated using the area factor for a 100m<sup>2</sup> survey grid for Ra-226 and Th-228 (AF = 1.6) from ANL, 2003.
- (7) The surface DCGL<sub>EMC</sub> for pitchblende was calculated using the area factor for a 4m<sup>2</sup> survey grid for Ra-226 (AF = 8.4) from ANL, 2003.

**Table 2-2**  
**Areas Evaluated for License Termination**  
**License Termination Report**  
**Seneca Army Depot Activity**

Site	Activities Performed	Associated NRC Licenses to Terminate/ Be Removed From	Other Ongoing Activities	Comments
120 Storage Igloos	Storage of packaged DU ammunition.	SUC-1275 SUC-1380 BML 12-00722-07	None	Activities under license BML 12-00722-07 were only performed at Igloo A0701
Building 5 Building 306 Building 2073 Building S-2084	Staging points to prepare DU ammunition for shipment.	SUC-1275 SUC-1380	None	--
Building 612	Unpacking, inspecting, and repackaging of DU ammunition.	SUC -1275 SUC-1380	None	Land transferred to State of New York in 2000 for the construction of a maximum security prison. Building has remained locked and unoccupied on the transferred property.
Warehouse 356	Possession of uranium and thorium ores, including columbium and tantalum minerals.	STC-133	Building is classified as a No Action Site under the CERCLA process with the USEPA and NYSDEC.	Removed from License STC-133 in 1994.
SEAD-12	Former Weapons Storage Area and staging location for radiological activities	None	At the feasibility study (FS) stage in the CERCLA process with USEPA and NYSDEC. Radiological final status survey (FSS) conducted as part of the CERCLA process.	--
SEAD-48	Storage of pitchblende uranium ore in the 1940's for a few months.	None <sup>(1)</sup>	FSS Investigation conducted under CERCLA process with USEPA and NYSDEC.	Released in 1988 by NRC for unrestricted use.

Notes:

(1) Two SEAD-48 Igloos (E0801 and E0802) are also included in the survey for the DU Storage Igloo Investigation

**Table 2-3**  
**Summary Statistics of Background Measurements**  
**License Termination Report**  
**Seneca Army Depot Activity**

Reference Area	Instrument <sup>(1)</sup>	Number of Measurements	Mean (cpm) <sup>(2)</sup>	St Dev (cpm)	Minimum (cpm)	Maximum (cpm)	Median (cpm)
Bldg 722	Alpha FM	15	3.8	2.4	0	8	4
Bldg 722	Beta FM	15	775	284.1	498	1435	715
Bldg 722	Alpha HH	105	3	1.9	0	8	2
Bldg 722	Beta HH	105	176	55.3	86	436	159
Bldg 722	Alpha PH	100	4	2.3	0	14	3
Bldg 722	Beta PH	100	365	186	160	1187	303.5
Bldg 722	Gamma - FIDLER out	120	11265	3307	5267	19762	11235
Bldg 2078	Alpha FM	31	7	3.4	1	13	7
Bldg 2078	Beta FM	31	951	182.2	628	1209	1065
Bldg 2078	Alpha HH	32	1	1.3	0	5	1
Bldg 2078	Beta HH	32	186	70.5	99	336	166.5
C0912 - 2000	Alpha FM	10	4.7	2	3	8	4
C0912 - 2000	Beta FM	10	707	35	650	757	711
C0912 - 2000	Alpha HH	26	2	2	0	5	2
C0912 - 2000	Beta HH	26	139	10	121	166	138
C0912 - 2000	Alpha PH	26	1	1	0	6	1
C0912 - 2000	Beta PH	26	289	41	216	411	291
C0912 - 2000	Gamma - FIDLER out	26	7889	157	7583	8219	7881
Igloos - 2002	Alpha PH	150	5	12	0	111	3
Igloos - 2002	Beta PH	150	222	56	111	596	216
Igloos - 2002	Gamma - FIDLER out	150	6445	1251	2417	7915	6973.5
C0912 - 2003	Alpha FM	22	3	2	0	6	3
C0912 - 2003	Beta FM	22	571	62	461	688	573.5
C0912 - 2003	Alpha PH	33	2	2	0	8	2
C0912 - 2003	Beta PH	33	219	28	163	286	213
C0912 - 2003	Gamma- FIDLER in	100	2785	954	924	4344	2175.5

Notes:

(1) Instruments are as follows:

Alpha/Beta FM = gas proportional floor monitor.

Alpha/Beta HH = gas proportional hand-held detector.

Alpha/Beta PH = phoswich scintillation detector.

Gamma FIDLER out = low-energy gamma scintillation detector with energy window open

Gamma FIDLER in = low-energy gamma scintillation detector with energy window set for range of 50 to 250 keV.

(2) cpm = counts per minute.

**Table 2-4**  
**Grouping of Survey Units per Site**  
**License Termination Report**  
**Seneca Army Depot Activity**

Site	Number of Survey Units
120 DU Storage Igloos	1 per Igloo
Building 306	12
Building 5	15
Building 2073	3
Building S-2084	3
Building 612	28
Warehouse 356	1
SEAD-48	
E0801	2
E0802	2
E0803	2
E0804	3
E0805	3
E0806	3
E0807	3
E0808	3
E0809	3
E0810	3
E0811	3
SEAD-12 Buildings	
800	3
802	26
803	7
804	6
805	1
806	9
807	9
809	1
810	20
812	31
813	8
814	6
815	19
816	14
817	2
819	12
823	1
824	1
825	1
827	1
SEAD-12 Exterior	11

**Table 3-1**  
**List of DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo Number <sup>(1, 2)</sup>				
A0201 <sup>(3)</sup>	B0709	C0510	D0107	E0112
A0316 <sup>(3)</sup>	B0711	C0511	D0108	E0211
A0317 <sup>(3)</sup>	B0801	C0513	D0110	E0301
A0508 <sup>(3)</sup>	B0802	C0603	D0113	E0302
A0701 <sup>(4)</sup>	B0804	C0604	D0206	E0303
A0706	B0809	C0605	D0207	E0312
A0707	B0810	C0606	D0305	E0402
A0710	B0811	C0608	D0306	E0410
A0711	B0909	C0701	D0312	E0411
A0901	C0203	C0706	D0401	E0413
A0905	C0303	C0707	D0406	E0504
A1108	C0307	C0708	D0407	E0506
A1109	C0308	C0801	D0413	E0508
B0109	C0401	C0803	D0601	E0510
B0411	C0403	C0807	D0604	E0512
B0501	C0405	C0809	D0607	E0602
B0602	C0406	C0901	D0704	E0604
B0603	C0407	C0902	D0705	E0609
B0609	C0408	C0906	D0711	E0610
B0610	C0501	C0907	D0712	E0702
B0701	C0503	C0908	D0801	E0706
B0705	C0504	C0909	D0805	E0711
B0707	C0505	D0104	E0103	E0801
B0708	C0508	D0105	E0105	E0802

Notes:

- (1) Unless otherwise noted, igloos were used for storage of packaged DU ammunition (SUC-1275).
- (2) Compiled from *Seneca Army Depot Activity License Termination and License Release Plan* (ANL, 2003).
- (3) Also potentially used for storage of special weapons (ROCs - H-3 and Pu-239)
- (4) Also used for the storage of light anti-tank rockets containing Pm-147 (BML 12-00722-07).

**Table 3-2**  
**Instrument Equivalent Derived Concentration Guideline Levels**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Applicable DCGLw	DCGLw (dpm/100cm <sup>2</sup> ) <sup>(1)</sup>	Probe Area (cm <sup>2</sup> )	Efficiency <sup>(2)</sup>	Above Background Instrument DCGLw (cpm) <sup>(3)</sup>	Background Average (cpm)	Background Dataset	Instrument Equivalent DCGLw (cpm) <sup>(4)</sup>
Alpha Phoswich	Depleted Uranium	31800	75	15%	3578	5	Igloo - 2002	3583
Beta Phoswich	Depleted Uranium	31800	75	11%	2624	222	Igloo - 2002	2846
Gamma FIDLER	Depleted Uranium	31800	126	15%	6020	6445	Igloo - 2002	12465
Alpha Phoswich	Pu-239 <sup>(5)</sup>	4240	75	15%	477	5	Igloo - 2002	482
Beta Phoswich	Pu-239	4240	75	12%	382	222	Igloo - 2002	604
Gamma FIDLER	Pu-239	4240	126	15%	803	6445	Igloo - 2002	7248

Notes:

- (1) Depleted uranium DCGL calculated using equation 4-4 of MARSSIM. Expected activity fractions for depleted uranium based on uranium depleted to 99.8 weight percent U-238, 0.2 weight percent U-235, and 0.0008 weight percent U-234 (WHO, 2001).
- (2) Average efficiency for instrument during survey based on daily instrument function checks (refer to **Appendix 3.A**).
- (3) The Above Background Instrument DCGLw is calculated using the instrument efficiency and probe area.
- (4) The Equivalent DCGLw for each instrument is the sum of the Above Background Instrument DCGLw and the Background Average for that instrument. The value is used for a direct comparison against site measurements.
- (5) Pu-239 is an ROC at Igloos A0201, A0316, A0317, and A0508. H-3 is also an ROC at those igloos, however the DCGL for Pu-239 is used because it is more conservative than the DCGL for H-3 (**Table 2-1**).



**Table 3-3**  
**Survey Instrumentation**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Measurement Type	Probe	Meter	Probe Area (cm <sup>2</sup> ) <sup>(1)</sup>	Average Instrument Efficiency <sup>(2)</sup>	1-Minute Direct Measurement MDA (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Scanning MDA (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	DCGLw for DU (dpm/100cm <sup>2</sup> ) <sup>(4)</sup>
Phoswich	Alpha/Beta	Ludlum Model 43-1-1	Ludlum Model 2224	75	Alpha: 15% Beta: 11%	Alpha: 50 Beta: 462	5444	31800
FIDLER	Low-Energy Gamma	Bicron G5 FIDLER	Bicron Analyst	126	15%	1090	11942	31800
Exposure Rate	Ambient Gamma Exposure Rate	Bicron MicroRem or Ludlum Model 19		-- <sup>(5)</sup>	--	--	--	NA <sup>(6)</sup>
GM Pancake	Alpha/Beta/Gamma	Ludlum Model 44-9	Ludlum Model 3	15	20%	--	2200-5000	NA
Gamma Spectrometer	In-Situ Gamma	Alpha Spectra FIDLER	RSA URSA-I MCA	126	15%	1090 for gross 1-minute count; otherwise measurement-specific	--	31800
E-Perm	Radon	RadElec SST E-Perm		--	--	0.2 to 0.5 pCi/L <sup>(7)</sup>	--	NA

Notes:

1) cm<sup>2</sup> = square centimeters.

2) Except where noted, the average instrument efficiency was determined from the daily instrument function check data (refer to **Appendix 3.A**).

3) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Except where noted, the minimum detectable amounts (MDAs) were calculated using the procedures outlined in MARSSIM Section 6.7 (NRC, 2000).

4) Gross activity DCGL<sub>w</sub> was calculated using radionuclide-specific DCGLs derived in the License Termination Plan (ANL 2003; **Appendix 1.A**).

5) "--" = Indicates that parameter was not used or calculated for instrument.

6) NA= not applicable. DCGLs were not applied to exposure rate, personnel/equipment frisking, or radon measurements.

7) pCi/L = picocuries per liter; MDA values from MARSSIM Table 6.10 (NRC, 2000).

**Table 3-4**  
**Total Number of Required Measurements**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Dataset <sup>(1)</sup>	Gross Activity DCGLw (dpm/100cm2) <sup>(2)</sup>	Instrument Specific DCGLw (cpm) <sup>(3)</sup>	LBGR <sup>(4)</sup>	$\Delta$ <sup>(5)</sup>	Observed Survey $\sigma$ (cpm) <sup>(6)</sup>	Observed Bkgd $\sigma$ (cpm)	$\Delta/\sigma$ <sup>(7)</sup>	Pr <sup>(8)</sup>	Z(1- $\alpha$ ) <sup>(9)</sup>	Z(1- $\beta$ ) <sup>(9)</sup>	Total N <sup>(10)</sup>
<b>A Block</b>											
Gamma FIDLER & Igloo Background	31800	12465	6233	6233	1440	1251	4.3	1.00	1.645	1.645	14
Alpha PH & Igloo Background	31800	3583	1792	1792	7.5	12	149.3	1.00	1.645	1.645	14
Beta PH & Igloo Background	31800	2846	1423	1423	56	56	25.4	1.00	1.645	1.645	14
<b>B Block</b>											
Gamma FIDLER & Igloo Background	31800	12645	6323	6323	1217	1251	5.1	1.00	1.645	1.645	14
Alpha PH & Igloo Background	31800	3583	1792	1792	5.7	12	149.3	1.00	1.645	1.645	14
Beta PH & Igloo Background	31800	2846	1423	1423	43	56	25.4	1.00	1.645	1.645	14
<b>C Block</b>											
Gamma FIDLER & Igloo Background	31800	12465	6233	6233	899	1251	5.0	1.00	1.645	1.645	14
Alpha PH & Igloo Background	31800	3583	1792	1792	9.9	12	149.3	1.00	1.645	1.645	14
Beta PH & Igloo Background	31800	2846	1423	1423	48	56	25.4	1.00	1.645	1.645	14
<b>D Block</b>											
Gamma FIDLER & Igloo Background	31800	12465	6233	6233	1408	1251	4.4	1.00	1.645	1.645	14
Alpha PH & Igloo Background	31800	3583	1792	1792	5.7	12	149.3	1.00	1.645	1.645	14
Beta PH & Igloo Background	31800	2846	1423	1423	45	56	25.4	1.00	1.645	1.645	14

**Table 3-4**  
**Total Number of Required Measurements**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Dataset <sup>(1)</sup>	Gross Activity DCGLw (dpm/100cm <sup>2</sup> ) <sup>(2)</sup>	Instrument Specific DCGLw (cpm) <sup>(3)</sup>	LBGR <sup>(4)</sup>	$\Delta$ <sup>(5)</sup>	Observed Survey $\sigma$ (cpm) <sup>(6)</sup>	Observed Bkgd $\sigma$ (cpm)	$\Delta/\sigma$ <sup>(7)</sup>	Pr <sup>(8)</sup>	Z(1- $\alpha$ ) <sup>(9)</sup>	Z(1- $\beta$ ) <sup>(9)</sup>	Total N <sup>(10)</sup>
<b>E Block</b>											
Gamma FIDLER & Igloo Background	31800	12465	6233	6233	1377	1251	4.5	1.00	1.645	1.645	14
Alpha PH & Igloo Background	31800	3583	1792	1792	12	12	149.3	1.00	1.645	1.645	14
Beta PH & Igloo Background	31800	2846	1423	1423	54	56	25.4	1.00	1.645	1.645	14

Notes:

(1) Measurements are combined for each "block" of igloos, Block A through Block E. Instruments: PH = alpha/beta phoswich detector; FIDLER = low-energy gamma scintillator.

(2) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Gross activity DCGLw for DU calculated per MARSSIM.

(3) cpm = counts per minute. Instrument-specific DCGLw calculated per MARSSIM. Includes average background count rate.

(4) LBGR = lower bound of gray region. Per MARSSIM, LBGR was set to 1/2 of the DCGLw.

(5)  $\Delta$  = DCGLw - LBGR.

(6) The standard deviation ( $\sigma$ ) for the survey data includes all measurements collected with that instrument.

(7)  $\Delta/\sigma$  calculated using the larger value between the survey standard deviation and the background standard deviation.

(8) Values of Pr are from Table 5.1 of MARSSIM using  $\Delta/\sigma$ . Pr is defined by MARSSIM as the probability that a random measurement from the survey unit exceeds a random measurement from the background reference area by less than the DCGLw when the survey unit median is equal to the LBGR above background.

(9) Values of Z(1- $\alpha$ ) and Z(1- $\beta$ ) (decision error percentiles) are from Table 5.2 of MARSSIM for  $\alpha=\beta=0.05$ .

(10) N = total required number of measurements or samples (includes both survey and background areas).

**Table 3-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**A-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
A0201	Alpha PH	3	2	0	7	2	30	150	2455	13835	-1.0	0.31	Pass	
A0201	Beta PH	214	218	108	277	38	30	150	2725	13565	0.0	0.97	Pass	
A0201	Gamma FIDLER	4554	4765	1894	5094	714	30	150	1071	15219	-6.3	2.8E-10	Fail	Background
A0316	Alpha PH	2	2	0	6	2	30	150	2237	14053	-1.9	0.064	Pass	
A0316	Beta PH	224	227	138	276	35	30	150	3025	13265	1.2	0.23	Pass	
A0316	Gamma FIDLER	4568	4806	1630	4985	807	30	150	1110	15181	-6.2	7.2E-10	Fail	Background
A0317	Alpha PH	3	2	0	6	2	30	150	2579	13712	-0.5	0.60	Pass	
A0317	Beta PH	208	212	117	276	39	30	150	2477	13813	-0.9	0.36	Pass	
<b>A0317</b>	<b>Gamma FIDLER</b>	<b>6943</b>	<b>7278</b>	<b>2696</b>	<b>7650</b>	<b>1216</b>	<b>30</b>	<b>150</b>	<b>3523</b>	<b>12767</b>	<b>3.1</b>	<b>1.9E-03</b>	<b>Fail</b>	<b>A0317</b>
A0508	Alpha PH	4	4	0	8	2	30	150	3132	13158	1.6	0.11	Pass	
A0508	Beta PH	232	230	116	361	51	30	150	3098	13192	1.5	0.14	Pass	
<b>A0508</b>	<b>Gamma FIDLER</b>	<b>7157</b>	<b>7475</b>	<b>3111</b>	<b>8056</b>	<b>1150</b>	<b>30</b>	<b>150</b>	<b>3938</b>	<b>12353</b>	<b>4.7</b>	<b>3.0E-06</b>	<b>Fail</b>	<b>A0508</b>
A0701	Alpha PH	2	2	0	4	1	30	150	2172	14118	-2.1	0.035	Fail	Background
A0701	Beta PH	206	202	124	381	54	30	150	2188	14102	-2.0	0.043	Fail	Background
A0701	Gamma FIDLER	4289	4429	2196	4785	478	30	150	744	15547	-7.6	3.8E-14	Fail	Background
<b>A0706</b>	<b>Alpha PH</b>	<b>5</b>	<b>4</b>	<b>1</b>	<b>18</b>	<b>3</b>	<b>30</b>	<b>150</b>	<b>3364</b>	<b>12927</b>	<b>2.5</b>	<b>0.012</b>	<b>Fail</b>	<b>A0706</b>
A0706	Beta PH	239	225	148	608	79	30	150	3046	13244	1.3	0.20	Pass	
<b>A0706</b>	<b>Gamma FIDLER</b>	<b>7039</b>	<b>7233</b>	<b>3540</b>	<b>8007</b>	<b>828</b>	<b>30</b>	<b>150</b>	<b>3445</b>	<b>12846</b>	<b>2.8</b>	<b>5.1E-03</b>	<b>Fail</b>	<b>A0706</b>
A0707	Alpha PH	3	2	0	17	3	30	150	2353	13938	-1.4	0.16	Pass	
A0707	Beta PH	225	204	143	415	61	30	150	2619	13671	-0.4	0.71	Pass	
<b>A0707</b>	<b>Gamma FIDLER</b>	<b>7119</b>	<b>7261</b>	<b>5045</b>	<b>7559</b>	<b>535</b>	<b>30</b>	<b>150</b>	<b>3556</b>	<b>12735</b>	<b>3.2</b>	<b>1.3E-03</b>	<b>Fail</b>	<b>A0707</b>
A0710	Alpha PH	3	2	0	29	5	30	150	2305	13985	-1.6	0.11	Pass	
<b>A0710</b>	<b>Beta PH</b>	<b>239</b>	<b>241</b>	<b>121</b>	<b>413</b>	<b>54</b>	<b>30</b>	<b>150</b>	<b>3293</b>	<b>12997</b>	<b>2.2</b>	<b>0.027</b>	<b>Fail</b>	<b>A0710</b>
A0710	Gamma FIDLER	4456	4546	2583	4920	424	30	150	814	15476	-7.3	3.0E-13	Fail	Background
<b>A0711</b>	<b>Alpha PH</b>	<b>7</b>	<b>4</b>	<b>1</b>	<b>64</b>	<b>11</b>	<b>30</b>	<b>150</b>	<b>3291</b>	<b>13000</b>	<b>2.2</b>	<b>0.026</b>	<b>Fail</b>	<b>A0711</b>
A0711	Beta PH	233	222	161	389	46	30	150	3092	13199	1.4	0.15	Pass	
A0711	Gamma FIDLER	6911	7040	3762	7861	689	30	150	2955	13336	0.9	0.36	Pass	
A0901	Alpha PH	2	1	0	30	5	30	150	1614	14676	-4.3	1.9E-05	Fail	Background
<b>A0901</b>	<b>Beta PH</b>	<b>238</b>	<b>235</b>	<b>145</b>	<b>407</b>	<b>47</b>	<b>30</b>	<b>150</b>	<b>3310</b>	<b>12981</b>	<b>2.3</b>	<b>0.022</b>	<b>Fail</b>	<b>A0901</b>
A0901	Gamma FIDLER	4466	4582	2115	4908	582	30	150	871	15419	-7.1	1.5E-12	Fail	Background
A0905	Alpha PH	3	1	0	49	9	30	150	1915	14375	-3.1	1.9E-03	Fail	Background
<b>A0905</b>	<b>Beta PH</b>	<b>243</b>	<b>246</b>	<b>136</b>	<b>350</b>	<b>58</b>	<b>30</b>	<b>150</b>	<b>3249</b>	<b>13041</b>	<b>2.0</b>	<b>0.040</b>	<b>Fail</b>	<b>A0905</b>

**Table 3-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**A-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
A0905	Gamma FIDLER	4573	4684	2289	5060	505	30	150	945	15346	-6.8	1.1E-11	Fail	Background
A1108	Alpha PH	2	1	0	29	5	30	150	1825	14465	-3.5	5.5E-04	Fail	Background
A1108	Beta PH	198	194	140	334	40	30	150	1990	14300	-2.8	5.4E-03	Fail	Background
A1108	Gamma FIDLER	6587	6783	3234	7364	787	30	150	2310	13980	-1.6	0.12	Pass	
A1109	Alpha PH	2	2	0	13	3	30	150	2145	14145	-2.2	0.027	Fail	Background
A1109	Beta PH	233	228	144	513	65	30	150	2945	13346	0.9	0.38	Pass	
A1109	Gamma FIDLER	4472	4531	2287	4957	490	30	150	863	15428	-7.1	1.2E-12	Fail	Background

Notes:

(1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

(3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.

(4) The statistical parameters Z and p-level were generated by the Statistica software package.

(5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.

(6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 3.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).

If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 3-6**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**B-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
B0109	Alpha PH	2	1	0	6	2	30	150	1814	14477	-3.5	4.7E-04	Fail	Background
B0109	Beta PH	202	199	117	273	32	30	150	2181	14109	-2.0	0.040	Fail	Background
B0109	Gamma FIDLER	6812	6937	3084	7399	779	30	150	2731	13560	0.1	0.95	Pass	
B0411	Alpha PH	1	1	0	4	1	30	150	1540	14751	-4.6	5.0E-06	Fail	Background
B0411	Beta PH	215	210	130	277	40	30	150	2668	13623	-0.2	0.86	Pass	
B0411	Gamma FIDLER	4332	4370	2381	4955	489	30	150	825	15465	-7.3	4.0E-13	Fail	Background
B0501	Alpha PH	1	0	0	8	2	30	150	1179	15112	-6.0	2.4E-09	Fail	Background
B0501	Beta PH	181	177	97	252	31	30	150	1489	14801	-4.7	3.0E-06	Fail	Background
B0501	Gamma FIDLER	6477	6752	2046	7274	1109	30	150	2248	14043	-1.8	0.073	Pass	
B0602	Alpha PH	2	2	0	11	2	30	150	2118	14173	-2.3	0.020	Fail	Background
B0602	Beta PH	191	189	131	256	32	30	150	1815	14476	-3.5	5.5E-04	Fail	Background
B0602	Gamma FIDLER	6803	6992	3624	7521	718	30	150	2694	13596	-0.1	0.94	Pass	
B0603	Alpha PH	2	1	0	10	2	30	150	1811	14479	-3.5	4.5E-04	Fail	Background
B0603	Beta PH	197	191	124	270	35	30	150	2030	14260	-2.6	8.6E-03	Fail	Background
B0603	Gamma FIDLER	6904	7079	3638	7532	738	30	150	3022	13269	1.2	0.24	Pass	
B0609	Alpha PH	3	2	0	19	3	30	150	2239	14052	-1.9	0.064	Pass	
B0609	Beta PH	219	218	100	294	47	30	150	2783	13508	0.3	0.80	Pass	
B0609	Gamma FIDLER	6730	6834	3446	7636	738	30	150	2513	13778	-0.8	0.44	Pass	
B0610	Alpha PH	2	1	0	19	3	30	150	1636	14655	-4.2	2.8E-05	Fail	Background
B0610	Beta PH	203	195	132	278	44	30	150	2266	14024	-1.7	0.085	Pass	
B0610	Gamma FIDLER	6851	6962	3477	7841	778	30	150	2866	13424	0.6	0.56	Pass	
B0701	Alpha PH	4	3	0	42	7	30	150	2796	13495	0.3	0.75	Pass	
B0701	Beta PH	205	212	113	267	41	30	150	2414	13876	-1.2	0.25	Pass	
B0701	Gamma FIDLER	6923	7126	3628	7609	780	30	150	3127	13163	1.6	0.11	Pass	
B0705	Alpha PH	3	2	0	39	7	30	150	2338	13953	-1.5	0.14	Pass	
B0705	Beta PH	204	203	108	291	45	30	150	2341	13950	-1.4	0.15	Pass	
B0705	Gamma FIDLER	6755	6924	3373	7372	744	30	150	2615	13675	-0.4	0.70	Pass	
B0707	Alpha PH	4	3	1	18	3	30	150	3052	13238	1.3	0.19	Pass	
B0707	Beta PH	207	207	126	287	39	30	150	2377	13914	-1.3	0.19	Pass	
B0707	Gamma FIDLER	6595	6926	3476	7772	911	30	150	2511	13780	-0.8	0.43	Pass	
B0708	Alpha PH	2	1	0	16	3	30	150	1696	14594	-4.0	7.6E-05	Fail	Background
B0708	Beta PH	192	191	127	293	37	30	150	1851	14440	-3.3	9.1E-04	Fail	Background
B0708	Gamma FIDLER	6814	6976	3552	7347	747	30	150	2779	13511	0.2	0.81	Pass	
B0709	Alpha PH	1	1	0	9	2	30	150	1461	14829	-4.9	1.0E-06	Fail	Background
B0709	Beta PH	197	190	99	300	47	30	150	2073	14217	-2.5	0.014	Fail	Background
B0709	Gamma FIDLER	6707	6975	3386	7513	958	30	150	2691	13600	-0.1	0.93	Pass	

**Table 3-6**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**B-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
B0711	Alpha PH	1	0	0	13	3	30	150	1492	14799	-4.7	2.0E-06	Fail	Background
B0711	Beta PH	208	202	143	346	42	30	150	2262	14028	-1.7	0.082	Pass	
B0711	Gamma FIDLER	6647	6824	3269	7346	773	30	150	2437	13854	-1.1	0.29	Pass	
B0801	Alpha PH	2	1	0	21	4	30	150	1612	14679	-4.3	1.8E-05	Fail	Background
B0801	Beta PH	196	198	120	247	31	30	150	2023	14267	-2.7	7.9E-03	Fail	Background
B0801	Gamma FIDLER	4555	4659	2512	5008	487	30	150	969	15321	-6.7	2.1E-11	Fail	Background
B0802	Alpha PH	2	1	0	20	4	30	150	1755	14536	-3.7	1.9E-04	Fail	Background
B0802	Beta PH	196	202	116	240	33	30	150	2023	14268	-2.7	7.9E-03	Fail	Background
B0802	Gamma FIDLER	4349	4454	2366	4910	486	30	150	807	15483	-7.3	2.4E-13	Fail	Background
B0804	Alpha PH	1	1	0	13	2	30	150	1502	14788	-4.7	2.0E-06	Fail	Background
B0804	Beta PH	192	183	115	276	43	30	150	1949	14341	-2.9	3.3E-03	Fail	Background
B0804	Gamma FIDLER	4332	4431	2304	4675	438	30	150	745	15545	-7.6	4.0E-14	Fail	Background
<b>B0809</b>	<b>Alpha PH</b>	<b>6</b>	<b>5</b>	<b>0</b>	<b>57</b>	<b>10</b>	<b>30</b>	<b>150</b>	<b>3314</b>	<b>12976</b>	<b>2.3</b>	<b>0.020</b>	<b>Fail</b>	<b>B0809</b>
B0809	Beta PH	228	208	132	486	71	30	150	2752	13538	0.1	0.89	Pass	
B0809	Gamma FIDLER	6673	6855	3957	7168	665	30	150	2420	13871	-1.1	0.26	Pass	
<b>B0810</b>	<b>Alpha PH</b>	<b>5</b>	<b>4</b>	<b>0</b>	<b>31</b>	<b>5</b>	<b>30</b>	<b>150</b>	<b>3276</b>	<b>13015</b>	<b>2.2</b>	<b>0.030</b>	<b>Fail</b>	<b>B0810</b>
B0810	Beta PH	217	214	143	354	43	30	150	2634	13657	-0.3	0.75	Pass	
B0810	Gamma FIDLER	6621	6800	3157	7241	758	30	150	2282	14008	-1.7	0.097	Pass	
B0811	Alpha PH	2	1	0	36	6	30	150	1668	14623	-4.1	4.8E-05	Fail	Background
B0811	Beta PH	208	201	131	295	43	30	150	2404	13886	-1.2	0.23	Pass	
B0811	Gamma FIDLER	6973	7136	3730	7736	802	30	150	3225	13065	2.0	0.050	Pass	
B0909	Alpha PH	3	1	0	42	8	30	150	1723	14567	-3.9	1.2E-04	Fail	Background
B0909	Beta PH	204	208	109	331	43	30	150	2274	14017	-1.7	0.090	Pass	
<b>B0909</b>	<b>Gamma FIDLER</b>	<b>7302</b>	<b>7416</b>	<b>3834</b>	<b>8358</b>	<b>835</b>	<b>30</b>	<b>150</b>	<b>3912</b>	<b>12379</b>	<b>4.6</b>	<b>4.0E-06</b>	<b>Fail</b>	<b>B0909</b>

Notes:

- (1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.
- (2) cpm = counts per minute.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 3.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 3-7**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**C-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
<b>C0203</b>	<b>Alpha PH</b>	<b>5</b>	<b>4</b>	<b>1</b>	<b>21</b>	<b>4</b>	<b>30</b>	<b>150</b>	<b>3450</b>	<b>12840</b>	<b>2.8</b>	<b>4.4E-03</b>	<b>Fail</b>	<b>C0203</b>
C0203	Beta PH	199	195	108	288	34	30	150	2054	14236	-2.5	0.011	Fail	Background
C0203	Gamma FIDLER	6736	6731	3531	7599	730	30	150	2550	13741	-0.6	0.53	Pass	
C0303	Alpha PH	5	1	0	101	18	30	150	1665	14626	-4.1	4.5E-05	Fail	Background
C0303	Beta PH	208	210	110	500	64	30	150	2209	14082	-1.9	0.052	Pass	
C0303	Gamma FIDLER	6424	6525	3271	7233	714	30	150	1977	14313	-2.8	4.6E-03	Fail	Background
C0307	Alpha PH	5	2	0	91	16	30	150	2404	13887	-1.2	0.23	Pass	
C0307	Beta PH	214	204	127	478	59	30	150	2407	13883	-1.2	0.24	Pass	
C0307	Gamma FIDLER	6651	6755	3328	7461	780	30	150	2445	13845	-1.0	0.30	Pass	
C0308	Alpha PH	6	3	0	101	18	30	150	2742	13548	0.1	0.92	Pass	
C0308	Beta PH	198	182	159	489	60	30	150	1722	14568	-3.8	1.4E-04	Fail	Background
C0308	Gamma FIDLER	6703	6771	3980	7317	628	30	150	2401	13890	-1.2	0.23	Pass	
C0401	Alpha PH	5	2	0	71	13	30	150	2338	13953	-1.5	0.14	Pass	
C0401	Beta PH	208	205	111	430	53	30	150	2302	13989	-1.6	0.11	Pass	
C0401	Gamma FIDLER	6634	6722	3358	7290	711	30	150	2300	13991	-1.6	0.11	Pass	
C0403	Alpha PH	4	2	0	57	10	30	150	2138	14153	-2.2	0.024821	Fail	Background
C0403	Beta PH	194	189	114	340	39	30	150	1821	14469	-3.4	6.0E-04	Fail	Background
C0403	Gamma FIDLER	6795	6911	3943	7380	646	30	150	2641	13650	-0.3	0.77	Pass	
C0405	Alpha PH	3	2	0	30	5	30	150	2242	14048	-1.8	0.066	Pass	
C0405	Beta PH	189	189	107	258	31	30	150	1764	14526	-3.7	2.6E-04	Fail	Background
C0405	Gamma FIDLER	6559	6708	3399	7262	741	30	150	2160	14131	-2.1	0.033	Fail	Background
C0406	Alpha PH	4	2	0	68	12	30	150	2176	14115	-2.1	0.036	Fail	Background
C0406	Beta PH	202	202	119	397	48	30	150	2107	14183	-2.3	0.020	Fail	Background
C0406	Gamma FIDLER	6537	6714	3369	7012	704	30	150	2072	14219	-2.5	0.014	Fail	Background
C0407	Alpha PH	3	1	0	63	11	30	150	1597	14693	-4.3	1.4E-05	Fail	Background
C0407	Beta PH	200	196	125	426	51	30	150	1968	14322	-2.9	4.1E-03	Fail	Background
C0407	Gamma FIDLER	6496	6595	3477	7174	658	30	150	2050	14241	-2.6	0.011	Fail	Background
C0408	Alpha PH	1	1	0	11	2	30	150	1455	14835	-4.9	1.0E-06	Fail	Background
C0408	Beta PH	183	175	142	332	35	30	150	1421	14869	-5.0	1.0E-06	Fail	Background
C0408	Gamma FIDLER	6604	6754	3696	7324	673	30	150	2221	14069	-1.9	0.058	Pass	
C0501	Alpha PH	2	2	0	6	2	30	150	1947	14344	-3.0	2.8E-03	Fail	Background
C0501	Beta PH	186	191	115	264	34	30	150	1712	14579	-3.9	1.2E-04	Fail	Background
C0501	Gamma FIDLER	6611	6748	3352	7199	712	30	150	2254	14037	-1.8	0.076	Pass	
C0503	Alpha PH	4	2	0	51	9	30	150	2366	13924	-1.4	0.18	Pass	



**Table 3-7**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**C-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
C0503	Beta PH	191	190	149	318	32	30	150	1633	14657	-4.2	3.3E-05	Fail	Background
C0503	Gamma FIDLER	6815	6940	4031	7475	626	30	150	2666	13624	-0.2	0.85	Pass	
C0504	Alpha PH	3	1	0	33	6	30	150	2081	14210	-2.5	0.014	Fail	Background
C0504	Beta PH	193	194	122	321	35	30	150	1783	14507	-3.6	3.5E-04	Fail	Background
C0504	Gamma FIDLER	6716	6884	3552	7675	716	30	150	2478	13813	-0.9	0.36	Pass	
C0505	Alpha PH	5	3	0	70	12	30	150	2520	13771	-0.8	0.45	Pass	
C0505	Beta PH	205	206	137	451	54	30	150	2114	14176	-2.3	0.021	Fail	Background
C0505	Gamma FIDLER	6852	6943	3631	7622	691	30	150	2804	13487	0.3	0.73	Pass	
C0508	Alpha PH	4	2	0	44	8	30	150	2340	13950	-1.5	0.15	Pass	
C0508	Beta PH	196	194	135	372	43	30	150	1859	14431	-3.3	1.0E-03	Fail	Background
C0508	Gamma FIDLER	6782	6938	3845	7785	669	30	150	2583	13707	-0.5	0.61	Pass	
C0510	Alpha PH	2	1	0	21	4	30	150	1840	14451	-3.4	6.7E-04	Fail	Background
C0510	Beta PH	190	176	127	569	77	30	150	1493	14798	-4.7	3.0E-06	Fail	Background
C0510	Gamma FIDLER	6684	6931	3552	7165	769	30	150	2484	13807	-0.9	0.37	Pass	
C0511	Alpha PH	2	2	0	11	2	30	150	2211	14079	-2.0	0.050	Pass	
C0511	Beta PH	188	188	135	248	30	30	150	1691	14600	-3.9	8.4E-05	Fail	Background
C0511	Gamma FIDLER	6217	6387	3367	7151	759	30	150	1907	14383	-3.1	1.9E-03	Fail	Background
C0513	Alpha PH	1	1	0	6	1	30	150	1550	14741	-4.5	6.0E-06	Fail	Background
C0513	Beta PH	187	188	132	274	37	30	150	1703	14587	-3.9	1.0E-04	Fail	Background
C0513	Gamma FIDLER	6787	6942	3565	7660	726	30	150	2652	13639	-0.2	0.81	Pass	
C0603	Alpha PH	7	2	0	139	25	30	150	2331	13960	-1.5	0.14	Pass	
C0603	Beta PH	208	193	121	699	102	30	150	1954	14337	-2.9	3.5E-03	Fail	Background
C0603	Gamma FIDLER	6499	6663	3705	7065	620	30	150	2003	14287	-2.7	6.3E-03	Fail	Background
C0604	Alpha PH	3	1	0	46	8	30	150	1765	14525	-3.7	2.3E-04	Fail	Background
C0604	Beta PH	188	178	126	363	43	30	150	1601	14689	-4.3	1.9E-05	Fail	Background
C0604	Gamma FIDLER	6369	6524	3089	7638	712	30	150	1891	14400	-3.2	1.6E-03	Fail	Background
C0605	Alpha PH	2	1	0	24	4	30	150	1826	14465	-3.5	5.5E-04	Fail	Background
C0605	Beta PH	204	196	138	308	39	30	150	2122	14168	-2.3	0.023	Fail	Background
C0605	Gamma FIDLER	6333	6467	3207	6868	671	30	150	1829	14461	-3.4	6.7E-04	Fail	Background
C0606	Alpha PH	1	0	0	10	2	30	150	1358	14933	-5.3	1.3E-07	Fail	Background
C0606	Beta PH	194	192	118	304	32	30	150	1850	14440	-3.3	9.0E-04	Fail	Background
C0606	Gamma FIDLER	6416	6505	4517	6986	458	30	150	1858	14432	-3.3	1.0E-03	Fail	Background
C0608	Alpha PH	2	2	0	20	4	30	150	1955	14336	-3.0	3.1E-03	Fail	Background
C0608	Beta PH	182	182	113	268	29	30	150	1500	14791	-4.7	3.0E-06	Fail	Background

**Table 3-7**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**C-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
C0608	Gamma FIDLER	5246	5518	2884	6489	966	30	150	1327	14964	-5.3	9.9E-08	Fail	Background
C0701	Alpha PH	4	2	0	59	11	30	150	2018	14273	-2.7	6.8E-03	Fail	Background
C0701	Beta PH	203	191	124	474	62	30	150	1987	14304	-2.8	5.2E-03	Fail	Background
C0701	Gamma FIDLER	6774	6924	3971	7462	638	30	150	2538	13752	-0.7	0.50	Pass	
C0706	Alpha PH	6	3	0	99	18	30	150	2783	13507	0.3	0.79	Pass	
C0706	Beta PH	202	195	140	512	65	30	150	1875	14415	-3.2	1.3E-03	Fail	Background
C0706	Gamma FIDLER	6611	6779	3562	7122	701	30	150	2228	14062	-1.9	0.062	Pass	
C0707	Alpha PH	3	3	0	29	5	30	150	2561	13730	-0.6	0.55	Pass	
C0707	Beta PH	204	205	129	287	33	30	150	2232	14059	-1.9	0.063	Pass	
C0707	Gamma FIDLER	6780	6933	3446	7484	748	30	150	2666	13624	-0.2	0.85	Pass	
C0708	Alpha PH	3	2	0	31	6	30	150	1998	14293	-2.8	5.3E-03	Fail	Background
C0708	Beta PH	192	187	125	300	34	30	150	1770	14520	-3.6	2.9E-04	Fail	Background
C0708	Gamma FIDLER	6759	6929	3410	7411	766	30	150	2590	13700	-0.5	0.63	Pass	
C0801	Alpha PH	1	1	0	3	1	30	150	1259	15032	-5.7	1.5E-08	Fail	Background
C0801	Beta PH	188	188	127	297	33	30	150	1656	14635	-4.1	4.8E-05	Fail	Background
<b>C0801</b>	<b>Gamma FIDLER</b>	<b>7039</b>	<b>7231</b>	<b>3551</b>	<b>7594</b>	<b>775</b>	<b>30</b>	<b>150</b>	<b>3430</b>	<b>12860</b>	<b>2.7</b>	<b>6.1E-03</b>	<b>Fail</b>	<b>C0801</b>
C0803	Alpha PH	1	1	0	3	1	30	150	1475	14815	-4.8	1.0E-06	Fail	Background
C0803	Beta PH	197	198	131	282	37	30	150	2047	14243	-2.6	0.010	Fail	Background
<b>C0803</b>	<b>Gamma FIDLER</b>	<b>7127</b>	<b>7265</b>	<b>3860</b>	<b>7737</b>	<b>746</b>	<b>30</b>	<b>150</b>	<b>3677</b>	<b>12614</b>	<b>3.7</b>	<b>2.2E-04</b>	<b>Fail</b>	<b>C0803</b>
C0807	Alpha PH	1	1	0	13	2	30	150	1402	14888	-5.1	3.4E-07	Fail	Background
C0807	Beta PH	189	183	116	287	35	30	150	1713	14578	-3.8	1.2E-04	Fail	Background
C0807	Gamma FIDLER	6863	7033	3668	7582	731	30	150	2862	13429	0.6	0.57	Pass	
C0809	Alpha PH	3	1	0	37	7	30	150	1994	14296	-2.8	5.2E-03	Fail	Background
C0809	Beta PH	200	194	118	358	55	30	150	1961	14329	-2.9	3.8E-03	Fail	Background
C0809	Gamma FIDLER	6826	7002	3520	7364	750	30	150	2807	13483	0.4	0.72	Pass	
C0901	Alpha PH	2	1	0	43	8	30	150	1578	14712	-4.4	1.0E-05	Fail	Background
C0901	Beta PH	194	189	110	381	54	30	150	1840	14451	-3.4	7.8E-04	Fail	Background
<b>C0901</b>	<b>Gamma FIDLER</b>	<b>7273</b>	<b>7400</b>	<b>3818</b>	<b>7904</b>	<b>787</b>	<b>30</b>	<b>150</b>	<b>4028</b>	<b>12263</b>	<b>5.0</b>	<b>4.7E-07</b>	<b>Fail</b>	<b>C0901</b>
C0902	Alpha PH	4	3	0	42	7	30	150	2638	13652	-0.3	0.77	Pass	
C0902	Beta PH	212	210	140	376	47	30	150	2318	13972	-1.5	0.13	Pass	
<b>C0902</b>	<b>Gamma FIDLER</b>	<b>7080</b>	<b>7387</b>	<b>3437</b>	<b>7864</b>	<b>1053</b>	<b>30</b>	<b>150</b>	<b>3755</b>	<b>12536</b>	<b>4.0</b>	<b>6.6E-05</b>	<b>Fail</b>	<b>C0902</b>
C0906	Alpha PH	5	2	0	113	20	30	150	2030	14260	-2.7	7.8E-03	Fail	Background
C0906	Beta PH	222	207	100	470	70	30	150	2464	13826	-1.0	0.34	Pass	
<b>C0906</b>	<b>Gamma FIDLER</b>	<b>7212</b>	<b>7434</b>	<b>3637</b>	<b>7757</b>	<b>840</b>	<b>30</b>	<b>150</b>	<b>3916</b>	<b>12374</b>	<b>4.6</b>	<b>4.0E-06</b>	<b>Fail</b>	<b>C0906</b>

**Table 3-7**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**C-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
C0907	Alpha PH	2	2	0	5	1	30	150	2110	14181	-2.4	0.019	Fail	Background
C0907	Beta PH	191	190	114	254	31	30	150	1827	14463	-3.4	6.5E-04	Fail	Background
C0907	Gamma FIDLER	6908	7089	3481	7523	789	30	150	3087	13204	1.4	0.15	Pass	
C0908	Alpha PH	3	2	0	40	7	30	150	2340	13951	-1.5	0.15	Pass	
C0908	Beta PH	201	207	129	316	37	30	150	2130	14160	-2.2	0.025	Fail	Background
<b>C0908</b>	<b>Gamma FIDLER</b>	<b>7117</b>	<b>7276</b>	<b>3428</b>	<b>7732</b>	<b>782</b>	<b>30</b>	<b>150</b>	<b>3660</b>	<b>12630</b>	<b>3.6</b>	<b>2.9E-04</b>	<b>Fail</b>	<b>C0908</b>
C0909	Alpha PH	3	2	0	42	7	30	150	2048	14242	-2.6	9.6E-03	Fail	Background
C0909	Beta PH	206	199	132	369	48	30	150	2230	14061	-1.9	0.062	Pass	
C0909	Gamma FIDLER	4894	4994	2535	5402	554	30	150	1378	14912	-5.1	2.9E-07	Fail	Background

Notes:

- (1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator
- (2) cpm = counts per minute.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 3.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 3-8**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**D-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
D0104	Alpha PH	5	2	0	72	13	30	150	2543	13747	-0.7	0.50	Pass	
D0104	Beta PH	233	227	154	448	60	30	150	2971	13320	1.0	0.33	Pass	
D0104	Gamma FIDLER	4624	4698	2319	5432	506	30	150	1010	15281	-6.5	5.9E-11	Fail	Background
D0105	Alpha PH	3	2	0	25	5	30	150	2166	14125	-2.1	3.3E-02	Fail	Background
D0105	Beta PH	220	213	137	315	42	30	150	2736	13554	0.1	0.94	Pass	
D0105	Gamma FIDLER	4519	4617	2339	4885	463	30	150	882	15408	-7.0	2.0E-12	Fail	Background
D0107	Alpha PH	3	1	0	47	8	30	150	1977	14313	-2.9	4.2E-03	Fail	Background
<b>D0107</b>	<b>Beta PH</b>	<b>251</b>	<b>249</b>	<b>186</b>	<b>415</b>	<b>47</b>	<b>30</b>	<b>150</b>	<b>3675</b>	<b>12616</b>	<b>3.7</b>	<b>2.3E-04</b>	<b>Fail</b>	<b>D0107</b>
D0107	Gamma FIDLER	4736	4769	2474	7483	701	30	150	1184	15106	-5.9	4.2E-09	Fail	Background
D0108	Alpha PH	4	1	0	81	15	30	150	1492	14798	-4.7	2.0E-06	Fail	Background
D0108	Beta PH	200	198	127	381	47	30	150	2040	14251	-2.6	9.5E-03	Fail	Background
<b>D0108</b>	<b>Gamma FIDLER</b>	<b>7038</b>	<b>7233</b>	<b>3537</b>	<b>7624</b>	<b>803</b>	<b>30</b>	<b>150</b>	<b>3466</b>	<b>12824</b>	<b>2.9</b>	<b>3.9E-03</b>	<b>Fail</b>	<b>D0108</b>
D0110	Alpha PH	2	1	0	16	3	30	150	1875	14416	-3.3	1.1E-03	Fail	Background
D0110	Beta PH	206	206	134	355	44	30	150	2312	13978	-1.5	0.12	Pass	
D0110	Gamma FIDLER	4393	4504	2225	4856	491	30	150	786	15504	-7.4	1.3E-13	Fail	Background
D0113	Alpha PH	5	4	0	31	5	30	150	3100	13190	1.5	0.14	Pass	
D0113	Beta PH	208	205	138	302	41	30	150	2353	13937	-1.4	0.16	Pass	
D0113	Gamma FIDLER	6586	6766	3152	7031	694	30	150	2097	14193	-2.4	0.018	Fail	Background
D0206	Alpha PH	3	2	0	35	6	30	150	2318	13973	-1.5	0.12	Pass	
D0206	Beta PH	207	195	135	318	47	30	150	2203	14087	-2.0	0.049	Fail	Background
D0206	Gamma FIDLER	4708	4804	2559	5043	437	30	150	1147	15144	-6.0	1.7E-09	Fail	Background
D0207	Alpha PH	2	2	0	20	4	30	150	2015	14275	-2.7	6.5E-03	Fail	Background
D0207	Beta PH	224	217	120	361	46	30	150	2856	13434	0.5	0.59	Pass	
D0207	Gamma FIDLER	4496	4612	2176	5038	523	30	150	901	15390	-7.0	3.3E-12	Fail	Background
D0305	Alpha PH	3	2	0	12	2	30	150	2352	13938	-1.4	0.16	Pass	
D0305	Beta PH	223	225	131	309	35	30	150	2954	13336	0.9	0.36	Pass	
D0305	Gamma FIDLER	6945	7150	3544	7537	768	30	150	3175	13116	1.8	0.078	Pass	
D0306	Alpha PH	3	1	0	33	6	30	150	2044	14246	-2.6	9.2E-03	Fail	Background
D0306	Beta PH	198	195	122	315	39	30	150	2040	14250	-2.6	9.6E-03	Fail	Background
<b>D0306</b>	<b>Gamma FIDLER</b>	<b>7052</b>	<b>7279</b>	<b>3633</b>	<b>7655</b>	<b>767</b>	<b>30</b>	<b>150</b>	<b>3463</b>	<b>12828</b>	<b>2.9</b>	<b>4.1E-03</b>	<b>Fail</b>	<b>D0306</b>
D0312	Alpha PH	2	2	0	13	3	30	150	2113	14177	-2.3	0.020	Fail	Background

**Table 3-8**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**D-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
D0312	Beta PH	198	203	120	266	30	30	150	2075	14215	-2.5	0.014	Fail	Background
<b>D0312</b>	<b>Gamma FIDLER</b>	<b>7123</b>	<b>7388</b>	<b>3550</b>	<b>7757</b>	<b>819</b>	<b>30</b>	<b>150</b>	<b>3647</b>	<b>12644</b>	<b>3.6</b>	<b>3.5E-04</b>	<b>Fail</b>	<b>D0312</b>
D0401	Alpha PH	2	1	0	14	3	30	150	1754	14537	-3.7	1.9E-04	Fail	Background
D0401	Beta PH	217	217	147	338	42	30	150	2591	13699	-0.5	0.63	Pass	
D0401	Gamma FIDLER	4579	4687	2341	4949	492	30	150	973	15318	-6.7	2.3E-11	Fail	Background
D0406	Alpha PH	2	1	0	24	4	30	150	1782	14508	-3.6	2.9E-04	Fail	Background
D0406	Beta PH	199	193	131	332	47	30	150	1992	14299	-2.8	5.5E-03	Fail	Background
<b>D0406</b>	<b>Gamma FIDLER</b>	<b>7269</b>	<b>7534</b>	<b>3542</b>	<b>7968</b>	<b>880</b>	<b>30</b>	<b>150</b>	<b>4015</b>	<b>12275</b>	<b>5.0</b>	<b>1.0E-06</b>	<b>Fail</b>	<b>D0406</b>
D0407	Alpha PH	2	1	0	28	5	30	150	1751	14540	-3.7	1.8E-04	Fail	Background
D0407	Beta PH	196	192	114	286	37	30	150	2027	14264	-2.6	8.2E-03	Fail	Background
<b>D0407</b>	<b>Gamma FIDLER</b>	<b>7197</b>	<b>7479</b>	<b>3611</b>	<b>7810</b>	<b>835</b>	<b>30</b>	<b>150</b>	<b>3805</b>	<b>12486</b>	<b>4.2</b>	<b>2.9E-05</b>	<b>Fail</b>	<b>D0407</b>
D0413	Alpha PH	2	2	0	13	2	30	150	2071	14220	-2.5	0.012273	Fail	Background
D0413	Beta PH	211	221	136	274	35	30	150	2566	13725	-0.6	0.57	Pass	
<b>D0413</b>	<b>Gamma FIDLER</b>	<b>7156</b>	<b>7351</b>	<b>3448</b>	<b>7883</b>	<b>838</b>	<b>30</b>	<b>150</b>	<b>3755</b>	<b>12535</b>	<b>4.0</b>	<b>6.6E-05</b>	<b>Fail</b>	<b>D0413</b>
D0601	Alpha PH	2	1	0	7	2	30	150	2005	14286	-2.8	5.8E-03	Fail	Background
D0601	Beta PH	222	223	129	301	47	30	150	2836	13454	0.5	0.64	Pass	
<b>D0601</b>	<b>Gamma FIDLER</b>	<b>7054</b>	<b>7192</b>	<b>3606</b>	<b>7729</b>	<b>791</b>	<b>30</b>	<b>150</b>	<b>3464</b>	<b>12826</b>	<b>2.9</b>	<b>4.0E-03</b>	<b>Fail</b>	<b>D0601</b>
D0604	Alpha PH	1	1	0	5	1	30	150	1534	14756	-4.6	5.0E-06	Fail	Background
<b>D0604</b>	<b>Beta PH</b>	<b>238</b>	<b>239</b>	<b>128</b>	<b>360</b>	<b>51</b>	<b>30</b>	<b>150</b>	<b>3228</b>	<b>13063</b>	<b>2.0</b>	<b>0.049</b>	<b>Fail</b>	<b>D0604</b>
<b>D0604</b>	<b>Gamma FIDLER</b>	<b>7148</b>	<b>7360</b>	<b>3762</b>	<b>7981</b>	<b>782</b>	<b>30</b>	<b>150</b>	<b>3649</b>	<b>12642</b>	<b>3.6</b>	<b>3.4E-04</b>	<b>Fail</b>	<b>D0604</b>
D0607	Alpha PH	2	1	0	13	2	30	150	1724	14566	-3.9	1.2E-04	Fail	Background
D0607	Beta PH	206	197	103	328	43	30	150	2250	14041	-1.8	0.074	Pass	
D0607	Gamma FIDLER	4590	4688	2349	5026	510	30	150	1034	15257	-6.5	1.1E-10	Fail	Background
D0704	Alpha PH	1	1	0	5	1	30	150	1654	14636	-4.1	3.8E-05	Fail	Background
D0704	Beta PH	199	197	143	312	34	30	150	2010	14280	-2.7	6.8E-03	Fail	Background
<b>D0704</b>	<b>Gamma FIDLER</b>	<b>7049</b>	<b>7245</b>	<b>3687</b>	<b>7523</b>	<b>746</b>	<b>30</b>	<b>150</b>	<b>3480</b>	<b>12810</b>	<b>2.9</b>	<b>3.3E-03</b>	<b>Fail</b>	<b>D0704</b>
D0705	Alpha PH	2	2	0	4	1	30	150	2019	14272	-2.7	6.8E-03	Fail	Background
D0705	Beta PH	230	227	134	306	36	30	150	3162	13128	1.7	0.086	Pass	
<b>D0705</b>	<b>Gamma FIDLER</b>	<b>7121</b>	<b>7372</b>	<b>3461</b>	<b>7676</b>	<b>837</b>	<b>30</b>	<b>150</b>	<b>3747</b>	<b>12543</b>	<b>4.0</b>	<b>7.5E-05</b>	<b>Fail</b>	<b>D0705</b>
D0711	Alpha PH	2	1	0	33	6	30	150	1633	14658	-4.2	2.7E-05	Fail	Background
D0711	Beta PH	205	200	134	306	36	30	150	2282	14008	-1.7	0.096	Pass	

**Table 3-8**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**D-Block Igloos -- Direct Measurements vs. Background**  
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Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
D0711	Gamma FIDLER	4591	4702	2286	4934	498	30	150	977	15314	-6.7	2.5E-11	Fail	Background
D0712	Alpha PH	2	2	0	5	1	30	150	1976	14314	-2.9	4.1E-03	Fail	Background
D0712	Beta PH	195	197	121	248	29	30	150	1963	14328	-2.9	3.9E-03	Fail	Background
D0712	Gamma FIDLER	4745	4860	2464	5106	500	30	150	1257	15033	-5.6	2.2E-08	Fail	Background
D0801	Alpha PH	2	1	0	20	4	30	150	1465	14825	-4.9	1.0E-06	Fail	Background
D0801	Beta PH	198	196	127	264	31	30	150	2036	14254	-2.6	9.1E-03	Fail	Background
D0801	Gamma FIDLER	4523	4618	2298	5040	496	30	150	914	15377	-6.9	4.7E-12	Fail	Background
D0805	Alpha PH	3	1	0	50	9	30	150	1751	14540	-3.7	1.8E-04	Fail	Background
D0805	Beta PH	228	219	143	370	54	30	150	2812	13478	0.4	0.71	Pass	
D0805	Gamma FIDLER	6953	7080	3837	7703	706	30	150	3110	13181	1.5	0.13	Pass	

Notes:

(1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator;

FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

(3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.

(4) The statistical parameters Z and p-level were generated by the Statistica software package.

(5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.

(6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 3.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).

If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 3-9**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**E-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
E0103	Alpha PH	3	1	0	57	10	30	150	1827	14463	-3.4	5.6E-04	Fail	Background
E0103	Beta PH	215	214	125	377	44	30	150	2570	13720	-0.6	0.58	Pass	
<b>E0103</b>	<b>Gamma FIDLER</b>	<b>7340</b>	<b>7559</b>	<b>3344</b>	<b>7969</b>	<b>897</b>	<b>30</b>	<b>150</b>	<b>4183</b>	<b>12107</b>	<b>5.6</b>	<b>1.8E-08</b>	<b>Fail</b>	<b>E0103</b>
E0105	Alpha PH	4	2	0	74	13	30	150	2108	14183	-2.4	0.018	Fail	Background
E0105	Beta PH	235	218	157	514	76	30	150	2810	13481	0.4	0.72	Pass	
<b>E0105</b>	<b>Gamma FIDLER</b>	<b>7131</b>	<b>7409</b>	<b>3273</b>	<b>7829</b>	<b>1040</b>	<b>30</b>	<b>150</b>	<b>3875</b>	<b>12416</b>	<b>4.5</b>	<b>9.0E-06</b>	<b>Fail</b>	<b>E0105</b>
E0112	Alpha PH	3	3	1	17	3	30	150	2658	13633	-0.2	0.82	Pass	
E0112	Beta PH	208	211	126	275	35	30	150	2408	13882	-1.2	0.24	Pass	
<b>E0112</b>	<b>Gamma FIDLER</b>	<b>7050</b>	<b>7313</b>	<b>3245</b>	<b>7603</b>	<b>877</b>	<b>30</b>	<b>150</b>	<b>3541</b>	<b>12750</b>	<b>3.2</b>	<b>1.5E-03</b>	<b>Fail</b>	<b>E0112</b>
E0211	Alpha PH	4	2	0	56	10	30	150	2102	14189	-2.4	0.017	Fail	Background
E0211	Beta PH	200	195	131	362	42	30	150	2031	14259	-2.6	8.6E-03	Fail	Background
E0211	Gamma FIDLER	6965	7143	3334	7535	777	30	150	3201	13090	1.9	0.062	Pass	
E0301	Alpha PH	3	2	0	31	6	30	150	1930	14360	-3.0	2.3E-03	Fail	Background
E0301	Beta PH	196	193	113	295	35	30	150	1959	14332	-2.9	3.7E-03	Fail	Background
E0301	Gamma FIDLER	4406	4512	2204	4840	503	30	150	819	15471	-7.3	3.4E-13	Fail	Background
E0302	Alpha PH	3	2	0	23	4	30	150	2462	13828	-1.0	0.33	Pass	
E0302	Beta PH	213	217	125	324	37	30	150	2556	13735	-0.6	0.54	Pass	
E0302	Gamma FIDLER	6651	6834	3175	7619	846	30	150	2517	13774	-0.8	0.45	Pass	
E0303	Alpha PH	6	4	0	75	13	30	150	3136	13154	1.6	0.10	Pass	
E0303	Beta PH	217	212	135	423	51	30	150	2578	13713	-0.5	0.60	Pass	
<b>E0303</b>	<b>Gamma FIDLER</b>	<b>7027</b>	<b>7175</b>	<b>3251</b>	<b>7830</b>	<b>843</b>	<b>30</b>	<b>150</b>	<b>3387</b>	<b>12904</b>	<b>2.6</b>	<b>1.0E-02</b>	<b>Fail</b>	<b>E0303</b>
E0312	Alpha PH	2	2	0	23	4	30	150	2042	14248	-2.6	8.9E-03	Fail	Background
E0312	Beta PH	193	190	133	299	30	30	150	1783	14508	-3.6	3.4E-04	Fail	Background
E0312	Gamma FIDLER	6634	6828	3147	7237	791	30	150	2383	13907	-1.3	0.20	Pass	
E0402	Alpha PH	2	2	0	12	2	30	150	1958	14333	-2.9	3.2E-03	Fail	Background
E0402	Beta PH	199	199	95	283	34	30	150	2088	14202	-2.4	0.016	Fail	Background
E0402	Gamma FIDLER	6696	6833	3125	7498	774	30	150	2477	13813	-0.9	0.36	Pass	
E0410	Alpha PH	2	1	0	13	2	30	150	1749	14541	-3.8	1.8E-04	Fail	Background
E0410	Beta PH	204	201	114	275	39	30	150	2321	13969	-1.5	0.13	Pass	
E0410	Gamma FIDLER	6832	7197	2850	7641	1101	30	150	3224	13067	2.0	0.051	Pass	
E0411	Alpha PH	2	1	0	18	3	30	150	1691	14600	-4.0	6.9E-05	Fail	Background
E0411	Beta PH	201	197	122	293	42	30	150	2138	14153	-2.2	0.027	Fail	Background
E0411	Gamma FIDLER	4520	4659	2185	4910	513	30	150	928	15362	-6.9	6.9E-12	Fail	Background
E0413	Alpha PH	2	2	0	5	1	30	150	2013	14277	-2.7	6.4E-03	Fail	Background
E0413	Beta PH	223	211	165	300	43	30	150	2781	13509	0.3	0.80	Pass	
E0413	Gamma FIDLER	6862	7139	3194	7467	887	30	150	3073	13217	1.4	0.17	Pass	

**Table 3-9**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**E-Block Igloos -- Direct Measurements vs. Background**  
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Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
E0504	Alpha PH	2	1	0	26	5	30	150	1741	14549	-3.8	1.6E-04	Fail	Background
E0504	Beta PH	229	219	185	306	34	30	150	3025	13265	1.2	0.23	Pass	
<b>E0504</b>	<b>Gamma FIDLER</b>	<b>7001</b>	<b>7221</b>	<b>3416</b>	<b>7860</b>	<b>859</b>	<b>30</b>	<b>150</b>	<b>3360</b>	<b>12931</b>	<b>2.5</b>	<b>0.013</b>	<b>Fail</b>	<b>E0504</b>
E0506	Alpha PH	2	1	0	6	2	30	150	1772	14518	-3.7	2.5E-04	Fail	Background
E0506	Beta PH	224	224	132	361	52	30	150	2862	13428	0.6	0.57	Pass	
E0506	Gamma FIDLER	6948	7073	3667	7806	732	30	150	3077	13213	1.4	0.16	Pass	
E0508	Alpha PH	1	1	0	5	1	30	150	1747	14544	-3.8	1.7E-04	Fail	Background
E0508	Beta PH	226	226	131	292	36	30	150	3016	13274	1.2	0.25	Pass	
<b>E0508</b>	<b>Gamma FIDLER</b>	<b>7233</b>	<b>7487</b>	<b>3557</b>	<b>7888</b>	<b>867</b>	<b>30</b>	<b>150</b>	<b>3955</b>	<b>12336</b>	<b>4.8</b>	<b>2.0E-06</b>	<b>Fail</b>	<b>E0508</b>
E0510	Alpha PH	2	1	0	16	3	30	150	1624	14667	-4.2	2.2E-05	Fail	Background
E0510	Beta PH	225	213	148	467	60	30	150	2707	13583	0.0	0.98	Pass	
<b>E0510</b>	<b>Gamma FIDLER</b>	<b>7036</b>	<b>7257</b>	<b>3566</b>	<b>7551</b>	<b>806</b>	<b>30</b>	<b>150</b>	<b>3486</b>	<b>12804</b>	<b>3.0</b>	<b>3.1E-03</b>	<b>Fail</b>	<b>E0510</b>
E0512	Alpha PH	2	1	0	21	4	30	150	1627	14663	-4.2	2.4E-05	Fail	Background
E0512	Beta PH	190	197	94	277	40	30	150	1866	14424	-3.3	1.1E-03	Fail	Background
E0512	Gamma FIDLER	4482	4684	1818	4969	696	30	150	976	15314	-6.7	2.5E-11	Fail	Background
<b>E0602</b>	<b>Alpha PH</b>	<b>13</b>	<b>7</b>	<b>1</b>	<b>206</b>	<b>37</b>	<b>30</b>	<b>150</b>	<b>3780</b>	<b>12510</b>	<b>4.1</b>	<b>3.8E-05</b>	<b>Fail</b>	<b>E0602</b>
E0602	Beta PH	245	231	172	902	127	30	150	3029	13261	1.2	0.23	Pass	
E0602	Gamma FIDLER	4523	4633	2399	5673	515	30	150	902	15388	-7.0	3.4E-12	Fail	Background
<b>E0604</b>	<b>Alpha PH</b>	<b>7</b>	<b>5</b>	<b>0</b>	<b>73</b>	<b>13</b>	<b>30</b>	<b>150</b>	<b>3421</b>	<b>12869</b>	<b>2.7</b>	<b>6.3E-03</b>	<b>Fail</b>	<b>E0604</b>
E0604	Beta PH	220	216	126	438	52	30	150	2652	13639	-0.2	0.81	Pass	
E0604	Gamma FIDLER	4624	4669	2486	6729	619	30	150	989	15302	-6.6	3.4E-11	Fail	Background
E0609	Alpha PH	9	3	0	188	34	30	150	2635	13656	-0.3	0.75	Pass	
E0609	Beta PH	232	207	134	820	117	30	150	2576	13714	-0.5	0.59	Pass	
E0609	Gamma FIDLER	4642	4718	2447	5153	481	30	150	1045	15246	-6.4	1.4E-10	Fail	Background
E0610	Alpha PH	3	3	0	11	2	30	150	2504	13786	-0.8	0.41	Pass	
E0610	Beta PH	212	205	121	312	43	30	150	2466	13824	-1.0	0.34	Pass	
E0610	Gamma FIDLER	4713	4887	2436	5132	558	30	150	1223	15067	-5.7	1.0E-08	Fail	Background
E0702	Alpha PH	3	1	0	53	10	30	150	1795	14496	-3.6	3.5E-04	Fail	Background
E0702	Beta PH	219	220	114	340	45	30	150	2748	13542	0.1	0.90	Pass	
E0702	Gamma FIDLER	4419	4569	2213	4857	494	30	150	822	15468	-7.3	3.7E-13	Fail	Background
E0706	Alpha PH	2	1	0	13	2	30	150	1814	14476	-3.5	4.7E-04	Fail	Background
E0706	Beta PH	203	201	118	341	39	30	150	2161	14130	-2.1	0.033	Fail	Background
E0706	Gamma FIDLER	6512	6623	3152	7361	770	30	150	2178	14112	-2.1	0.039	Fail	Background
E0711	Alpha PH	2	1	0	16	3	30	150	1667	14623	-4.1	4.7E-05	Fail	Background
E0711	Beta PH	201	197	126	264	32	30	150	2122	14168	-2.3	0.023	Fail	Background
E0711	Gamma FIDLER	6711	6909	3166	7245	845	30	150	2555	13736	-0.6	0.54	Pass	



**Table 3-9**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**E-Block Igloos -- Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
E0801	Alpha PH	2	2	0	12	2	30	150	2290	14001	-1.7	0.099	Pass	
E0801	Beta PH	222	227	162	307	34	30	150	2881	13410	0.6	0.53	Pass	
E0801	Gamma FIDLER	4586	4712	2309	5035	502	30	150	993	15297	-6.6	3.9E-11	Fail	Background
E0802	Alpha PH	3	3	1	19	3	30	150	2747	13543	0.1	0.90	Pass	
E0802	Beta PH	225	217	168	330	41	30	150	2877	13414	0.6	0.54	Pass	
E0802	Gamma FIDLER	4575	4691	2281	5105	506	30	150	964	15326	-6.7	1.8E-11	Fail	Background

Notes:

(1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

(3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.

(4) The statistical parameters Z and p-level were generated by the Statistica software package.

(5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.

(6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 3.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 3-10**  
**Wilcoxon Rank Sum Test Results**  
**Direct Measurements vs. DCGL<sub>w</sub>-Adjusted Background <sup>(1)</sup>**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Measurement</b>	<b>Valid N Survey <sup>(2)</sup></b>	<b>Valid N Background <sup>(2)</sup></b>	<b>Rank Sum Survey</b>	<b>Rank Sum Background</b>	<b>Z <sup>(3)</sup></b>	<b>p-level <sup>(3)</sup></b>	<b>Pass/Fail WRS test? <sup>(4)</sup></b>	<b>Higher dataset if test fails <sup>(5)</sup></b>
A0317	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0317	Gamma FIDLER - Pu-239	30	150	1803.5	14486.5	-3.5	4.7E-04	Fail	DCGLw-Adjusted Background
A0508	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0508	Gamma FIDLER - Pu-239	30	150	2064	14226	-2.5	0.012	Fail	DCGLw-Adjusted Background
A0706	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0706	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0707	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0710	Beta PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0711	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0901	Beta PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
A0905	Beta PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
B0809	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
B0810	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
B0909	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0203	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0801	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0803	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0901	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0902	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0906	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
C0908	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0107	Beta PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0108	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0306	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0312	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0406	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background

**Table 3-10**  
**Wilcoxon Rank Sum Test Results**  
**Direct Measurements vs. DCGL<sub>w</sub>-Adjusted Background <sup>(1)</sup>**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Measurement</b>	<b>Valid N Survey <sup>(2)</sup></b>	<b>Valid N Background <sup>(2)</sup></b>	<b>Rank Sum Survey</b>	<b>Rank Sum Background</b>	<b>Z <sup>(3)</sup></b>	<b>p-level <sup>(3)</sup></b>	<b>Pass/Fail WRS test? <sup>(4)</sup></b>	<b>Higher dataset if test fails <sup>(5)</sup></b>
D0407	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0413	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0601	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0604	Beta PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0604	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0704	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
D0705	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0103	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0105	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0112	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0303	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0504	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0508	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0510	Gamma FIDLER	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0602	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background
E0604	Alpha PH	30	150	465	15825	-8.6	5.8E-18	Fail	DCGLw-Adjusted Background

Notes:

- (1) The DCGLw-adjusted background is created by adding the DCGLw to each background measurement for a given instrument. Unless otherwise noted, the DCGLw for depleted uranium was used.
- (2) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the DCGLw-adjusted background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 3.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N). If the site dataset is determined to be elevated above the DCGL<sub>w</sub>-adjusted background it is shaded and listed in boldface.

**Table 3-11**  
**Summary of Igloo Scanning Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Measurement Type</b>	<b>Minimum (cpm) <sup>(1)</sup></b>	<b>Maximum (cpm)</b>	<b>Mean (cpm)</b>	<b>Flag Value (cpm) <sup>(2)</sup></b>	<b>Maximum Reading Greater than Flag?</b>
<b>ALPHA/BETA PHOSWICH</b>						
A0201	Alpha/Beta	100	340	220	6428	No
A0316	Alpha/Beta	80	340	210	6428	No
A0317	Alpha/Beta	80	340	210	6428	No
A0508	Alpha/Beta	60	400	230	6428	No
A0701	Alpha/Beta	60	380	220	6428	No
A0706	Alpha/Beta	100	700	400	6428	No
A0707	Alpha/Beta	60	460	260	6428	No
A0710	Alpha/Beta	100	460	280	6428	No
A0711	Alpha/Beta	100	500	300	6428	No
A0901	Alpha/Beta	100	500	300	6428	No
A0905	Alpha/Beta	100	480	290	6428	No
A1108	Alpha/Beta	60	400	230	6428	No
A1109	Alpha/Beta	100	400	250	6428	No
B0109	Alpha/Beta	80	360	220	6428	No
B0411	Alpha/Beta	100	360	230	6428	No
B0501	Alpha/Beta	60	300	180	6428	No
B0602	Alpha/Beta	80	360	220	6428	No
B0603	Alpha/Beta	80	360	220	6428	No
B0609	Alpha/Beta	100	400	250	6428	No
B0610	Alpha/Beta	80	340	210	6428	No
B0701	Alpha/Beta	80	460	270	6428	No
B0705	Alpha/Beta	80	380	230	6428	No
B0707	Alpha/Beta	80	380	230	6428	No
B0708	Alpha/Beta	80	300	190	6428	No
B0709	Alpha/Beta	40	360	200	6428	No
B0711	Alpha/Beta	80	340	210	6428	No
B0801	Alpha/Beta	100	280	190	6428	No
B0802	Alpha/Beta	60	360	210	6428	No
B0804	Alpha/Beta	100	380	240	6428	No
B0809	Alpha/Beta	80	600	340	6428	No
B0810	Alpha/Beta	100	440	270	6428	No
B0811	Alpha/Beta	60	380	220	6428	No
B0909	Alpha/Beta	80	500	290	6428	No
C0203	Alpha/Beta	80	380	230	6428	No
C0303	Alpha/Beta	60	600	330	6428	No
C0307	Alpha/Beta	80	600	340	6428	No
C0308	Alpha/Beta	120	600	360	6428	No
C0401	Alpha/Beta	80	600	340	6428	No
C0403	Alpha/Beta	60	500	280	6428	No
C0405	Alpha/Beta	40	500	270	6428	No
C0406	Alpha/Beta	100	500	300	6428	No
C0407	Alpha/Beta	80	440	260	6428	No
C0408	Alpha/Beta	40	300	170	6428	No
C0501	Alpha/Beta	80	300	190	6428	No
C0503	Alpha/Beta	100	500	300	6428	No
C0504	Alpha/Beta	100	300	200	6428	No
C0505	Alpha/Beta	100	500	300	6428	No
C0508	Alpha/Beta	80	500	290	6428	No
C0510	Alpha/Beta	80	600	340	6428	No
C0511	Alpha/Beta	100	300	200	6428	No
C0513	Alpha/Beta	40	300	170	6428	No
C0603	Alpha/Beta	60	600	330	6428	No
C0604	Alpha/Beta	80	600	340	6428	No

**Table 3-11**  
**Summary of Igloo Scanning Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Measurement Type</b>	<b>Minimum (cpm) <sup>(1)</sup></b>	<b>Maximum (cpm)</b>	<b>Mean (cpm)</b>	<b>Flag Value (cpm) <sup>(2)</sup></b>	<b>Maximum Reading Greater than Flag?</b>
C0605	Alpha/Beta	80	400	240	6428	No
C0606	Alpha/Beta	60	300	180	6428	No
C0608	Alpha/Beta	60	420	240	6428	No
C0701	Alpha/Beta	80	600	340	6428	No
C0706	Alpha/Beta	80	600	340	6428	No
C0707	Alpha/Beta	80	320	200	6428	No
C0708	Alpha/Beta	80	360	220	6428	No
C0801	Alpha/Beta	80	320	200	6428	No
C0803	Alpha/Beta	80	280	180	6428	No
C0807	Alpha/Beta	80	320	200	6428	No
C0809	Alpha/Beta	60	420	240	6428	No
C0901	Alpha/Beta	60	450	255	6428	No
C0902	Alpha/Beta	100	420	260	6428	No
C0906	Alpha/Beta	80	400	240	6428	No
C0907	Alpha/Beta	80	340	210	6428	No
C0908	Alpha/Beta	100	460	280	6428	No
C0909	Alpha/Beta	100	480	290	6428	No
D0104	Alpha/Beta	80	500	290	6428	No
D0105	Alpha/Beta	100	420	260	6428	No
D0107	Alpha/Beta	120	450	285	6428	No
D0108	Alpha/Beta	80	600	340	6428	No
D0110	Alpha/Beta	80	360	220	6428	No
D0113	Alpha/Beta	40	400	220	6428	No
D0206	Alpha/Beta	80	360	220	6428	No
D0207	Alpha/Beta	80	440	260	6428	No
D0305	Alpha/Beta	100	340	220	6428	No
D0306	Alpha/Beta	80	400	240	6428	No
D0312	Alpha/Beta	80	340	210	6428	No
D0401	Alpha/Beta	80	400	240	6428	No
D0406	Alpha/Beta	100	400	250	6428	No
D0407	Alpha/Beta	60	440	250	6428	No
D0413	Alpha/Beta	100	400	250	6428	No
D0601	Alpha/Beta	100	400	250	6428	No
D0604	Alpha/Beta	100	400	250	6428	No
D0607	Alpha/Beta	80	360	220	6428	No
D0704	Alpha/Beta	100	440	270	6428	No
D0705	Alpha/Beta	100	300	200	6428	No
D0711	Alpha/Beta	60	420	240	6428	No
D0712	Alpha/Beta	60	420	240	6428	No
D0801	Alpha/Beta	100	280	190	6428	No
D0805	Alpha/Beta	100	420	260	6428	No
E0103	Alpha/Beta	80	600	340	6428	No
E0105	Alpha/Beta	100	600	350	6428	No
E0112	Alpha/Beta	80	400	240	6428	No
E0211	Alpha/Beta	80	500	290	6428	No
E0301	Alpha/Beta	80	340	210	6428	No
E0302	Alpha/Beta	60	400	230	6428	No
E0303	Alpha/Beta	100	420	260	6428	No
E0312	Alpha/Beta	60	380	220	6428	No
E0402	Alpha/Beta	80	340	210	6428	No
E0410	Alpha/Beta	80	400	240	6428	No
E0411	Alpha/Beta	80	300	190	6428	No
E0413	Alpha/Beta	100	320	210	6428	No
E0504	Alpha/Beta	100	360	230	6428	No

**Table 3-11**  
**Summary of Igloo Scanning Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Measurement Type</b>	<b>Minimum (cpm) <sup>(1)</sup></b>	<b>Maximum (cpm)</b>	<b>Mean (cpm)</b>	<b>Flag Value (cpm) <sup>(2)</sup></b>	<b>Maximum Reading Greater than Flag?</b>
E0506	Alpha/Beta	100	400	250	6428	No
E0508	Alpha/Beta	80	380	230	6428	No
E0510	Alpha/Beta	100	400	250	6428	No
E0512	Alpha/Beta	60	300	180	6428	No
E0602	Alpha/Beta	100	1000	550	6428	No
E0604	Alpha/Beta	100	600	350	6428	No
E0609	Alpha/Beta	100	1200	650	6428	No
E0610	Alpha/Beta	100	400	250	6428	No
E0702	Alpha/Beta	80	460	270	6428	No
E0706	Alpha/Beta	80	500	290	6428	No
E0711	Alpha/Beta	60	300	180	6428	No
E0801	Alpha/Beta	80	400	240	6428	No
E0802	Alpha/Beta	100	380	240	6428	No
<b><u>GAMMA FIDLER</u></b>						
A0201	Gamma	1500	7000	4250	12465	No
A0316	Gamma	1000	7000	4000	12465	No
A0317	Gamma	2000	10000	6000	12465	No
A0508	Gamma	2000	11000	6500	12465	No
A0701	Gamma	1000	7000	4000	12465	No
A0706	Gamma	3000	10000	6500	12465	No
A0707	Gamma	3000	11000	7000	12465	No
A0710	Gamma	2000	6000	4000	12465	No
A0711	Gamma	3000	10000	6500	12465	No
A0901	Gamma	1800	6000	3900	12465	No
A0905	Gamma	1000	7000	4000	12465	No
A1108	Gamma	3000	8000	5500	12465	No
A1109	Gamma	1000	7000	4000	12465	No
B0109	Gamma	3000	8000	5500	12465	No
B0411	Gamma	2000	7000	4500	12465	No
B0501	Gamma	1000	10000	5500	12465	No
B0602	Gamma	3000	10000	6500	12465	No
B0603	Gamma	3000	10000	6500	12465	No
B0609	Gamma	3000	10000	6500	12465	No
B0610	Gamma	3000	10000	6500	12465	No
B0701	Gamma	3000	11000	7000	12465	No
B0705	Gamma	3000	10000	6500	12465	No
B0707	Gamma	3000	10000	6500	12465	No
B0708	Gamma	2000	10000	6000	12465	No
B0709	Gamma	2000	10000	6000	12465	No
B0711	Gamma	3000	10000	6500	12465	No
B0801	Gamma	1000	7000	4000	12465	No
B0802	Gamma	2000	7000	4500	12465	No
B0804	Gamma	1000	6000	3500	12465	No
B0809	Gamma	3000	10000	6500	12465	No
B0810	Gamma	3000	10000	6500	12465	No
B0811	Gamma	3000	10000	6500	12465	No
B0909	Gamma	3000	11000	7000	12465	No
C0203	Gamma	3000	10000	6500	12465	No
C0303	Gamma	3000	9000	6000	12465	No
C0307	Gamma	3000	9000	6000	12465	No
C0308	Gamma	3000	10000	6500	12465	No
C0401	Gamma	3000	10000	6500	12465	No
C0403	Gamma	3000	11000	7000	12465	No

**Table 3-11**  
**Summary of Igloo Scanning Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Measurement Type</b>	<b>Minimum (cpm) <sup>(1)</sup></b>	<b>Maximum (cpm)</b>	<b>Mean (cpm)</b>	<b>Flag Value (cpm) <sup>(2)</sup></b>	<b>Maximum Reading Greater than Flag?</b>
C0405	Gamma	3000	9000	6000	12465	No
C0406	Gamma	3000	10000	6500	12465	No
C0407	Gamma	3000	10000	6500	12465	No
C0408	Gamma	3000	9000	6000	12465	No
C0501	Gamma	3000	10000	6500	12465	No
C0503	Gamma	3000	10000	6500	12465	No
C0504	Gamma	3000	10000	6500	12465	No
C0505	Gamma	3000	10000	6500	12465	No
C0508	Gamma	3000	11000	7000	12465	No
C0510	Gamma	3000	10000	6500	12465	No
C0511	Gamma	3000	9000	6000	12465	No
C0513	Gamma	3000	10000	6500	12465	No
C0603	Gamma	3000	10000	6500	12465	No
C0604	Gamma	2000	9000	5500	12465	No
C0605	Gamma	2000	9000	5500	12465	No
C0606	Gamma	3000	9000	6000	12465	No
C0608	Gamma	2000	7000	4500	12465	No
C0701	Gamma	3000	9000	6000	12465	No
C0706	Gamma	3000	9000	6000	12465	No
C0707	Gamma	3000	10000	6500	12465	No
C0708	Gamma	3000	10000	6500	12465	No
C0801	Gamma	3000	10000	6500	12465	No
C0803	Gamma	3000	9000	6000	12465	No
C0807	Gamma	3000	9000	6000	12465	No
C0809	Gamma	3000	9000	6000	12465	No
C0901	Gamma	3000	9000	6000	12465	No
C0902	Gamma	3000	10000	6500	12465	No
C0906	Gamma	3000	11000	7000	12465	No
C0907	Gamma	3000	9000	6000	12465	No
C0908	Gamma	3000	10000	6500	12465	No
C0909	Gamma	2000	7000	4500	12465	No
D0104	Gamma	2000	7000	4500	12465	No
D0105	Gamma	2000	6000	4000	12465	No
D0107	Gamma	1000	10000	5500	12465	No
D0108	Gamma	3000	9000	6000	12465	No
D0110	Gamma	2000	6000	4000	12465	No
D0113	Gamma	3000	9000	6000	12465	No
D0206	Gamma	2000	6000	4000	12465	No
D0207	Gamma	2000	6000	4000	12465	No
D0305	Gamma	3000	10000	6500	12465	No
D0306	Gamma	3000	11000	7000	12465	No
D0312	Gamma	2000	10000	6000	12465	No
D0401	Gamma	2000	6000	4000	12465	No
D0406	Gamma	2000	11000	6500	12465	No
D0407	Gamma	3000	10000	6500	12465	No
D0413	Gamma	3000	11000	7000	12465	No
D0601	Gamma	3000	10000	6500	12465	No
D0604	Gamma	3000	10000	6500	12465	No
D0607	Gamma	2000	6000	4000	12465	No
D0704	Gamma	3000	10000	6500	12465	No
D0705	Gamma	3000	10000	6500	12465	No
D0711	Gamma	2000	6000	4000	12465	No
D0712	Gamma	1000	7000	4000	12465	No
D0801	Gamma	1000	6000	3500	12465	No

**Table 3-11**  
**Summary of Igloo Scanning Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Measurement Type	Minimum (cpm) <sup>(1)</sup>	Maximum (cpm)	Mean (cpm)	Flag Value (cpm) <sup>(2)</sup>	Maximum Reading Greater than Flag?
D0805	Gamma	2000	10000	6000	12465	No
E0103	Gamma	2000	10000	6000	12465	No
E0105	Gamma	2000	11000	6500	12465	No
E0112	Gamma	3000	10000	6500	12465	No
E0211	Gamma	3000	11000	7000	12465	No
E0301	Gamma	1000	7000	4000	12465	No
E0302	Gamma	3000	8000	5500	12465	No
E0303	Gamma	2000	11000	6500	12465	No
E0312	Gamma	2000	10000	6000	12465	No
E0402	Gamma	3000	8000	5500	12465	No
E0410	Gamma	2000	11000	6500	12465	No
E0411	Gamma	1000	7000	4000	12465	No
E0413	Gamma	3000	9000	6000	12465	No
E0504	Gamma	3000	10000	6500	12465	No
E0506	Gamma	2000	11000	6500	12465	No
E0508	Gamma	3000	10000	6500	12465	No
E0510	Gamma	2000	12000	7000	12465	No
E0512	Gamma	1000	7000	4000	12465	No
E0602	Gamma	1000	6000	3500	12465	No
E0604	Gamma	1000	7000	4000	12465	No
E0609	Gamma	1000	7000	4000	12465	No
E0610	Gamma	1000	7000	4000	12465	No
E0702	Gamma	1000	8000	4500	12465	No
E0706	Gamma	3000	8000	5500	12465	No
E0711	Gamma	2000	8000	5000	12465	No
E0801	Gamma	1000	7000	4000	12465	No
E0802	Gamma	1000	6000	3500	12465	No

Notes:

(1) cpm = counts per minute.

(2) The scanning flag values for measurements in the Class 3 survey units are based on the gross activity DCGL for DU. Average background is included in the flag value. The alpha/beta flag value is the sum of the individual alpha and beta DU DCGLw's.



**Table 3-12**  
**Summary of In-Situ Gamma Spectroscopy Screening**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

		Upper Bound Activity (dpm/100 cm2) <sup>(1)</sup>														
		Uranium Decay Series						Thorium Decay Series				Actinium Decay Series				
Sample Material <sup>(2)</sup>	Location	U-238	Th-234	U-234	Ra-226	Pb-214	Pb-210	Ac-228	Th-228	Pb-212	Tl-208	U-235	Th-231	Pa-231	Ra-223	Bi-211
Concrete floor locations	B0909-21	27.2	-- <sup>(3)</sup>	22.9	--	--	8.3	--	2,793.4	--	--	43.7	16.3	--	--	--
	C0909-12	17.9	--	15.0	--	--	6.2	--	--	64.7	--	72.7	10.8	--	--	--
Igloo Vent, location # 29	C0303-29	--	329.3	--	418.9	23.7	--	--	1,473.4	--	--	28.8	--	--	45.0	151.6
	C0603-29	--	764.2	--	--	--	-196.6 <sup>(4)</sup>	--	4,379.1	--	920.9	45.4	--	--	--	--
	C0906-29	14.8	143.6	12.4	--	--	--	--	2,671.4	--	--	85.0	--	--	--	--
	E0602-29	20.4	935.0	17.1	--	--	--	--	8,891.0	22.1	--	62.5	--	--	30.7	--
	E0609-29	5.3	891.9	4.5	--	--	--	--	3,989.9	-2.4	--	20.0	3.2	--	122.0	--
Igloo vent, location # 29 after bkgd subtracted <sup>(5)</sup>	C0603-29	16.5	1,409.6	13.7	--	--	--	--	4,478.4	27.4	2,430.6	64.7	60.2	--	137.0	--
	C0906-29	--	--	--	-331.6	--	--	--	--	--	--	--	--	--	--	--
	E0602-29	-0.2	339.4	-0.2	--	--	--	--	-1,278.8	55.9	-413.3	168.4	-8.3	-13.0	-17.8	--
	E0609-29	18.0	1,844.0	15.0	--	--	--	--	5,152.1	107.9	1,202.4	154.3	186.7	240.7	157.5	--

Notes:

(1) dpm/100cm2 = decays per minute per 100 square centimeters. None of the Upper Bound Activities (reported quantity plus 50%) are above the DCGLs for the radionuclides of concern (U-234, U-235, and U-238) at the DU igloos.

(2) Gamma spectroscopy measurements were taken in place with an Alpha Spectra FIDLER probe and URSA MCA.

(3) "--" = the radionuclide was not identified.

(4) A shaded result indicates a negative value (radionuclide identified but not accurately quantified).

(5) Location C0303-29 did not have a spectrum after background subtraction.

**Table 3-13**  
**Summary of Smear Sampling Results** <sup>(1, 2)</sup>  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Alpha (dpm) <sup>(3)</sup>			Beta (dpm)			Gamma (dpm)			Tritium Beta (dpm)		
	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max
A0201	0	0.18	1.4	0	0.85	4.9	0	0	0	0	0	0
A0316	0	0.083	1.4	0	1.4	6.3	0	0	0	0	0.35	10
A0317	0	0.17	1.6	0	0.73	5.4	0	0	0	0	0	0
A0508	0	0.22	1.2	0	0.67	5.1	0	0	0	0	0	0
A0701	0	0.17	2.0	0	1.2	7.5	0	0	0	-- <sup>(4)</sup>	--	--
A0706	0	0.82	10	0	5.5	54	0	0	0	--	--	--
A0707	0	0.20	3.7	0	2.5	16	0	0	0	--	--	--
A0710	0	0.08	1.2	0	3.0	17	0	0	0	--	--	--
A0711	0	0.31	3.8	0	2.9	16	0	0	0	--	--	--
A0901	0	0.77	17	0	2.8	55	0	2.4	71	--	--	--
A0905	0	0.49	9.8	0	4.6	68	0	1.6	47	--	--	--
A1108	0	0.30	5.8	0	1.0	16	0	0	0	--	--	--
A1109	0	0	0	0	0.63	5.6	0	0	0	--	--	--
B0109	0	0.11	1.4	0	2.5	22	0	0	0	--	--	--
B0411	0	0	0	0	3.1	13	0	0	0	--	--	--
B0501	0	0	0	0	2.1	15	0	0	0	--	--	--
B0602	0	0	0	0	1.9	8.1	0	0	0	--	--	--
B0603	0	0.06	1.8	0	1.0	6.3	0	0	0	--	--	--
B0609	0	0.35	2.2	0	5.8	16	0	0	0	--	--	--
B0610	0	0.13	1.4	0	1.4	6.3	0	0	0	--	--	--
B0701	0	0.15	2.8	0	3.4	11	0	13	62	--	--	--
B0705	0	0.16	1.8	0	2.7	8.2	0	0	0	--	--	--
B0707	0	0.14	1.9	0	2.3	9.9	0	0	0	--	--	--
B0708	0	0	0	0	0.34	3.6	0	9.1	61	--	--	--
B0709	0	0.037	1.1	0	2.5	6.0	0	0	0	--	--	--
B0711	0	0.19	1.9	0	2.6	6.9	0	3.6	58	--	--	--
B0801	0	0.26	2.2	0	1.4	6.8	0	0	0	--	--	--
B0802	0	0	0	0	0.3	5.2	0	1.6	47	--	--	--
B0804	0	0.053	1.6	0	0.3	3.3	0	11	69	--	--	--
B0809	0	0.067	1	0	1.0	6.1	0	0	0	--	--	--
B0810	0	0.11	1.1	0	1.1	6.8	0	0	0	--	--	--
B0811	0	0.25	5.9	0	1.1	16	0	1.5	46	--	--	--
B0909	0	0.25	2.5	0	2.6	12	0	0	0	--	--	--
C0203	0	0	0	0	0.14	4.1	0	1.6	47	--	--	--
C0303	0	0.19	5.7	0	0.59	14	0	0	0	--	--	--
C0307	0	0.10	3.1	0	1.0	15	0	0	0	--	--	--
C0308	0	0.23	2.3	0	1.7	15	0	1.5	44	--	--	--
C0401	0	0	0	0	0.43	3.8	0	0	0	--	--	--
C0403	0	0.18	4.3	0	0.93	12	0	3.4	55	--	--	--
C0405	0	0.087	2.6	0	0.26	4.0	0	0	0	--	--	--
C0406	0	0	0	0	0.27	4.3	0	0	0	--	--	--
C0407	0	0.200	4.1	0	1.0	18	0	0	0	--	--	--
C0408	0	0	0	0	0.30	4.8	0	5.0	57	--	--	--
C0501	0	0.17	3.1	0	0.96	7.8	0	1.5	45	--	--	--
C0503	0	0.46	10	0	1.2	26	0	3.4	52	--	--	--
C0504	0	0.083	2.5	0	0.20	6.1	0	0	0	--	--	--
C0505	0	0	0	0	0.44	13	0	11	57	--	--	--
C0508	0	0	0	0	0.15	4.6	0	3.5	55	--	--	--
C0510	0	0.13	3.9	0	1.1	22	0	1.5	46	--	--	--
C0511	0	0.043	1.3	0	0.31	5.6	0	2.2	65	--	--	--

**Table 3-13**  
**Summary of Smear Sampling Results <sup>(1, 2)</sup>**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Alpha (dpm) <sup>(3)</sup>			Beta (dpm)			Gamma (dpm)			Tritium Beta (dpm)		
	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max
C0513	0	0	0	0	0.31	5.6	0	3.8	65	--	--	--
C0603	0	0.063	1.9	0	0.12	3.5	0	0	0	--	--	--
C0604	0	0.29	7.2	0	2.6	32	0	0	0	--	--	--
C0605	0	0.11	3.4	0	4.9	27	0	0	0	--	--	--
C0606	0	0.61	9.0	0	2.6	11	0	3.5	58	--	--	--
C0608	0	0.23	2.9	0	3.2	22	0	3.2	50	--	--	--
C0701	0	0.22	1.7	0	0.78	4.4	0	2.1	64	--	--	--
C0706	0	0.04	1.1	0	0.88	4.7	0	0	0	--	--	--
C0707	0	0.12	1.5	0	1.7	4.7	0	0	0	--	--	--
C0708	0	0.12	1.5	0	0.90	4.7	0	0	0	--	--	--
C0801	0	0.42	2.5	0	1.9	5.9	0	1.7	51	--	--	--
C0803	0	0.40	2.9	0	2.8	7.4	0	6.4	55	--	--	--
C0807	0	0.38	4.0	0	2.8	12	0	1.9	56	--	--	--
C0809	0	0.17	2.1	0	1.5	7.8	0	0	0	--	--	--
C0901	0	0.30	1.7	0	2.1	20	0	0	0	--	--	--
C0902	0	0.42	3.2	0	3.9	9.4	0	0	0	--	--	--
C0906	0	0.13	1.3	0	1.1	6.8	0	1.8	53	--	--	--
C0907	0	0.14	1.7	0	0.90	5.0	0	0	0	--	--	--
C0908	0	0.24	2.9	0	2.3	21	0	0	0	--	--	--
C0909	0	0.62	2.1	0	2.7	27	0	0	0	--	--	--
D0104	0	0.12	3.7	0	0.63	6.7	0	0	0	--	--	--
D0105	0	0	0	0	0.28	5.3	0	0	0	--	--	--
D0107	0	0.39	8.9	0	1.3	29	0	1.6	47	--	--	--
D0108	0	0	0	0	0.36	3.9	0	0	0	--	--	--
D0110	0	0.36	6.4	0	4.4	25	0	4.9	52	--	--	--
D0113	0	0.13	2.2	0	1.5	18	0	0	0	--	--	--
D0206	0	0.22	2.2	0	2.3	9.9	0	0	0	--	--	--
D0207	0	0.55	10	0	4.4	66	0	0	0	--	--	--
D0305	0	0	0	0	0.71	5.4	0	8.7	63	--	--	--
D0306	0	0.22	2.2	0	0.64	5.5	0	1.6	47	--	--	--
D0312	0	0	0	0	0.61	4.8	0	3.3	55	--	--	--
D0401	0	0.14	4.2	0	1.8	22	0	1.7	51	--	--	--
D0405	0	0	0	0	3.2	17	0	5.1	56	--	--	--
D0406	0	0.12	1.8	0	2.7	10	0	3.5	61	--	--	--
D0407	0	0.14	4.2	0	2.8	15	0	0	0	--	--	--
D0413	0	0.047	1.4	0	0.90	6.1	0	3.2	48	--	--	--
D0601	0	0.073	2.2	0	0.89	5.8	0	0	0	--	--	--
D0604	0	0.17	1.8	0	0.99	5.1	0	3.2	51	--	--	--
D0607	0	0	0	0	2.5	9.0	0	0	0	--	--	--
D0704	0	0.79	16	0	2.8	49	0	0	0	--	--	--
D0705	0	0.093	1.4	0	2.6	9.3	0	0	0	--	--	--
D0711	0	0.37	7.4	0	1.8	13	0	6.2	72	--	--	--
D0712	0	0.18	2.1	0	2.7	17	0	0	0	--	--	--
D0801	0	0	0	0	1.7	9.6	0	1.7	50	--	--	--
D0805	0	0.16	1.4	0	4.4	14	0	0	0	--	--	--
E0103	0	0.43	5.2	0	3.1	21	0	0	0	--	--	--
E0105	0	0.43	7.4	0	3.9	18	0	5.0	52	--	--	--
E0112	0	0.36	1.7	0	4.3	30	0	4.9	52	--	--	--
E0211	0	0.44	6.9	0	2.6	38	0	0	0	--	--	--
E0301	0	0.52	12	0	2.3	32	0	3.8	61	--	--	--

**Table 3-13**  
**Summary of Smear Sampling Results <sup>(1, 2)</sup>**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Igloo	Alpha (dpm) <sup>(3)</sup>			Beta (dpm)			Gamma (dpm)			Tritium Beta (dpm)		
	Min	Average	Max	Min	Average	Max	Min	Average	Max	Min	Average	Max
E0302	0	0.45	2.2	0	2.8	11	0	3.1	47	--	--	--
E0303	0	0.28	1.8	0	3.7	11	0	0	0	--	--	--
E0312	0	0.58	11	0	4.9	74	0	1.9	56	--	--	--
E0402	0	0.16	2.4	0	2.7	28	0	0	0	--	--	--
E0410	0	0.25	2.4	0	4.7	20	0	0	0	--	--	--
E0411	0	0.35	4.4	0	3.1	22	0	0	0	--	--	--
E0413	0	0.16	1.7	0	2.5	11	0	1.8	54	--	--	--
E0504	0	0.23	3.9	0	3.6	15	0	0	0	--	--	--
E0506	0	0.17	1.0	0	2.3	17	0	0	0	--	--	--
E0508	0	0.48	5.2	0	3.7	23	0	0	0	--	--	--
E0510	0	0.87	18	0	6.7	130	0	7.0	65	--	--	--
E0512	0	0.41	3.2	0	2.9	9.2	0	3.8	65	--	--	--
E0602	0	1.2	17	0	5.5	38	0	4.4	77	--	--	--
E0604	0	0.057	1.7	0	1.2	5.9	0	1.8	53	--	--	--
E0609	0	0.92	22	0	4.0	67	0	0	0	--	--	--
E0610	0	0.51	9.1	0	6.7	36	0	1.9	56	--	--	--
E0702	0	0.077	2.3	0	2.1	15	0	1.8	54	--	--	--
E0706	0	0.15	2.7	0	2.7	22	0	0	0	--	--	--
E0711	0	0.30	1.9	0	1.0	5.8	0	0	0	--	--	--
E0801	0	0.34	1.9	0	0.61	5.8	0	0	0	--	--	--
E0802	0	0.32	1.6	0	1.4	8.0	0	0	0	--	--	--

Notes:

- (1) 10 CFR 835, Appendix D, removable contamination limits: natural U, U-235, U-238, and assoc. decay products - 1,000 dpm/100cm<sup>2</sup>;  
Tritium - 10,000 beta-gamma/100cm<sup>2</sup>.
- (2) Smear samples collected over a 100 cm<sup>2</sup> area.
- (3) dpm = disintegrations per minute.
- (4) "--" = Tritium smears were not collected at this survey unit.

**Table 3-14**  
**Summary of Material Sampling Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Sample ID	Location	Collection Date	Parameter <sup>(1)</sup>	Method	Lab Result (pCi/g) <sup>(2)</sup>	Uncertainty (pCi/g)	Qualifier <sup>(3)</sup>	MDL (pCi/g) <sup>(4)</sup>
B0909-21	Floor	09/09/02	Thorium-230	EML HASL 300	1.00	0.406		0.173
			Thorium-232	EML HASL 300	0.282	0.178	J	0.148
			Uranium-233/234	EML HASL 300	0.445	0.214	J	0.142
			Uranium-235/236	EML HASL 300	0.0119	0.0483	U	0.142
			Uranium-238	EML HASL 300	0.428	0.208	J	0.120
			Cesium-137	EML HASL 300	0.00963	0.0138	U	0.0284
			Radium-226	EML HASL 300	0.533	0.0949	J	0.0518
E0602-29	Air Vent	09/16/02	Thorium-230	EML HASL 300	0.333	0.199	UJ	0.179
			Thorium-232	EML HASL 300	0.0157	0.0428	U	0.116
			Uranium-233/234	EML HASL 300	0.177	0.161	U	0.199
			Uranium-235/236	EML HASL 300	0.139	0.164	U	0.290
			Uranium-238	EML HASL 300	0.337	0.220	J	0.199
			Cesium-137	EML HASL 300	0.00495	0.0416	U	0.0697
			Radium-226	EML HASL 300	0.0821	0.0845	U	0.147

Notes:

(1) Only a limited number of radionuclides were specified for isotope-specific analysis.

(2) pCi/g = picocuries per gram.

(3) Validated analytical result.

U = Indicates that the target analyte was analyzed for but not detected above the detection limit.

J = Indicated an estimated value. The result was greater than the detection limit, but less than the reporting limit.

UJ = The target analyte was analyzed for, but was not detected at or above the reported estimated result.

(4) MDL = method detection limit.

**Table 3-15**  
**Summary of Radon Sampling Results**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Igloo</b>	<b>Results (pCi/L) <sup>(1)</sup></b>	<b>Duplicate Results (pCi/L)</b>
<b>Affected Igloos</b>		
E0602	6.1	5.8
E0609	8.5	5.5
C0603	3.8	3.6
C0906	3.5	2.6
C0303	2.2	-- <sup>(2)</sup>
C0308	2.1	--
C0706	3.3	--
C0307	4.8	--
D0108	2.7	--
E0303	7.9	--
E0105	8.4	--
E0604	4.9	--
<b>Background Igloos</b>		
A1107	7	9.3
B0806	2.1	--
E0403	1.8	--
C0912	2.5	--
D0405	3.6	--
<b>Dataset</b>	<b>Mean (pCi/L)</b>	<b>Std. Dev (pCi/L)</b>
Affected Igloos	4.7	3.1
Background Igloos	4.4	2.1
All Measurements	4.6	2.4
<b>Exposure</b>	<b>Dose Based on Average Concentration (mrem/yr) <sup>(3)</sup></b>	<b>Dose Based on Maximum Concentration (mrem/yr)</b>
Workers	1.1	2.3

Notes:

(1) pCi/L = picocuries per liter.

(2) "--" = duplicate measurement was not collected at this location.

(3) mrem/yr = millirem per year. Dose calculated per BIER IV (BEIR, 1988).

**Table 3-16**  
**Dose Contribution from Above-Background Survey Units**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Dataset above Background <sup>(1)</sup>	Igloo	Average Measurement (cpm) <sup>(2)</sup>	Maximum Measurement (cpm)	Equivalent DCGLw (cpm) <sup>(3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5)</sup>
Alpha PH	A0706 <sup>(6)</sup>	5	18	3583	10	0.05
	A0711	7	64	3583	10	0.18
	B0809	6	57	3583	10	0.16
	B0810	5	31	3583	10	0.09
	C0203	5	21	3583	10	0.06
	E0602	13	206	3583	10	0.57
	E0604	7	73	3583	10	0.20
Beta PH	A0710	239	413	2846	10	1.45
	A0901	238	407	2846	10	1.43
	A0905	243	350	2846	10	1.23
	D0107	251	415	2846	10	1.46
	D0604	238	360	2846	10	1.26
Gamma	A0317	6943	7650	12465	10	6.14
	A0508	7157	8056	12465	10	6.46
	A0706	7039	8007	12465	10	6.42
	A0707	7119	7559	12465	10	6.06
	B0909	7302	8358	12465	10	6.71
	C0801	7039	7594	12465	10	6.09
	C0803	7127	7737	12465	10	6.21
	C0901	7273	7904	12465	10	6.34
	C0902	7080	7864	12465	10	6.31
	C0906	7212	7757	12465	10	6.22
	C0908	7117	7732	12465	10	6.20
	D0108	7038	7624	12465	10	6.12
	D0306	7052	7655	12465	10	6.14
	D0312	7123	7757	12465	10	6.22
	D0406	7269	7968	12465	10	6.39
	D0407	7197	7810	12465	10	6.27
	D0413	7156	7883	12465	10	6.32
	D0601	7054	7729	12465	10	6.20
	D0604	7148	7981	12465	10	6.40
	D0704	7049	7523	12465	10	6.04
	D0705	7121	7676	12465	10	6.16
	E0103	7340	7969	12465	10	6.39
	E0105	7131	7829	12465	10	6.28
	E0112	7050	7603	12465	10	6.10
	E0303	7027	7830	12465	10	6.28
	E0504	7001	7860	12465	10	6.31

**Table 3-16**  
**Dose Contribution from Above-Background Survey Units**  
**DU Storage Igloos**  
**License Termination Report**  
**Seneca Army Depot Activity**

Dataset above Background <sup>(1)</sup>	Igloo	Average Measurement (cpm) <sup>(2)</sup>	Maximum Measurement (cpm)	Equivalent DCGLw (cpm) <sup>(3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5)</sup>
	E0508	7233	7888	12465	10	6.33
	E0510	7036	7551	12465	10	6.06

Notes:

- (1) Datasets above background determined by WRS test (**Tables 3-5** through **3-9**); Instruments: PH = alpha/beta phoswich detector; FIDLER = low-energy gamma scintillator.
- (2) cpm = counts per minute.
- (3) The instrument equivalent DCGLw for DU was calculated as described in **Table 3.2**.
- (4) The dose limit of 10 mrem/yr was established in the *Seneca Army Activity Depot License Termination and License Release Plan* (ANL, 2003).
- (5) The calculated dose contribution is the dose limit multiplied by ratio of the maximum survey unit measurement to the equivalent DCGLw.
- (6) Italicized igloos had a dose contribution from more than one above-background dataset. The overall dose from Igloo A0706 was 6.47 mrem/yr. The overall dose from Igloo D0604 was 7.66 mrem/yr.



**Table 4-1**  
**List of DU Buildings and Survey Units**  
**License Termination Report**  
**Seneca Army Depot Activity**

Building	Room	Survey Unit Designation	MARSSIM Classification	Applicable Licenses
5	1	5-1	2	SUC-1275; SUC-1380
	2	5-2	2	SUC-1275; SUC-1380
	3	5-3	2	SUC-1275; SUC-1380
	4	5-4	2	SUC-1275; SUC-1380
	5	5-5	2	SUC-1275; SUC-1380
	6	5-6	2	SUC-1275; SUC-1380
	7	5-7	2	SUC-1275; SUC-1380
	8	5-8	2	SUC-1275; SUC-1380
	9	5-9	2	SUC-1275; SUC-1380
	10	5-10	2	SUC-1275; SUC-1380
	11	5-11	3	SUC-1275; SUC-1380
	12	5-12	3	SUC-1275; SUC-1380
	13	5-13	3	SUC-1275; SUC-1380
	14	5-14	3	SUC-1275; SUC-1380
	15	5-15	3	SUC-1275; SUC-1380
	16	5-16	2	SUC-1275; SUC-1380
306	1	306-1	3	SUC-1275; SUC-1380
	2	306-2	3	SUC-1275; SUC-1380
	3	306-3	3	SUC-1275; SUC-1380
	4	306-4	3	SUC-1275; SUC-1380
	5	306-5	3	SUC-1275; SUC-1380
	6	306-6	3	SUC-1275; SUC-1380
	7	306-7	3	SUC-1275; SUC-1380
	8	306-8	3	SUC-1275; SUC-1380
	10	306-10	2	SUC-1275; SUC-1380
	11	306-11	2	SUC-1275; SUC-1380
	12	306-12	2	SUC-1275; SUC-1380
	13	306-13	2	SUC-1275; SUC-1380
2073	1	2073-1	2	SUC-1275; SUC-1380
	2	2073-2	2	SUC-1275; SUC-1380
	3	2073-3	2	SUC-1275; SUC-1380
S-2084	2	2084-2	2	SUC-1275; SUC-1380
	3	2084-3	2	SUC-1275; SUC-1380
	6	2084-6	2	SUC-1275; SUC-1380

Notes:

- (1) Buildings were used for receipt and storage of packaged DU ammunition (SUC-1275).
- (2) Compiled from *Seneca Army Depot Activity License Termination and License Release Plan* (ANL, 2003).

**Table 4-2**  
**Instrument Equivalent Derived Concentration Guideline Levels**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Applicable DCGLw	DCGLw (dpm/100cm <sup>2</sup> ) <sup>(1)</sup>	Probe Area (cm <sup>2</sup> )	Instrument Efficiency <sup>(2)</sup>	Above Background Instrument DCGLw (cpm) <sup>(3)</sup>	Background Average (cpm)	Background Dataset	Instrument Equivalent DCGLw (cpm) <sup>(4)</sup>
Alpha Floor Monitor	DU	31800	425	5%	6758	4	Bldg 722	<b>6761</b>
Beta Floor Monitor	DU	31800	425	19%	25003	775	Bldg 722	<b>25778</b>
Alpha Phoswich	DU	31800	75	15%	3578	4	Bldg 722	<b>3582</b>
Beta Phoswich	DU	31800	75	11%	2624	365	Bldg 722	<b>2989</b>
Gamma FIDLER	DU	31800	126	15%	6020	11265	Bldg 722	<b>17285</b>

Notes:

- (1) Depleted uranium DCGL calculated using equation 4-4 of MARSSIM. Expected activity fractions for depleted uranium based on uranium depleted to 99.8 weight percent U-238, 0.2 weight percent U-235, and 0.0008 weight percent U-234 (WHO, 2001).
- (2) Average efficiency for instrument during survey (**Appendix 4.A**).
- (3) The Above Background Instrument DCGLw is calculated using the instrument efficiency and probe area.  
The value is used for a direct comparison against site measurements.
- (4) The Equivalent DCGLw for each instrument is the sum of the Above Background Instrument DCGLw and the Background Average for that instrument.

**Table 4-3**  
**Survey Instrumentation**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Measurement Type	Probe	Meter	Probe Area (cm <sup>2</sup> ) <sup>(1)</sup>	Average Instrument Efficiency <sup>(2)</sup>	1-Minute Direct Measurement MDA (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Scanning MDA (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	DCGLw for DU (dpm/100cm <sup>2</sup> ) <sup>(4)</sup>
Phoswich	Alpha/Beta	Ludlum Model 43-1-1	Ludlum Model 2224	75	Alpha: 15% Beta: 11%	Alpha: 45 Beta: 592	6830	31800
Floor Monitor	Alpha/Beta	Ludlum Model 43-37	Ludlum Model 2360	425	Alpha: 4.8% Beta: 18.5%	Alpha: 22 Beta: 78	1211	31800
FIDLER	Low-Energy Gamma	Bicron G5 FIDLER	Bicron Analyst	126	15%	1435	15721	31800
Exposure Rate	Ambient Gamma Exposure Rate	Bicron MicroRem or Ludlum Model 19		-- <sup>(5)</sup>	--	--	--	NA <sup>(6)</sup>
GM Pancake	Alpha/Beta/Gamma	Ludlum Model 44-9	Ludlum Model 3	15	20%	--	2200-5000	NA
Gamma Spectrometer	In-Situ Gamma	Alpha Spectra FIDLER	RSA URSA-I MCA	126	15%	1435 for gross 1-minute count; otherwise measurement-specific	--	31800

Notes:

(1) cm<sup>2</sup> = square centimeters.

(2) Except where noted, the average instrument efficiency was determined from the daily function check data (refer to **Appendix 4.A**).

(3) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Except where noted, the minimum detectable activities (MDAs) were calculated using the procedures outlined in MARSSIM Section 6.7 (NRC, 2000).

(4) Gross activity DCGL<sub>w</sub> was calculated using radionuclide-specific DCGLs derived by ANL, 2003 (**Appendix 1.A**).

(5) "--" = Indicates that parameter was not used or calculated for instrument.

(6) NA= not applicable. DCGLs were not applied to exposure rate or personnel/equipment frisking measurements.

**Table 4-4**  
**Total Number of Required Measurements**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Dataset <sup>(1)</sup>	Gross Activity DCGLw (dpm/100cm <sup>2</sup> ) <sup>(2)</sup>	Instrument Specific DCGLw (cpm) <sup>(3)</sup>	LBGR <sup>(4)</sup>	$\Delta$ <sup>(5)</sup>	Observed Survey $\sigma$ (cpm) <sup>(6)</sup>	Observed Bkgd $\sigma$ (cpm)	$\Delta/\sigma$ <sup>(7)</sup>	Pr <sup>(8)</sup>	Z(1- $\alpha$ ) <sup>(9)</sup>	Z(1- $\beta$ ) <sup>(9)</sup>	Total N <sup>(10)</sup>
Gamma FIDLER & Bldg 722 Background	31800	17285	8643	8643	2415	3307	2.6	0.96	1.645	1.645	17
Alpha PH & Bldg 722 Background	31800	3582	1791	1791	1.25	2.3	779	1.00	1.645	1.645	14
Beta PH & Bldg 722 Background	31800	2989	1495	1495	63	186	8	1.00	1.645	1.645	14
Alpha FM & Bldg 722 Background	31800	6761	3381	3381	2.6	2.4	1310	1.00	1.645	1.645	14
Beta FM & Bldg 722 Background	31800	25778	12889	12889	137	284	45	1.00	1.645	1.645	14

Notes:

- (1) All measurements for all survey units are combined for this evaluation. Instruments: FM = alpha/beta gas proportional floor monitor; FIDLER = low-energy gamma scintillator; PH = alpha/beta phoswich detector.
- (2) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Gross activity DCGLw for DU calculated per MARSSIM.
- (3) cpm = counts per minute. Instrument-specific DCGLw calculated per MARSSIM. Includes average background count rate.
- (4) LBGR = lower bound of gray region. Per MARSSIM, LBGR was set to 1/2 of the DCGLw.
- (5)  $\Delta$  = DCGLw - LBGR.
- (6) The standard deviation ( $\sigma$ ) for the survey data includes all measurements collected with that instrument.
- (7)  $\Delta/\sigma$  calculated using the larger value between the survey standard deviation and the background standard deviation.
- (8) Values of Pr are from Table 5.1 of MARSSIM using  $\Delta/\sigma$ . Pr is defined by MARSSIM as the probability that a random measurement from the survey unit exceeds a random measurement from the background reference area by less than the DCGLW when the survey unit median is equal to the LBGR above background.
- (9) Values of Z(1- $\alpha$ ) and Z(1- $\beta$ ) (decision error percentiles) are from Table 5.2 of MARSSIM for  $\alpha=\beta=0.05$ .
- (10) N = total required number of measurements or samples (includes both survey and background areas).

**Table 4-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 5 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
5	1	Alpha FM	5	5	1	11	2	53	15	1940	407	1.7	0.096	Pass	
5	1	Beta FM	661	671	401	1043	112	53	15	1730	616	-1.5	0.15	Pass	
5	1	Alpha PH	1	1	0	8	2	32	100	932	7847	-6.4	1.4E-10	Fail	Background
5	1	Beta PH	170	154.5	118	336	46	32	100	709	8069	-7.5	4.9E-14	Fail	Background
5	1	Gamma FIDLER	5172	4466	3572	10791	1546	85	120	4087	17028	-11.2	6.8E-29	Fail	Background
5	2	Alpha FM	5	4.5	2	11	3	14	15	234	201	1.1	0.29	Pass	
5	2	Beta FM	693	676.5	444	1087	143	14	15	194	242	-0.7	0.47	Pass	
5	2	Alpha PH	1	1	0	3	1	6	100	89	5582	-3.2	1.3E-03	Fail	Background
5	2	Beta PH	175	183	129	212	35	6	100	57	5615	-3.6	3.0E-04	Fail	Background
5	2	Gamma FIDLER	6317	6436.5	3457	12071	2104	20	120	462	9408	-5.6	1.7E-08	Fail	Background
5	3	Alpha FM	6	5	2	10	3	11	15	180	172	1.6	0.10	Pass	
5	3	Beta FM	663	676	390	809	105	11	15	133	218	-0.8	0.42	Pass	
5	3	Alpha PH	1	1	0	2	1	6	100	70	5602	-3.5	5.1E-04	Fail	Background
5	3	Beta PH	177	169.5	146	211	23	6	100	49	5622	-3.7	2.0E-04	Fail	Background
5	3	Gamma FIDLER	4258	4338	2488	5494	700	17	120	156	9297	-6.6	3.1E-11	Fail	Background
5	4	Alpha FM	5	5	2	9	2	11	15	179	173	1.6	0.11	Pass	
5	4	Beta FM	672	666	540	816	73	11	15	137	215	-0.6	0.53	Pass	
5	4	Alpha PH	1	0	0	2	1	6	100	70	5601	-3.5	5.2E-04	Fail	Background
5	4	Beta PH	220	200.5	184	335	57	6	100	121	5550	-2.7	6.2E-03	Fail	Background
5	4	Gamma FIDLER	4874	4665	3877	7619	888	17	120	182	9271	-6.5	9.8E-11	Fail	Background
5	5	Alpha FM	5	5	0	11	3	30	15	757	279	1.6	0.11	Pass	
5	5	Beta FM	678	684	564	754	50	30	15	652	384	-0.9	0.35	Pass	
5	5	Alpha PH	1	0	0	4	1	59	100	2324	10396	-8.7	5.0E-18	Fail	Background
5	5	Beta PH	143	140	107	223	23	59	100	1831	10889	-10.3	7.1E-25	Fail	Background
5	5	Gamma FIDLER	4419	4277	3181	7493	796	89	120	4078	17867	-12.2	0	Fail	Background
5	6	Alpha FM	5	5	1	12	3	30	15	743	292	1.3	0.20	Pass	
5	6	Beta FM	649	664.5	449	754	72	30	15	628	407	-1.5	0.14	Pass	
5	6	Alpha PH	1	1	0	3	1	18	100	361	6660	-5.4	7.9E-08	Fail	Background
5	6	Beta PH	162	163.5	133	207	20	18	100	213	6809	-6.4	1.3E-10	Fail	Background
5	6	Gamma FIDLER	4981	4392	3536	7462	1213	48	120	1371	12826	-9.4	4.2E-21	Fail	Background
5	7	Alpha FM	3	3	1	5	1	7	15	71	182	-0.7	0.50	Pass	
5	7	Beta FM	813	808	726	887	55	7	15	107	146	1.9	0.062	Pass	
5	7	Alpha PH	1	1	0	3	1	17	100	399	6505	-4.7	2.0E-06	Fail	Background
5	7	Beta PH	252	208	163	385	77	17	100	624	6280	-2.9	3.3E-03	Fail	Background
5	7	Gamma FIDLER	8261	8009.5	3378	13108	2717	24	120	1012	9428	-3.9	9.5E-05	Fail	Background

**Table 4-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 5 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
5	8	Alpha FM	4	4	1	6	1	13	15	195	212	0.3	0.78	Pass	
5	8	Beta FM	787	830	575	1059	180	13	15	205	201	0.8	0.45	Pass	
5	8	Alpha PH	2	2	0	4	1	8	100	190	5696	-2.9	3.5E-03	Fail	Background
5	8	Beta PH	274	274	178	377	82	8	100	312	5574	-1.5	0.15	Pass	
5	8	Gamma FIDLER	8829	8441	5344	13109	2172	21	120	944	9068	-3.2	1.5E-03	Fail	Background
5	9	Alpha FM	4	4	0	12	2	27	15	600	303	0.5	0.60	Pass	
5	9	Beta FM	703	726	415	802	92	27	15	572	332	-0.2	0.81	Pass	
5	9	Alpha PH	1	1	0	5	1	36	100	1162	8154	-6.5	8.0E-11	Fail	Background
5	9	Beta PH	169	169	129	201	19	36	100	784	8532	-8.3	1.1E-16	Fail	Background
5	9	Gamma FIDLER	4825	4069	3152	7284	1303	63	120	2257	14579	-10.4	2.7E-25	Fail	Background
5	10	Alpha FM	5	4	2	8	2	16	15	280	216	1.0	0.33	Pass	
5	10	Beta FM	761	783	559	1031	137	16	15	278	218	0.9	0.38	Pass	
5	10	Alpha PH	2	2	0	3	1	9	100	213	5783	-3.1	1.6E-03	Fail	Background
5	10	Beta PH	209	175	163	331	61	9	100	185	5811	-3.4	6.3E-04	Fail	Background
5	10	Gamma FIDLER	6625	7314	3478	11742	2072	25	120	694	9891	-5.9	3.2E-09	Fail	Background
5	11	Alpha FM	5	5	4	6	1	3	-- <sup>(7)</sup>	--	--	--	--	NA <sup>(7)</sup>	Site max < background max
5	11	Beta FM	764	752	751	790	22	3	--	--	--	--	--	NA	Site max < background max
5	11	Alpha PH	1	1	0	2	1	27	100	553	7575	-7.0	2.7E-12	Fail	Background
5	11	Beta PH	182	173	131	409	60	27	100	576	7553	-6.8	1.1E-11	Fail	Background
5	11	Gamma FIDLER	9021	9085.5	6061	11913	1350	30	120	1512	9813	-3.5	4.0E-04	Fail	Background
5	12	Alpha PH	1	1	0	3	1	30	100	836	7680	-6.3	2.8E-10	Fail	Background
5	12	Beta PH	263	249	182	369	56	30	100	1440	7076	-2.9	3.7E-03	Fail	Background
5	12	Gamma FIDLER	10822	11026.5	8096	13713	1596	30	120	2133	9192	-0.6	0.54	Pass	
5	13	Alpha FM	6	5	4	8	2	3	--	--	--	--	--	NA	Site max = background max
5	13	Beta FM	781	775	769	799	16	3	--	--	--	--	--	NA	Site max < background max
5	13	Alpha PH	1	0	0	10	2	27	100	664	7464	-6.3	2.5E-10	Fail	Background
5	13	Beta PH	210	200	143	291	41	27	100	801	7327	-5.5	4.7E-08	Fail	Background
5	13	Gamma FIDLER	6757	6631.5	4543	9098	1091	30	120	863.5	10461.5	-6.6	4.6E-11	Fail	Background
5	14	Alpha FM	4	5	2	5	2	4	--	--	--	--	--	NA	Site max < background max

**Table 4-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 5 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
5 14	Beta FM	505	497	460	564	45	4	--	--	--	--	--	NA	<b>Site max &lt; background max</b>
5 14	Alpha PH	1	0	0	4	1	26	100	610.5	7390.5	-6.3	2.3E-10	Fail	Background
5 14	Beta PH	155	141	111	365	51	26	100	457	7544	-7.2	6.1E-13	Fail	Background
5 14	Gamma FIDLER	5196	5004	3884	7693	926	30	120	545	10780	-8.1	6.4E-16	Fail	Background
5 15	Alpha FM	5	5	5	5	0	2	--	--	--	--	--	NA	<b>Site max &lt; background max</b>
5 15	Beta FM	684	684	650	718	48	2	--	--	--	--	--	NA	<b>Site max &lt; background max</b>
5 15	Alpha PH	1	1	0	3	1	28	100	758.5	7497.5	-6.1	1.0E-09	Fail	Background
5 15	Beta PH	230	213	153	444	66	28	100	978	7278	-4.8	2.0E-06	Fail	Background
5 15	Gamma FIDLER	9220	9193	5878	11574	1339	30	120	1582	9743	-3.2	1.3E-03	Fail	Background
5 16	Alpha FM	5	4	1	10	3.0	8	15	110.5	165.5	0.9	0.35	Pass	
5 16	Beta FM	699	644	599	873	110	8	15	97	179	0.1	0.95	Pass	
5 16	Alpha PH	0.6	0	0	2	0.89	5	100	49.5	5515.5	-3.2	1.2E-03	Fail	Background
5 16	Beta PH	217	178	169	343	73	5	100	101	5464	-2.5	0.014	Fail	Background
5 16	Gamma FIDLER	7420	7662	4519	9388	1539	13	120	342	8569	-4.0	6.1E-05	Fail	Background

Notes:

(1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

(3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.

(4) The statistical parameters Z and p-level were generated by the Statistica software package.

(5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.

(6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 4.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).

If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

(7) "--" = parameter not calculated because WRS test not performed; NA = not applicable. A minimum of five measurements was necessary for the WRS test. When this criterion was not met, the maximum survey result was compared to the maximum background result for that instrument.

**Table 4-6**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 306 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
306	1	Alpha PH	1	1	0	3	1	30	100	703	7813	-7.0	1.9E-12	Fail	Background
306	1	Beta PH	162	166	115	208	19	30	100	537	7978	-7.9	3.0E-15	Fail	Background
306	1	Gamma	9450	9189	5283	13635	2071	30	120	1682	9644	-2.7	6.1E-03	Fail	Background
306	2	Alpha PH	2	1	0	7	2	30	100	1105	7410	-4.8	2.0E-06	Fail	Background
306	2	Beta PH	184	190	114	231	31	30	100	690	7826	-7.0	1.8E-12	Fail	Background
306	2	Gamma	8142	8064	4281	11294	1342	30	120	1250	10075	-4.8	2.0E-06	Fail	Background
306	3	Alpha PH	2	2	0	5	2	30	100	1203	7312	-4.3	2.1E-05	Fail	Background
306	3	Beta PH	252	237	174	410	60	30	100	1294	7221	-3.7	2.1E-04	Fail	Background
306	3	Gamma	10457	9938	6750	17053	2538	30	120	1980	9345	-1.3	0.18	Pass	
306	4	Alpha PH	2	2	0	6	2	30	100	1194	7321	-4.3	1.7E-05	Fail	Background
306	4	Beta PH	287	264	152	475	77	30	100	1623	6893	-1.9	0.058	Pass	
306	4	Gamma	10752	10396	5468	15915	2629	30	120	2111	9214	-0.7	0.47	Pass	
306	5	Alpha PH	1	1	0	5	1	30	100	887	7628	-6.0	1.8E-09	Fail	Background
306	5	Beta PH	218	199	119	339	65	30	100	1058	7458	-5.0	5.3E-07	Fail	Background
306	5	Gamma	7737	7292	4083	11176	1778	30	120	1165	10160	-5.2	2.4E-07	Fail	Background
306	6	Alpha PH	1	1	0	5	1	30	100	944	7571	-5.7	1.2E-08	Fail	Background
306	6	Beta PH	239	236	165	346	47	30	100	1244	7271	-4.0	6.8E-05	Fail	Background
306	6	Gamma	8787	8682	6194	12980	1846	30	120	1452	9873	-3.8	1.3E-04	Fail	Background
306	7	Alpha PH	1	1	0	3	1	30	100	949	7567	-5.7	1.3E-08	Fail	Background
306	7	Beta PH	209	200	142	348	46	30	100	878	7638	-6.0	1.9E-09	Fail	Background
306	7	Gamma	7837	7709	4346	10787	1921	30	120	1175	10151	-5.1	3.0E-07	Fail	Background
306	8	Alpha PH	2	1	0	4	1	30	100	1036	7480	-5.2	2.0E-07	Fail	Background
306	8	Beta PH	197	183	137	347	50	30	100	821	7695	-6.3	2.5E-10	Fail	Background
306	8	Gamma	6290	6079	4605	12064	1512	30	120	788	10537	-6.9	3.9E-12	Fail	Background
306	10	Alpha FM	7	7	1	13	3	23	15	549	193	3.0	2.6E-03	Fail	306-10
306	10	Beta FM	723	645	421	1311	272	23	15	408	334	-1.2	0.22	Pass	
306	10	Alpha PH	1	1	0	4	1	18	100	432	6590	-4.8	1.0E-06	Fail	Background
306	10	Beta PH	181	163	149	363	50	18	100	292	6730	-5.8	5.4E-09	Fail	Background
306	10	Gamma	6394	5787	4216	12382	1858	41	120	1357	11685	-7.6	2.5E-14	Fail	Background
306	11	Alpha FM	6	5	3	12	3	18	15	367	195	2.2	0.027	Fail	306-11
306	11	Beta FM	607	571	436	1034	141	18	15	236	325	-2.5	0.011	Fail	Background
306	11	Alpha PH	1	1	0	4	1	28	100	704	7552	-6.4	1.4E-10	Fail	Background
306	11	Beta PH	151	155	112	181	20	28	100	438	7819	-7.9	3.1E-15	Fail	Background
306	11	Gamma	5835	5743	3627	8451	902	46	120	1380	12481	-8.9	6.8E-19	Fail	Background
306	12	Alpha FM	5	5	0	12	3	42	15	1308	345	1.6	0.099	Pass	



**Table 4-6**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 306 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
306	12	Beta FM	593	581	415	971	129	42	15	1050	603	-3.0	2.3E-03	Fail	Background
306	12	Alpha PH	1	1	0	4	1	47	100	1802	9077	-7.0	1.9E-12	Fail	Background
306	12	Beta PH	147	145	93	189	21	47	100	1179	9700	-9.6	1.3E-21	Fail	Background
306	12	Gamma	5163	5190	2616	10669	1490	89	120	4443	17502	-11.3	8.5E-30	Fail	Background
306	13	Alpha FM	7	7	1	18	4	21	15	472	194	2.7	7.0E-03	Fail	306-13
306	13	Beta FM	667	636	557	1106	130	21	15	351	316	-1.2	0.22	Pass	
306	13	Alpha PH	1	1	0	3	1	21	100	459	6922	-5.7	1.3E-08	Fail	Background
306	13	Beta PH	200	180	140	711	119	21	100	423	6959	-5.9	4.2E-09	Fail	Background
306	13	Gamma	4866	4556	3723	7393	976	42	120	1000	12204	-9.3	2.0E-20	Fail	Background

Notes:

- (1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.
- (2) cpm = counts per minute.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 4.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 4-7**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 2073 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
2073	1	Alpha FM	5	5	0	12	3	56	15	2139	417	1.7	0.081	Pass	
2073	1	Beta FM	578	609	397	686	82	56	15	1787	769	-3.2	1.3E-03	Fail	Background
2073	1	Alpha PH	1	1	0	5	1	67	100	3086	10942	-8.4	4.60E-17	Fail	Background
2073	1	Beta PH	161	160	105	213	23	67	100	2442	11587	-10.4	2.4E-25	Fail	Background
2073	1	Gamma FIDLER	3854	3693	2139	6819	850	123	120	7701	21945	-13.3	0	Fail	Background
2073	2	Alpha PH	2	2	0	4	1	25	100	821	7055	-4.7	2.0E-06	Fail	Background
2073	2	Beta PH	188	196	91	234	40	25	100	560	7316	-6.3	3.7E-10	Fail	Background
2073	2	Gamma FIDLER	5184	5496	2891	6077	930	25	120	415	10170	-7.4	1.6E-13	Fail	Background
2073	3	Alpha FM	7	7	3	11	2	32	15	924	205	3.6	3.3E-04	Fail	2073-3
2073	3	Beta FM	522	555	368	684	100	32	15	598	531	-3.9	1.0E-04	Fail	Background
2073	3	Alpha PH	1	1	0	3	1	31	100	850	7797	-6.5	5.9E-11	Fail	Background
2073	3	Beta PH	146	142	110	179	20	31	100	525	8122	-8.2	1.7E-16	Fail	Background
2073	3	Gamma FIDLER	5516	5499	3949	6765	524	63	120	2262	14575	-10.4	3.0E-25	Fail	Background

Notes:

(1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

(3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.

(4) The statistical parameters Z and p-level were generated by the Statistica software package.

(5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.

(6) The greater dataset is determined by examining box-and-whisker plots ( **Appendix 4.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).

If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 4-8**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building S-2084 Direct Measurements vs. Background**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
2084	2	Alpha FM	4	3.5	0	9	2	20	15	366	265	0.2	0.85	Pass	
2084	2	Beta FM	594	642	400	716	104	20	15	289	341	-2.4	0.018	Fail	Background
2084	2	Alpha Phoswich	1	1	0	4	1	14	100	314	6242	-4.3	1.8E-05	Fail	Background
2084	2	Beta Phoswich	132	126	91	193	29	14	100	116	6440	-6.0	2.6E-09	Fail	Background
2084	2	Gamma	5569	5574	3336	6558	534	34	120	751	11185	-8.2	2.2E-16	Fail	Background
2084	3	Alpha FM	6	5	1	15	3	74	15	3530	476	2.2	0.028	Fail	2084-3
2084	3	Beta FM	631	660	371	823	126	74	15	3165	841	-1.8	0.070	Pass	
2084	3	Alpha Phoswich	1	1	0	7	1	99	100	6294	13607	-9.0	6.8E-19	Fail	Background
2084	3	Beta Phoswich	126	122	90	221	24	99	100	5006	14895	-12.1	0	Fail	Background
2084	3	Gamma	3994	3757	2287	6176	832	173	120	15165	27906	-14.4	0	Fail	Background
2084	6	Alpha FM	4	5	1	9	2	15	15	248	218	0.6	0.53	Pass	
2084	6	Beta FM	512	447	378	760	121	15	15	151	314	-3.4	7.2E-04	Fail	Background
2084	6	Gamma	5335	5291	4553	6187	486	15	120	163	9017	-6.0	2.0E-09	Fail	Background

Notes:

(1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; PH = alpha/beta phoswich scintillator; FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

(3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.

(4) The statistical parameters Z and p-level were generated by the Statistica software package.

(5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.

(6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 4.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).

If the site dataset is determined to be elevated above background it is shaded and listed in boldface.

**Table 4-9**  
**Wilcoxon Rank Sum Test Results**  
**Direct Measurements vs. DCGL<sub>w</sub>-Adjusted Background <sup>(1)</sup>**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement <sup>(2)</sup>	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
306-10	Alpha FM	23	15	276	465	-5.2	2.6E-07	Fail	DCGL <sub>w</sub> -Adjusted Background
306-11	Alpha FM	18	15	171	390	-4.9	1.1E-06	Fail	DCGL <sub>w</sub> -Adjusted Background
306-13	Alpha FM	21	15	231	435	-5.1	4.3E-07	Fail	DCGL <sub>w</sub> -Adjusted Background
2073-3	Alpha FM	32	15	528	600	-5.5	4.3E-08	Fail	DCGL <sub>w</sub> -Adjusted Background
2084-3	Alpha FM	74	15	2775	1230	-6.1	1.2E-09	Fail	DCGL <sub>w</sub> -Adjusted Background

Notes:

- (1) The DCGL<sub>w</sub>-adjusted background is created by adding the depleted uranium DCGL<sub>w</sub> to each background measurement for a given instrument.
- (2) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the DCGL<sub>w</sub>-adjusted background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 4.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above the DCGL<sub>w</sub>-adjusted background it is shaded and listed in boldface.

**Table 4-10**  
**Summary of Building Scanning Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement Type	Number of Grids Scanned	Minimum (cpm)	Maximum (cpm)	Mean (cpm)	Flag Value (cpm)	Maximum Reading Greater than Flag?
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**ALPHA/BETA FLOOR MONITOR**

5	1	Alpha/Beta	53	300	1200	750	32339	No
5	2	Alpha/Beta	14	200	1300	750	32339	No
5	3	Alpha/Beta	11	300	900	600	32339	No
5	4	Alpha/Beta	11	400	900	650	32339	No
5	5	Alpha/Beta	30	400	900	650	32339	No
5	6	Alpha/Beta	30	300	1000	650	32339	No
5	7	Alpha/Beta	7	600	1100	850	32339	No
5	8	Alpha/Beta	13	400	1300	850	32339	No
5	9	Alpha/Beta	27	300	1000	650	32339	No
5	10	Alpha/Beta	16	400	1200	800	32339	No
5	16	Alpha/Beta	8	400	1200	800	32339	No
306	10	Alpha/Beta	23	300	1400	850	32339	No
306	11	Alpha/Beta	18	300	1200	750	32339	No
306	12	Alpha/Beta	42	300	1200	750	32339	No
306	13	Alpha/Beta	21	400	1200	800	32339	No
2073	1	Alpha/Beta	56	200	900	550	32339	No
2073	3	Alpha/Beta	32	200	800	500	32339	No
2084	2	Alpha/Beta	20	200	800	500	32339	No
2084	3	Alpha/Beta	74	200	1000	600	32339	No
2084	6	Alpha/Beta	15	200	800	500	32339	No

**ALPHA/BETA PHOSWICH**

5	1	Alpha/Beta	32	80	400	240	6571	No
5	2	Alpha/Beta	6	80	300	190	6571	No
5	3	Alpha/Beta	6	100	380	240	6571	No
5	4	Alpha/Beta	6	100	400	250	6571	No
5	5	Alpha/Beta	59	40	300	170	6571	No
5	6	Alpha/Beta	18	80	280	180	6571	No
5	7	Alpha/Beta	17	80	460	270	6571	No
5	8	Alpha/Beta	8	100	420	260	6571	No
5	9	Alpha/Beta	32	80	320	200	6571	No
5	10	Alpha/Beta	9	100	480	290	6571	No
5	11	Alpha/Beta	2	100	240	170	6571	No
5	12	Alpha/Beta	2	120	380	250	6571	No
5	13	Alpha/Beta	4	100	300	200	6571	No
5	14	Alpha/Beta	2	80	380	230	6571	No
5	15	Alpha/Beta	2	140	380	260	6571	No
5	16	Alpha/Beta	5	120	460	290	6571	No
306	1	Alpha/Beta	5	60	240	150	6571	No
306	2	Alpha/Beta	4	60	300	180	6571	No

**Table 4-10**  
**Summary of Building Scanning Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement Type	Number of Grids Scanned	Minimum (cpm)	Maximum (cpm)	Mean (cpm)	Flag Value (cpm)	Maximum Reading Greater than Flag?
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**ALPHA/BETA PHOSWICH (Continued)**

306	3	Alpha/Beta	1	100	320	210	6571	No
306	4	Alpha/Beta	1	180	320	250	6571	No
306	5	Alpha/Beta	2	140	400	270	6571	No
306	6	Alpha/Beta	3	120	380	250	6571	No
306	7	Alpha/Beta	6	100	300	200	6571	No
306	8	Alpha/Beta	3	100	360	230	6571	No
306	10	Alpha/Beta	18	60	480	270	6571	No
306	11	Alpha/Beta	28	60	300	180	6571	No
306	12	Alpha/Beta	47	60	300	180	6571	No
306	13	Alpha/Beta	21	60	800	430	6571	No
2073	1	Alpha/Beta	67	80	300	190	6571	No
2073	2	Alpha/Beta	25	60	340	200	6571	No
2073	3	Alpha/Beta	31	40	260	150	6571	No
2084	2	Alpha/Beta	14	60	220	140	6571	No
2084	3	Alpha/Beta	99	40	280	160	6571	No

**GAMMA FIDLER**

5	1	Gamma	85	2000	14000	8000	17285	No
5	2	Gamma	20	2000	15000	8500	17285	No
5	3	Gamma	17	2000	7000	4500	17285	No
5	4	Gamma	17	2000	10000	6000	17285	No
5	5	Gamma	89	2000	10000	6000	17285	No
5	6	Gamma	48	2000	10000	6000	17285	No
5	7	Gamma	24	2000	16000	9000	17285	No
5	8	Gamma	21	4000	15000	9500	17285	No
5	9	Gamma	63	2000	10000	6000	17285	No
5	10	Gamma	25	3200	13000	8100	17285	No
5	11	Gamma	30	5000	11000	8000	17285	No
5	12	Gamma	30	8000	13000	10500	17285	No
5	13	Gamma	30	4000	9000	6500	17285	No
5	14	Gamma	30	3000	7000	5000	17285	No
5	15	Gamma	30	5000	12000	8500	17285	No
5	16	Gamma	13	3000	13000	8000	17285	No
306	1	Gamma	30	6000	12000	9000	17285	No
306	2	Gamma	30	5000	11000	8000	17285	No
306	3	Gamma	30	7000	12000	9500	17285	No
306	4	Gamma	30	8000	12000	10000	17285	No
306	5	Gamma	30	5000	10000	7500	17285	No
306	6	Gamma	30	6000	10000	8000	17285	No
306	7	Gamma	30	4000	11000	7500	17285	No

**Table 4-10**  
**Summary of Building Scanning Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement Type	Number of Grids Scanned	Minimum (cpm)	Maximum (cpm)	Mean (cpm)	Flag Value (cpm)	Maximum Reading Greater than Flag?
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**GAMMA FIDLER (Continued)**

306	8	Gamma	30	4000	9000	6500	17285	No
306	10	Gamma	41	3000	13000	8000	17285	No
306	11	Gamma	46	3000	10000	6500	17285	No
306	12	Gamma	89	2000	12000	7000	17285	No
306	13	Gamma	42	2000	9000	5500	17285	No
2073	1	Gamma	123	1000	8000	4500	17285	No
2073	2	Gamma	25	2000	8000	5000	17285	No
2073	3	Gamma	63	3000	8000	5500	17285	No
2084	2	Gamma	34	2000	8000	5000	17285	No
2084	3	Gamma	173	1000	8000	4500	17285	No
2084	6	Gamma	15	3000	7000	5000	17285	No

Notes:

(1) cpm = counts per minute.

(2) The scanning flag values for measurements in the Class 2 and 3 survey units are based on the gross activity DCGL for DU. Average background is included in the flag value. The alpha/beta flag values are the sum of the individual alpha and beta DU DCGLw's for that instrument (**Table 4-4**).

**Table 4-11**  
**Summary of In-Situ Gamma Spectroscopy Screening**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

		Upper Bound Activity (dpm/100 cm2) <sup>(1)</sup>														
Sample Material <sup>(2)</sup>	Location	Uranium Decay Series						Thorium Decay Series				Actinium Decay Series				
		U-238	Th-234	U-234	Ra-226	Pb-214	Pb-210	Ac-228	Th-228	Pb-212	Tl-208	U-235	Th-231	Pa-231	Ra-223	Bi-211
Ceramic Tile	306-3-11	33.5	436	28.1	--	--	11.8	--	1,844	25.7	--	170.2	9.1	14.3	40.4	--
	306-3-14	22.1	281	18.6	--	--	7.8	--	1,519	64.4	451,440	117.8	--	--	46.4	--
	306-3-3	2,884	--	2,417	--	--	1,015.3	--	17,249	61.7	--	--	134.2	--	--	--
	306-4-15	613.1	463	513.9	--	--	66.2	293.5	-69,548	62.4	437,379	187.2	368.3	--	-2,127	--
Cinder Block	5-8-10	55.9	567	46.9	--	--	--	360.0	1,339	--	239,470	-41.4	33.6	--	-193.0	--
Concrete	2084-3-51	12.8	467	10.7	--	--	4.5	--	2,948	--	--	189.3	--	--	--	--
	2084-3-72	6.4	2,378	5.3	--	--	2.2	--	17,274	--	--	108.8	--	--	--	--
Insulation over steel	2073-3-41	16.9	1,244	14.2	--	--	--	--	1,793	--	--	60.0	10.2	--	--	--
Plastic window material	2084-3-55	15.7	1,601	13.3	--	--	5.6	--	7,163	--	--	--	--	--	--	--
Terracotta	5-10-19	27.2	380	22.9	--	--	3.0	940.9	8,569	--	--	110.1	16.3	--	--	--
	5-1-49	7.5	1,381	6.3	1,992	55.1	2.6	876.5	6,461	7.8	--	121.0	--	--	197.5	--
	5-1-50	--	2,651	--	1,293	57.2	--	--	20,916	66.1	--	78.5	--	--	--	126.3
Wallboard	2084-3-81	--	-1,930	--	--	--	1.3	--	2,403	85.6	--	65.4	65.2	102.7	73.5	--
Wallboard over steel	2073-1-71	--	694	--	--	--	--	--	2,305	--	--	--	--	--	--	--
	2073-3-23	16.6	167	13.9	--	--	5.8	105.9	1,622	--	--	80.9	5.4	--	--	--
	2073-3-24	7.8	635	6.5	--	--	1.1	--	2,134	--	155.6	--	--	--	65.2	--

Notes:

- (1) dpm/100cm2 = decays per minute per 100 square centimeters. None of the Upper Bound Activities (reported quantity plus 50%) are above the DCGLs for the radionuclides of concern (U-234, U-235, and U-238) at the DU buildings.
- (2) Gamma spectroscopy measurements were taken in place with an Alpha Spectra FIDLER probe and URSA MCA.
- (3) "--" = the radionuclide was not identified.
- (4) A shaded result indicates a negative value (radionuclide identified but not accurately quantified).



**Table 4-12**  
**Summary of Smear Sampling Results<sup>(1,2)</sup>**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Alpha (dpm) <sup>(3)</sup>			Beta (dpm)			Gamma (dpm)		
		Min	Average	Max	Min	Average	Max	Min	Average	Max
5	1	0	0.066	1.9	0	0.10	4.8	0	7.1	68
5	2	0	0.045	0.9	0	0.56	3	0	0	0
5	3	0	0	0	0	0.37	3.3	0	3.1	53
5	4	0	0.053	0.9	0	0.19	3.3	0	0	0
5	5	0	0	0	0	0.28	5.1	0	0	0
5	6	0	0	0	0	0.079	3.8	0	2.1	53
5	7	0	0.046	1.1	0	0	0	0	0	0
5	8	0	0	0	0	0.51	4	0	0	0
5	9	0	0.16	2	0	0.40	5.4	0	8.9	64
5	10	0	0.50	2	0	0.43	3.7	0	0	0
5	11	0	0	0	0	0.42	4.1	0	1.7	48
5	12	0	0.088	1.6	0	0.19	3.2	0	4.2	46
5	13	0	0	0	0	0.23	3.7	0	6.3	51
5	14	0	0.053	1.6	0	0.14	4.1	0	1.5	44
5	15	0	0.12	0.9	0	0.12	3.7	0	0	0
5	16	0	0.20	1.7	0	0	0	0	0	0
306	1	0	0.037	1.1	0	1.07	4.9	0	0	0
306	2	0	0.19	1.8	0	0.11	3.3	0	0	0
306	3	0	0.037	1.1	0	0.43	4.3	0	0	0
306	4	0	0.15	1.4	0	0	0	0	0	0
306	5	0	0.30	1.8	0	0.23	3.6	0	5.2	55
306	6	0	0.073	1.1	0	0.80	4.6	0	0	0
306	7	0	0.08	1.4	0	0.14	4.1	0	0	0
306	8	0	0.087	1.5	0	1.0	5.7	0	0	0
306	10	0	0.063	1.5	0	0.97	4.3	0	0	0
306	11	0	0.022	1	0	0.24	4.3	0	0	0
306	12	0	0.083	1.5	0	0.95	5.2	0	0.48	43
306	13	0	0.19	2.7	0	0.45	4.8	0	0	0
2073	1	0	0.022	1.7	0	0.13	4.8	0	0.55	68
2073	2	0	0.27	1.7	0	0.42	3.8	0	0	0
2073	3	0	0.14	1.4	0	0.63	4.8	0	2.5	56
2084	2	0	0.33	1.7	0	0.40	3.8	0	0	0
2084	3	0	0.21	15	0	0.86	28	0	3.9	179
2084	6	0	0.12	1.8	0	1.2	6.5	0	0	0

Notes:

- (1) 10 CFR 835, Appendix D, removable contamination limits: natural U, U-235, U-238, and assoc. decay products - 1,000 dpm  
Tritium - 10,000 beta-gamma/100cm<sup>2</sup>.
- (2) Smear samples collected over a 100 cm<sup>2</sup> area.
- (3) dpm = disintegrations per minute.

**Table 4-13**  
**Summary of Analytical Material Sampling Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Sample ID	Collection Date	Parameter <sup>(1)</sup>	Method	Lab Result (pCi/g) <sup>(2)</sup>	Uncertainty (pCi/g)	Qualifier <sup>(3)</sup>	MDL (pCi/g) <sup>(4)</sup>
5	8	5-8-10	09/14/02	Thorium-230	DOE EML HASL 300	0.981	0.389		0.115
				Thorium-232	DOE EML HASL 300	0.975	0.389		0.115
				Uranium-233/234	DOE EML HASL 300	0.818	0.346	J	0.304
				Uranium-235/236	DOE EML HASL 300	0.147	0.159	U	0.273
				Uranium-238	DOE EML HASL 300	0.673	0.307	J	0.260
				Cesium-137	DOE EML HASL 300	0.00405	0.0213	U	0.0339
				Radium-226	DOE EML HASL 300	1.24	0.181		0.0604
5	10	5-10-19	09/14/02	Thorium-230	DOE EML HASL 300	1.53	0.613		0.0842
				Thorium-232	DOE EML HASL 300	1.48	0.600		0.148
				Uranium-233/234	DOE EML HASL 300	1.29	0.489		0.329
				Uranium-235/236	DOE EML HASL 300	0.057	0.134	U	0.313
				Uranium-238	DOE EML HASL 300	1.01	0.417		0.192
				Cesium-137	DOE EML HASL 300	-0.0109	0.0162	U	0.028
				Radium-226	DOE EML HASL 300	1.28	0.176		0.0546
306	3	306-3-3	09/14/02	Thorium-230	DOE EML HASL 300	2.06	0.707		0.211
				Thorium-232	DOE EML HASL 300	2.09	0.713		0.139
				Uranium-233/234	DOE EML HASL 300	1.35	0.447		0.184
				Uranium-235/236	DOE EML HASL 300	0.216	0.172	J	0.206
				Uranium-238	DOE EML HASL 300	1.66	0.509		0.205
				Cesium-137	DOE EML HASL 300	-0.0146	0.0198	U	0.0284
				Radium-226	DOE EML HASL 300	1.65	0.229		0.0543

**Table 4-13**  
**Summary of Analytical Material Sampling Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Sample ID	Collection Date	Parameter <sup>(1)</sup>	Method	Lab Result (pCi/g) <sup>(2)</sup>	Uncertainty (pCi/g)	Qualifier <sup>(3)</sup>	MDL (pCi/g) <sup>(4)</sup>
306	3	306-3-14	09/14/02	Thorium-230	DOE EML HASL 300	1.77	1.42		0.986
				Thorium-232	DOE EML HASL 300	1.69	1.35		0.680
				Uranium-233/234	DOE EML HASL 300	1.69	0.558		0.324
				Uranium-235/236	DOE EML HASL 300	0.198	0.172	J	0.182
				Uranium-238	DOE EML HASL 300	1.42	0.498		0.239
				Cesium-137	DOE EML HASL 300	-0.0245	0.0296	U	0.0445
				Radium-226	DOE EML HASL 300	1.83	0.263		0.0886
2073		2073-71-49	09/10/02	Thorium-230	DOE EML HASL 300	0.603	0.341		0.233
				Thorium-232	DOE EML HASL 300	0.000166	0.00923	U	0.233
				Uranium-233/234	DOE EML HASL 300	0.183	0.204	U	0.344
				Uranium-235/236	DOE EML HASL 300	-0.00965	0.0194	U	0.212
				Uranium-238	DOE EML HASL 300	0.101	0.142	U	0.249
				Cesium-137	DOE EML HASL 300	0.00943	0.0318	U	0.0572
				Radium-226	DOE EML HASL 300	0.0518	0.111	U	0.106
2073		2073-24-412	09/10/02	Thorium-230	DOE EML HASL 300	0.185	0.113	UJ	0.0912
				Thorium-232	DOE EML HASL 300	0.0249	0.0411	U	0.0774
				Uranium-233/234	DOE EML HASL 300	-0.149	0.0716	U	0.326
				Uranium-235/236	DOE EML HASL 300	0.0204	0.0586	U	0.148
				Uranium-238	DOE EML HASL 300	0.0547	0.0813	U	0.158
				Cesium-137	DOE EML HASL 300	0.0188	0.0406	U	0.0695
				Radium-226	DOE EML HASL 300	0.110	0.167	U	0.181

**Table 4-13**  
**Summary of Analytical Material Sampling Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Sample ID	Collection Date	Parameter <sup>(1)</sup>	Method	Lab Result (pCi/g) <sup>(2)</sup>	Uncertainty (pCi/g)	Qualifier <sup>(3)</sup>	MDL (pCi/g) <sup>(4)</sup>
2084	3	2084-3-51	09/14/02	Thorium-230	DOE EML HASL 300	1.02	0.403		0.189
				Thorium-232	DOE EML HASL 300	0.277	0.174	J	0.146
				Uranium-233/234	DOE EML HASL 300	0.510	0.231	J	0.181
				Uranium-235/236	DOE EML HASL 300	0.0683	0.0928	U	0.170
				Uranium-238	DOE EML HASL 300	0.526	0.231	J	0.139
				Cesium-137	DOE EML HASL 300	-0.0191	0.0327	U	0.0513
				Radium-226	DOE EML HASL 300	0.468	0.174	J	0.117
2084	3	2084-3-55	09/14/02	Thorium-230	DOE EML HASL 300	0.403	0.243	UJ	0.215
				Thorium-232	DOE EML HASL 300	0.284	0.195	J	0.140
				Uranium-233/234	DOE EML HASL 300	0.130	0.170	U	0.314
				Uranium-235/236	DOE EML HASL 300	0.0103	0.0794	U	0.255
				Uranium-238	DOE EML HASL 300	0.129	0.150	U	0.227
				Cesium-137	DOE EML HASL 300	0.0221	0.0717	U	0.117
				Radium-226	DOE EML HASL 300	0.459	0.314	J	0.224

Notes:

(1) Only a limited number of radionuclides were specified for isotope-specific analysis.

(2) pCi/g = picocuries per gram.

(3) Validated analytical result.

U = Indicates that the target analyte was analyzed for but not detected above the detection limit.

J = Indicated an estimated value. The result was greater than the detection limit, but less than the reporting limit.

UJ = The target analyte was analyzed for, but was not detected at or above the reported estimated result.

(4) MDL = method detection limit.

**Table 4-13**  
**Summary of Analytical Material Sampling Results**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Sample ID	Collection Date	Parameter <sup>(1)</sup>	Method	Lab Result (pCi/g) <sup>(2)</sup>	Uncertainty (pCi/g)	Qualifier <sup>(3)</sup>	MDL (pCi/g) <sup>(4)</sup>

**Table 4-14**  
**Dose Contribution from Above-Background Survey Units**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Dataset above Background <sup>(1)</sup>	Average Measurement (cpm) <sup>(2)</sup>	Maximum Measurement (cpm)	Equivalent DCGLw (cpm) <sup>(3)</sup>	Dose Limit (mrem/yr) <sup>(4,5)</sup>	Dose Contribution (mrem/yr) <sup>(6)</sup>
306	10	Alpha FM	7	13	6761	10	0.019
306	11	Alpha FM	6	12	6761	10	0.018
306	13	Alpha FM	7	18	6761	10	0.027
<b>Total for Building 306:</b>							<b>0.064</b>
2073	3	Alpha FM	7	11	6761	10	0.016
<b>Total for Building 2073:</b>							<b>0.016</b>
2084	3	Alpha FM	6	15	6761	10	0.022
<b>Total for Building S-2084:</b>							<b>0.022</b>

Notes:

- (1) Datasets above background determined by WRS test (**Tables 4-5 through 4-8**); Instruments: FM = alpha/beta gas proportional floor monitor.
- (2) cpm = counts per minute.
- (3) The instrument equivalent DCGLw for DU was calculated as described in **Table 4.2**.
- (4) The dose limit of 10 mrem/yr was established in the *Seneca Army Activity Depot License Termination and License Release Plan* (ANL, 2003).
- (5) There were no datasets above background for Building 5; therefore, there is no total dose to be calculated.
- (6) The calculated dose contribution is the dose limit multiplied by ratio of the maximum survey unit measurement to the equivalent DCGLw.

**Table 5-1**  
**List of Building 612 Survey Units <sup>(1,2)</sup>**  
**License Termination Report**  
**Seneca Army Depot Activity**

Building	Room	Survey Unit Designation	MARSSIM Classification	Applicable Licenses
612	A	612-A	1	SUC-1275; SUC-1380
	B	612-B	1	SUC-1275; SUC-1380
	C	612-C	1	SUC-1275; SUC-1380
	D	612-D	1	SUC-1275; SUC-1380
	E	612-E	1	SUC-1275; SUC-1380
	F	612-F	1	SUC-1275; SUC-1380
	G	612-G	1	SUC-1275; SUC-1380
	H	612-H	1	SUC-1275; SUC-1380
	I	612-I	1	SUC-1275; SUC-1380
	J	612-J	1	SUC-1275; SUC-1380
	K	612-K	1	SUC-1275; SUC-1380
	L	612-L	1	SUC-1275; SUC-1380
	M	612-M	1	SUC-1275; SUC-1380
	N	612-N	1	SUC-1275; SUC-1380
	O	612-O	1	SUC-1275; SUC-1380
	P	612-P	1	SUC-1275; SUC-1380
	Q	612-Q	1	SUC-1275; SUC-1380
	R	612-R	1	SUC-1275; SUC-1380
	S	612-S	1	SUC-1275; SUC-1380
	T	612-T	1	SUC-1275; SUC-1380
	U	612-U	1	SUC-1275; SUC-1380
	V	612-V	1	SUC-1275; SUC-1380
	W	612-W	1	SUC-1275; SUC-1380
	X	612-X	1	SUC-1275; SUC-1380
	Y	612-Y	1	SUC-1275; SUC-1380
	Z	612-Z	1	SUC-1275; SUC-1380
	AA	612-AA	1	SUC-1275; SUC-1380
	BB	612-BB	1	SUC-1275; SUC-1380

Notes:

(1) Buildings were used for receipt and storage of packaged DU ammunition (SUC-1275).

(2) Compiled from *Seneca Army Depot Activity License Termination and License Release Plan* (ANL, 2003).

**Table 5-2**  
**Instrument Equivalent Derived Concentration Guideline Levels**  
**Building 612**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Applicable DCGLw	DCGLw (dpm/100cm <sup>2</sup> ) <sup>(1)</sup>	DCGL <sub>EMC</sub> (dpm/100cm <sup>2</sup> ) <sup>(2)</sup>	Probe Area (cm <sup>2</sup> )	Instrument Efficiency <sup>(3)</sup>	Above Background Instrument DCGLw (cpm) <sup>(4)</sup>	Above Background Instrument DCGL <sub>EMC</sub> (cpm) <sup>(4)</sup>	Background Average (cpm)	Background Dataset	Instrument Equivalent DCGLw (cpm) <sup>(5)</sup>	Instrument Equivalent DCGL <sub>EMC</sub> (cpm) <sup>(5)</sup>
Alpha Floor Monitor	DU	31800	378420	425	5%	6758	80414	4	Blgd 2078	<b>6761</b>	<b>80418</b>
Beta Floor Monitor	DU	31800	378420	425	19%	25003	297533	775	Blgd 2078	<b>25778</b>	<b>298308</b>
Alpha Handheld Gas Proportional	DU	31800	378420	100	15%	4770	56763	4	Blgd 2078	<b>4774</b>	<b>56767</b>
Beta Handheld Gas Proportional	DU	31800	378420	100	11%	3498	41626	365	Blgd 2078	<b>3863</b>	<b>41991</b>
Gamma FIDLER	DU	31800	378420	126	0.75%	301	3576	3211	DFC <sup>(6)</sup>	<b>3512</b>	<b>6787</b>

Notes:

(1) Depleted uranium DCGL calculated using equation 4-4 of MARSSIM. Expected activity fractions for depleted uranium based on uranium depleted to 99.8 weight percent U-238, 0.2 weight percent U-235, and 0.0008 weight percent U-234 (WHO, 2001).

(2) DCGL<sub>EMC</sub> based on area factor of 11.9 for 4 m2 grid (from ANL, 2003, for worst-case radionuclide [U-235]).

(3) Average efficiency for instrument during survey (**Appendix 5.A**).

(4) The Above Background Instrument DCGLw and DCGL<sub>EMC</sub> are calculated using the instrument efficiency and probe area.

(5) The Equivalent DCGLw or DCGL<sub>EMC</sub> for each instrument is the sum of the Above Background Instrument DCGLw or DCGL<sub>EMC</sub> and the Background Average for that instrument.

The value is used for a direct comparison against site measurements.

(6) DFC = daily function checks. The background average used in this calculation for the FIDLER was from the background measurements conducted as part of the daily function check.



**Table 5-3**  
**Survey Instrumentation**  
**Building 612**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Measurement Type	Probe	Meter	Probe Area (cm <sup>2</sup> ) <sup>(1)</sup>	Average Instrument Efficiency <sup>(2)</sup>	1-Minute Direct Measurement MDA (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Scanning MDA (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	DCGLw for DU (dpm/100cm <sup>2</sup> ) <sup>(4)</sup>
Hand-Held Gas Proportional	Alpha/Beta	Ludlum Model 43-68	Ludlum Model 2360	100	Alpha: 18.9% Beta: 24%	Alpha: 14 Beta: 145	1696	31800
Floor Monitor	Alpha/Beta	Ludlum Model 43-37	Ludlum Model 2360	425	Alpha: 19.3% Beta: 33.4%	Alpha: 8 Beta: 56	698	31800
FIDLER	Low-Energy Gamma	Bicron G5 FIDLER	Bicron Analyst	126	0.75%	15324 <sup>(5)</sup>	167867 <sup>(5)</sup>	31800
Exposure Rate	Ambient Gamma Exposure Rate	NA <sup>(6)</sup>		-- <sup>(7)</sup>	--	--	--	NA <sup>(8)</sup>
GM Pancake	Alpha/Beta/Gamma	NA <sup>(6)</sup>		--	--	--	--	NA <sup>(8)</sup>

Notes:

(1) cm<sup>2</sup> = square centimeters.

(2) Except where noted, the average instrument efficiency was determined from the daily function check data (refer to **Appendix 5.A**).

(3) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Except where noted, the minimum detectable activities (MDAs) were calculated using the procedures outlined in MARSSIM Section 6.7 (NRC, 2000).

(4) Gross activity DCGL<sub>w</sub> was calculated using radionuclide-specific DCGLs derived by ANL, 2003 (**Appendix 1.A**).

(5) Average background from daily function checks used in MDA calculations for FIDLER (**Appendix 5.A**).

(6) Not applicable for instrument.

(7) "--" = Indicates that parameter was not used or calculated for instrument.

(8) NA= not applicable. DCGLs were not applied to exposure rate or personnel/equipment frisking measurements.

**Table 5-4**  
**Total Number of Required Measurements**  
**Building 612**  
**License Termination Report**  
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Dataset <sup>(1)</sup>	Gross Activity DCGLw (dpm/100cm <sup>2</sup> ) <sup>(2)</sup>	Instrument Specific DCGLw (cpm) <sup>(3)</sup>	LBGR <sup>(4)</sup>	$\Delta$ <sup>(5)</sup>	Observed Survey $\sigma$ (cpm) <sup>(6)</sup>	Observed Bkgd $\sigma$ (cpm)	$\Delta/\sigma$ <sup>(7)</sup>	Pr <sup>(8)</sup>	Z(1- $\alpha$ ) <sup>(9)</sup>	Z(1- $\beta$ ) <sup>(9)</sup>	Total N <sup>(10)</sup>
FIDLER - DFC bkgd <sup>(11)</sup>	31800	3512	1756	1756	1270	1156	1.4	0.84	1.645	1.645	31
FIDLER - 722 bkgd	31800	11566	5783	5783	1270	3307	1.7	0.89	1.645	1.645	24
FIDLER - C0912 out bkgd	31800	6746	3373	3373	1270	1251	2.7	0.96	1.645	1.645	17
FIDLER - C0912 in bkgd	31800	3086	1543	1543	1270	954	1.2	0.80	1.645	1.645	40
Alpha HH - 2078	31800	6091	3046	3046	1	1	2308	1.00	1.645	1.645	14
Beta HH - 2078	31800	7786	3893	3893	45	71	55	1.00	1.645	1.645	14
Alpha FM - 2078	31800	26091	13046	13046	2	3	3801	1.00	1.645	1.645	14
Beta FM - 2078	31800	46091	23046	23046	70	182	126	1.00	1.645	1.645	14

Notes:

- (1) All measurements for all survey units are combined for this evaluation. Instruments: FM = alpha/beta gas proportional floor monitor; FIDLER = low-energy gamma scintillator; HH = alpha/beta gas proportional hand-held detector.
- (2) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Gross activity DCGLw for DU calculated per MARSSIM.
- (3) cpm = counts per minute. Instrument-specific DCGLw calculated per MARSSIM. Includes average background count rate.
- (4) LBGR = lower bound of gray region. Per MARSSIM, LBGR was set to 1/2 of the DCGLw.
- (5)  $\Delta$  = DCGLw - LBGR.
- (6) The standard deviation ( $\sigma$ ) for the survey data includes all measurements collected with that instrument.
- (7)  $\Delta/\sigma$  calculated using the larger value between the survey standard deviation and the background standard deviation.
- (8) Values of Pr are from Table 5.1 of MARSSIM using  $\Delta/\sigma$ . Pr is defined by MARSSIM as the probability that a random measurement from the survey unit exceeds a random measurement from the background reference area by less than the DCGLW when the survey unit median is equal to the LBGR above background.
- (9) Values of Z(1- $\alpha$ ) and Z(1- $\beta$ ) (decision error percentiles) are from Table 5.2 of MARSSIM for  $\alpha=\beta=0.05$ .
- (10) N = total required number of measurements or samples (includes both survey and background areas).
- (11) Background measurements used for FIDLER background dataset included FIDLER measurements from:
  - '- daily instrument function check data (DFC bkgd);
  - '- Building 722 (722 bkgd)
  - '- open energy window measurements from Igloo C0912 (C0912 out bkgd);
  - '- closed energy window measurements from Igloo C0912 (C0912 in bkgd).

**Table 5-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 612 Alpha and Beta Direct Measurements vs. Background**  
**License Termination Report**  
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Survey Unit (Bldg/Room)	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
612-A	Alpha HH	1	1	0	4	1	47	32	1667.5	1492.5	-2.1222	0.034	Fail	Bkgd
612-A	Beta HH	161	158	115	262	31	47	32	1801	1359	-0.7889	0.43	Pass	Bkgd
612-A	Alpha FM	3	3	0	5	2	12	31	132	814	-3.5741	3.5E-04	Fail	Bkgd
612-A	Beta FM	670	666.5	559	733	51	12	31	119.5	826.5	-3.9126	9.1E-05	Fail	Bkgd
612-AA	Alpha HH	1	1	0	4	1	97	32	5990.5	2394.5	-1.7151	0.086	Pass	Bkgd
612-AA	Beta HH	126	123	66	221	35	97	32	5424.5	2960.5	-4.8016	1.6E-06	Fail	Bkgd
612-AA	Alpha FM	4	4	0	10	2	45	31	1318.5	1607.5	-4.3758	1.2E-05	Fail	Bkgd
612-AA	Beta FM	853	852	748	958	43	45	31	1482.5	1443.5	-2.6424	8.2E-03	Fail	Bkgd
612-B	Alpha HH	2	1	0	4	1	22	32	645	840	0.7042	0.48	Pass	Bkgd
<b>612-B</b>	<b>Beta HH</b>	<b>195</b>	<b>192</b>	<b>144</b>	<b>245</b>	<b>31</b>	<b>22</b>	<b>32</b>	<b>724.5</b>	<b>760.5</b>	<b>2.1037</b>	<b>0.035</b>	<b>Fail</b>	<b>612-B</b>
612-BB	Alpha HH	1	1	0	3	1	27	32	746.5	1023.5	-0.9661	0.33	Pass	Bkgd
612-BB	Beta HH	131	138	70	181	32	27	32	579.5	1190.5	-3.5069	4.5E-04	Fail	Bkgd
612-BB	Alpha FM	4	4.5	0	6	2	10	31	113	748	-2.9448	3.2E-03	Fail	Bkgd
612-BB	Beta FM	907	899.5	850	1003	44	10	31	180	681	-0.9108	0.36	Pass	Bkgd
612-C	Alpha HH	2	2	0	3	1	11	32	267.5	678.5	0.7098	0.48	Pass	Bkgd
612-C	Beta HH	175	185	137	205	26	11	32	271.5	674.5	0.8211	0.41	Pass	Bkgd
612-C	Alpha FM	4	4	4	4	0	2	-- <sup>(7)</sup>	--	--	--	--	NA <sup>(7)</sup>	Site max < background max
612-C	Beta FM	709	709	674	744	49	2	--	--	--	--	--	NA	Site max < background max
612-D	Alpha HH	2	2	0	5	1	14	32	377	704	1.1459	0.25	Pass	Bkgd
612-D	Beta HH	158	160.5	118	209	26	14	32	296	785	-0.7878	0.43	Pass	Bkgd
612-D	Alpha FM	6	6.5	2	10	3	4	--	--	--	--	--	NA	Site max < background max
612-D	Beta FM	728	727.5	676	782	43	4	--	--	--	--	--	NA	Site max < background max
612-E	Alpha HH	1	1	0	4	1	16	32	387	789	-0.1094	0.91	Pass	Bkgd
612-E	Beta HH	174	181	124	242	30	16	32	427	749	0.7655	0.44	Pass	Bkgd
612-E	Alpha FM	5	4.5	4	5	1	6	31	69	634	-1.8542	0.064	Pass	Bkgd
612-E	Beta FM	696	704	619	763	52	6	31	48	655	-2.7195	6.5E-03	Fail	Bkgd
612-F	Alpha HH	1	1	0	3	1	33	32	1068.5	1076.5	-0.269	0.79	Pass	Bkgd
612-F	Beta HH	154	152	98	210	33	33	32	978	1167	-1.4565	0.15	Pass	Bkgd
612-F	Alpha FM	3	3.5	0	6	2	12	31	144.5	801.5	-3.2356	1.2E-03	Fail	Bkgd
612-F	Beta FM	713	714	653	762	33	12	31	138.5	807.5	-3.3981	6.8E-04	Fail	Bkgd
612-G	Alpha HH	1	1	0	2	1	9	32	154.5	706.5	-1.0866	0.28	Pass	Bkgd
612-G	Beta HH	130	131	94	157	21	9	32	100	761	-2.8032	5.1E-03	Fail	Bkgd
612-H	Alpha HH	1	1	0	3	1	9	32	161.5	699.5	-0.8662	0.39	Pass	Bkgd
612-H	Beta HH	153	147	115	187	24	9	32	157	704	-1.0079	0.31	Pass	Bkgd
612-I	Alpha HH	2	1.5	0	6	2	16	32	405.5	770.5	0.2953	0.77	Pass	Bkgd

**Table 5-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 612 Alpha and Beta Direct Measurements vs. Background**  
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Survey Unit (Bldg/Room)	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
612-I	Beta HH	165	167	121	207	27	16	32	385.5	790.5	-0.1422	0.89	Pass	Bkgd
612-J	Alpha HH	1	1	0	3	1	17	32	371.5	853.5	-1.1237	0.26	Pass	Bkgd
612-J	Beta HH	178	189	121	237	34	17	32	473	752	1.0082	0.31	Pass	Bkgd
612-K	Alpha HH	1	1	0	3	1	27	32	686.5	1083.5	-1.879	0.060	Pass	Bkgd
612-K	Beta HH	117	96	70	230	44	27	32	528.5	1241.5	-4.2829	1.8E-05	Fail	Bkgd
612-K	Alpha FM	8	8	4	13	3	5	31	103.5	562.5	0.5032	0.61	Pass	Bkgd
612-K	Beta FM	908	890	876	955	36	5	31	77	589	-0.709	0.48	Pass	Bkgd
612-L	Alpha HH	1	0	0	2	1	23	32	484.5	1055.5	-2.7216	6.5E-03	Fail	Bkgd
612-L	Beta HH	129	133	61	217	45	23	32	453.5	1086.5	-3.2505	1.2E-03	Fail	Bkgd
612-L	Alpha FM	4	4	3	6	2	6	31	65	638	-2.019	0.043	Fail	Bkgd
612-L	Beta FM	880	879	843	922	31	6	31	90.5	612.5	-0.9683	0.33	Pass	Bkgd
612-M	Alpha HH	1	1	0	5	1	170	32	16458	4045	-2.6273	8.6E-03	Fail	Bkgd
612-M	Beta HH	114	101	60	627	53	170	32	15238	5265	-6.6489	3.0E-11	Fail	Bkgd
612-M	Alpha FM	4	3.5	0	12	3	62	31	2394.5	1976.5	-4.2339	2.3E-05	Fail	Bkgd
612-M	Beta FM	855	859	781	933	37	62	31	2571	1800	-2.7954	5.2E-03	Fail	Bkgd
612-N	Alpha HH	1	1	0	6	2	27	32	717	1053	-1.4149	0.16	Pass	Bkgd
612-N	Beta HH	124	102	72	231	44	27	32	574.5	1195.5	-3.583	3.4E-04	Fail	Bkgd
612-N	Alpha FM	4	4	1	6	2	10	31	115	746	-2.8841	3.9E-03	Fail	Bkgd
612-N	Beta FM	883	890	815	926	35	10	31	170	691	-1.2144	0.22	Pass	Bkgd
612-O	Alpha HH	1	1	0	5	1	26	32	709	1002	-0.9068	0.36	Pass	Bkgd
612-O	Beta HH	119	118	70	194	31	26	32	485	1226	-4.4091	1.0E-05	Fail	Bkgd
612-O	Alpha FM	2	2.5	1	4	1	10	31	83.5	777.5	-3.8404	1.2E-04	Fail	Bkgd
612-O	Beta FM	850	847	779	910	41	10	31	153	708	-1.7305	0.084	Pass	Bkgd
612-P	Alpha HH	1	1	0	4	1	31	32	860.5	1155.5	-1.8079	0.071	Pass	Bkgd
612-P	Beta HH	149	140	84	383	54	31	32	806	1210	-2.5572	0.011	Fail	Bkgd
612-P	Alpha FM	3	3	1	6	1	10	31	99	762	-3.3698	7.5E-04	Fail	Bkgd
612-P	Beta FM	863	891	525	939	120	10	31	165	696	-1.3661	0.17	Pass	Bkgd
612-Q	Alpha HH	1	1	0	3	1	31	32	906.5	1109.5	-1.1755	0.24	Pass	Bkgd
612-Q	Beta HH	147	154	77	213	35	31	32	862	1154	-1.7873	0.074	Pass	Bkgd
612-Q	Alpha FM	5	5	0	10	3	9	31	136	684	-1.5709	0.12	Pass	Bkgd
612-Q	Beta FM	977	999	904	1023	42	9	31	178	642	-0.2105	0.83	Pass	Bkgd
612-R	Alpha HH	1	1	0	4	1	18	32	447	828	-0.2425	0.81	Pass	Bkgd
612-R	Beta HH	132	137.5	61	172	30	18	32	310	965	-3.0115	2.6E-03	Fail	Bkgd
612-R	Alpha FM	3	2	0	7	2	10	31	95	766	-3.4913	4.8E-04	Fail	Bkgd
612-R	Beta FM	868	880.5	759	910	44	10	31	165.5	695.5	-1.351	0.18	Pass	Bkgd
612-S	Alpha HH	1	1	0	5	1	25	32	642.5	1010.5	-1.3267	0.18	Pass	Bkgd
612-S	Beta HH	128	131	74	241	39	25	32	500	1153	-3.6184	3.0E-04	Fail	Bkgd
612-S	Alpha FM	4	4	1	7	2	10	31	124.5	736.5	-2.5957	9.4E-03	Fail	Bkgd
612-S	Beta FM	839	875.5	641	920	95	10	31	149	712	-1.8519	0.064	Pass	Bkgd

**Table 5-5**  
**Summary Statistics and Wilcoxon Rank Sum Test Results**  
**Building 612 Alpha and Beta Direct Measurements vs. Background**  
**License Termination Report**  
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Survey Unit (Bldg/Room)	Measurement <sup>(1)</sup>	Mean (cpm) <sup>(2)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
612-T	Alpha HH	1	1	0	3	1	26	32	724	987	-0.6723	0.50	Pass	Bkgd
612-T	Beta HH	127	128.5	79	229	35	26	32	515.5	1195.5	-3.9322	8.4E-05	Fail	Bkgd
612-T	Alpha FM	4	3.5	2	6	1	10	31	116	745	-2.8537	4.3E-03	Fail	Bkgd
612-T	Beta FM	863	868	811	897	25	10	31	158.5	702.5	-1.5635	0.12	Pass	Bkgd
612-U	Alpha HH	1	1	0	4	1	64	32	3049	1607	-0.4275	0.67	Pass	Bkgd
612-U	Beta HH	115	106	67	228	33	64	32	2367.5	2288.5	-5.7242	1.0E-08	Fail	Bkgd
612-U	Alpha FM	4	4	1	11	2	30	31	682.5	1208.5	-3.5705	3.6E-04	Fail	Bkgd
612-U	Beta FM	864	871.5	785	955	41	30	31	782	1109	-2.1351	0.033	Fail	Bkgd
612-V	Alpha HH	1	1	0	4	1	73	32	3689.5	1875.5	-1.2496	0.21	Pass	Bkgd
612-V	Beta HH	116	117	45	233	39	73	32	3072.5	2492.5	-5.5448	2.9E-08	Fail	Bkgd
612-V	Alpha FM	5	4	0	11	2	45	31	1429.5	1496.5	-3.2026	1.4E-03	Fail	Bkgd
612-V	Beta FM	888	900	785	971	46	45	31	1571	1355	-1.707	0.088	Pass	Bkgd
612-W	Alpha HH	1	1	0	4	1	68	32	3174	1876	-1.9212	0.055	Pass	Bkgd
612-W	Beta HH	113	91.5	66	419	59	68	32	2635.5	2414.5	-5.9003	3.6E-09	Fail	Bkgd
612-W	Alpha FM	5	4	1	10	3	35	31	955	1256	-2.7945	5.2E-03	Fail	Bkgd
612-W	Beta FM	852	863	723	906	43	35	31	979.5	1231.5	-2.4797	0.013	Fail	Bkgd
612-X	Alpha HH	1	1	0	5	1	72	32	3564	1896	-1.5213	0.13	Pass	Bkgd
612-X	Beta HH	105	99.5	53	173	29	72	32	2838.5	2621.5	-6.6309	3.3E-11	Fail	Bkgd
612-X	Alpha FM	5	5	0	10	2	35	31	951.5	1259.5	-2.8394	4.5E-03	Fail	Bkgd
612-X	Beta FM	877	886	774	963	47	35	31	1030	1181	-1.8309	0.067	Pass	Bkgd
612-Y	Alpha HH	1	1	0	5	1	100	32	6425	2353	-1.1947	0.23	Pass	Bkgd
612-Y	Beta HH	112	101	61	328	41	100	32	5470.5	3307.5	-6.2631	3.8E-10	Fail	Bkgd
612-Y	Alpha FM	5	4	0	18	3	44	31	1394.5	1455.5	-2.9857	2.8E-03	Fail	Bkgd
612-Y	Beta FM	873	871.5	785	976	42	44	31	1473	1377	-2.1411	0.032	Fail	Bkgd
612-Z	Alpha HH	1	1	0	4	1	63	32	2923.5	1636.5	-0.7914	0.43	Pass	Bkgd
612-Z	Beta HH	124	121	66	308	40	63	32	2386.5	2173.5	-5.0198	5.2E-07	Fail	Bkgd
612-Z	Alpha FM	5	4	1	12	2	30	31	709	1182	-3.1882	1.4E-03	Fail	Bkgd
612-Z	Beta FM	901	900	813	975	44	30	31	838.5	1052.5	-1.32	0.19	Pass	Bkgd

Notes:

- (1) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: FM = alpha/beta gas proportional floor monitor; HH = alpha/beta handheld gas proportional;
- (2) cpm = counts per minute.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 5.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above background it is shaded and listed in boldface.
- (7) "--" = parameter not calculated; NA = not applicable. A minimum of five measurements was necessary for the WRS test. When this criterion was not met, the maximum survey result was compared to the maximum background result for that instrument.

**Table 5-6**  
**Wilcoxon Rank Sum Test Results**  
**Direct Measurements vs. DCGL<sub>w</sub>-Adjusted Background <sup>(1)</sup>**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement <sup>(2)</sup>	Valid N Survey <sup>(3)</sup>	Valid N Background <sup>(3)</sup>	Rank Sum Survey	Rank Sum Background	Z <sup>(4)</sup>	p-level <sup>(4)</sup>	Pass/Fail WRS test? <sup>(5)</sup>	Higher dataset if test fails <sup>(6)</sup>
612-B	Beta HH	22	32	253	1232	-6.2	5.8E-10	Fail	DCGL <sub>w</sub> -Adjusted Background

Notes:

- (1) The DCGL<sub>w</sub>-adjusted background is created by adding the depleted uranium DCGL<sub>w</sub> to each background measurement for a given instrument.
- (2) Measurements from each survey unit were grouped by radiation type and instrument. Instruments: HH = alpha/beta handheld gas proportional detector.
- (3) The Valid N for a dataset refers to the number of measurements in that dataset used in the WRS test.
- (4) The statistical parameters Z and p-level were generated by the Statistica software package.
- (5) The test is said to fail (i.e., the null hypothesis that the survey dataset and the DCGL<sub>w</sub>-adjusted background dataset are the same is rejected) when the p-level is less than the acceptable Type I error of 0.05.
- (6) The greater dataset is determined by examining box-and-whisker plots (**Appendix 5.C**) and by comparing the average ranks (Average Rank = Rank Sum/Valid N).  
If the site dataset is determined to be elevated above the DCGL<sub>w</sub>-adjusted background it is shaded and listed in boldface.

**Table 5-7**  
**Summary Statistics**  
**Building 612 Gamma Direct Measurements**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Measurement	Number of Measurements	Mean (cpm) <sup>(1)</sup>	Median (cpm)	Minimum (cpm)	Maximum (cpm)	Std. Dev. (cpm)
612-A	Gamma FIDLER	59	3939	4638	1733	5749	1424
612-AA	Gamma FIDLER	142	2619	2448	372	4569	775
612-B	Gamma FIDLER	22	5818	5983.5	4552	7271	751
612-BB	Gamma FIDLER	37	2583	2169	1640	3995	776
612-C	Gamma FIDLER	13	5964	5918	4978	6824	566
612-D	Gamma FIDLER	18	5969	6173.5	4432	7019	909
612-E	Gamma FIDLER	22	5747	5719.5	4898	6882	577
612-F	Gamma FIDLER	44	4918	4840	2873	7078	944
612-G	Gamma FIDLER	9	4097	4002	3922	4420	176
612-H	Gamma FIDLER	9	4183	4000	3253	5269	592
612-I	Gamma FIDLER	16	3992	4326	1947	5812	1280
612-J	Gamma FIDLER	17	6049	5761	5402	7016	601
612-K	Gamma FIDLER	32	2430	2415	1418	3589	508
612-L	Gamma FIDLER	29	2479	2501	1535	3469	513
612-M	Gamma FIDLER	232	2440	2429.5	1114	4229	656
612-N	Gamma FIDLER	37	2338	2018	1082	3650	745
612-O	Gamma FIDLER	36	2373	1988	1521	3704	730
612-P	Gamma FIDLER	41	2410	1979	1323	4035	870
612-Q	Gamma FIDLER	41	2408	2095	1714	3822	589
612-R	Gamma FIDLER	37	2951	2017	1455	5766	1528
612-S	Gamma FIDLER	35	2226	1839	1406	3704	742
612-T	Gamma FIDLER	36	2289	1966	1421	3551	698
612-U	Gamma FIDLER	95	2021	1747	523	3934	807
612-V	Gamma FIDLER	117	1967	1775	602	4569	645
612-W	Gamma FIDLER	103	2138	2065	529	3453	654
612-X	Gamma FIDLER	107	2245	2271	610	3802	675
612-Y	Gamma FIDLER	146	2002	1992	425	4433	777
612-Z	Gamma FIDLER	93	2090	1996	502	4291	755

Notes:

(1) Gamma FIDLER = low-energy gamma scintillator.

(2) cpm = counts per minute.

**Table 5-8**  
**Survey Units with Measurements Exceeding DCGL<sub>EMC</sub>**  
**Building 612**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)	Dataset	Total Number of Measurements	Measurements Exceeding DCGL <sub>EMC</sub>	Maximum Measurement (cpm) <sup>(1)</sup>	DCGL <sub>EMC</sub> (cpm) <sup>(2)</sup>
612-B	Gamma FIDLER	22	3	7271	6787
612-C	Gamma FIDLER	13	1	6824	6787
612-D	Gamma FIDLER	18	4	7019	6787
612-E	Gamma FIDLER	22	2	6882	6787
612-F	Gamma FIDLER	45	2	7078	6787
612-J	Gamma FIDLER	17	3	7016	6787

Notes:

(1) cpm = counts per minute. Complete survey data is presented in **Appendix 5.C**.

(2) DCGL<sub>EMC</sub> from **Table 5-2**.



**Table 5-9**  
**Summary of Smear Sampling Results <sup>(1,2)</sup>**  
**Building 612**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Number of Smears	Alpha (dpm) <sup>(3)</sup>			Beta (dpm)			Gamma (dpm)		
			Min	Average	Max	Min	Average	Max	Min	Average	Max
612	A	59	0.0	0.0	1.1	0.0	0.0	0	0.0	0.0	0.0
612	AA	142	0.0	0.0	0.8	0.0	0.0	3.6	0.0	0.0	0.0
612	B	22	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0.0
612	BB	37	0.0	0.0	0.7	0.0	0.0	0	0.0	0.0	0.0
612	C	13	0.0	0.2	1.8	0.0	0.0	0	0.0	0.0	0.0
612	D	18	0.0	0.2	1.3	0.0	0.0	0	0.0	0.0	0.0
612	E	22	0.0	0.1	0.6	0.0	0.1	2.5	0.0	0.0	0.0
612	F	45	0.0	0.1	0.9	0.0	0.5	3.8	0.0	0.0	0.0
612	G	9	0.0	0.2	1.3	0.0	0.0	0	0.0	0.0	0.0
612	H	9	0.0	0.0	0	0.0	0.0	0	0.0	6.4	57.2
612	I	16	0.0	0.0	0	0.0	0.0	0	0.0	4.7	74.7
612	J	17	0.0	0.1	0.9	0.0	0.0	0	0.0	0.0	0.0
612	K	32	0.0	0.1	1.5	0.0	0.1	4.6	0.0	3.7	62.0
612	L	29	0.0	0.1	1.5	0.0	0.0	0	0.0	0.0	0.0
612	M	232	0.0	0.0	1.1	0.0	0.1	4.5	0.0	0.5	63.0
612	N	37	0.0	0.1	1.4	0.0	0.0	0	0.0	0.0	0.0
612	O	36	0.0	0.1	1	0.0	0.0	0	0.0	0.0	0.0
612	P	41	0.0	0.0	1.1	0.0	0.1	2.5	0.0	1.3	51.9
612	Q	41	0.0	0.1	1.5	0.0	0.4	3.8	0.0	0.0	0.0
612	R	37	0.0	0.1	1.2	0.0	0.2	4	0.0	0.0	0.0
612	S	35	0.0	0.1	1.5	0.0	0.3	2.9	0.0	0.0	0.0
612	T	36	0.0	0.1	1.2	0.0	0.3	3.5	0.0	0.0	0.0
612	U	95	0.0	0.1	1.4	0.0	0.2	3.7	0.0	0.0	0.0
612	V	118	0.0	0.0	1	0.0	0.1	4.1	0.0	0.0	0.0
612	W	103	0.0	0.0	1.1	0.0	0.2	3.3	0.0	0.0	0.0
612	X	107	0.0	0.1	1.1	0.0	0.0	3.2	0.0	0.7	71.5
612	Y	146	0.0	0.0	1	0.0	0.1	4.7	0.0	0.0	0.0
612	Z	93	0.0	0.1	1.3	0.0	0.0	4.1	0.0	0.0	0.0

Notes:

(1) 10 CFR 835, Appendix D, removable contamination limits: natural U, U-235, U-238, and assoc. decay products - 1,000 dpm/100cm<sup>2</sup>;  
Tritium - 10,000 beta-gamma/100cm<sup>2</sup>.

(2) Smear samples collected over a 100 cm<sup>2</sup> area.

(3) dpm = decays per minute.

**Table 5-10**  
**Dose Contribution from Above-Background Survey Units**  
**DU Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

Survey Unit (Bldg/Room)		Dataset above Background <sup>(1)</sup>	Average Measurement (cpm) <sup>(2)</sup>	Maximum Measurement (cpm)	Equivalent DCGLw (cpm) <sup>(3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5)</sup>
612	B	Beta HH	195	245	3863	10	0.63
<b>Total for Building 612:</b>							<b>0.63</b>

Notes:

- (1) Datasets above background determined by WRS test (**Table 5-5**); Instruments: HH = alpha/beta gas proportional floor monitor.
- (2) cpm = counts per minute.
- (3) The instrument equivalent DCGLw for DU was calculated as described in **Table 5-2**.
- (4) The dose limit of 10 mrem/yr was established in the *Seneca Army Activity Depot License Termination and License Release Plan* (ANL, 2003).
- (5) The calculated dose contribution is the dose limit multiplied by ratio of the maximum survey unit measurement to the equivalent DCGLw.

**Table 6-1**  
**Release Limits**  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Radionuclide	LTP DCGLw (dpm/100cm <sup>2</sup> ) <sup>(2)</sup>	NRC Guidelines <sup>(1)</sup>			10 CFR 835	
		Removable (dpm/100cm <sup>2</sup> )	Average (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Maximum (dpm/100cm <sup>2</sup> ) <sup>(4)</sup>	Removable (dpm/100cm <sup>2</sup> )	Total (Fixed plus Removable) (dpm/100cm <sup>2</sup> )
Th-232 <sup>(5)</sup>	3090	200	1000	3000	200	1000
U-238 <sup>(6)</sup>	31600 (U-238) 4062 (U ore)	1000 ( $\alpha$ only) <sup>(7)</sup>	5000 ( $\alpha$ only)	15000 ( $\alpha$ only)	1000 ( $\alpha$ only)	5000 ( $\alpha$ only)

Notes:

- (1) From "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" (NRC, 1987).
- (2) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters.
- (3) The average is applicable to not more than 1 square meter.
- (4) The maximum limit is applicable to an area of not more than 100 cm<sup>2</sup>.
- (5) NRC Guidelines and 10 CFR 835 list the same limits for natural thorium and Th-232. DCGL was developed for Th-232 (ANL, 2003).
- (6) NRC Guidelines and 10 CFR 835 list the same limits for natural uranium and U-238. DCGL was developed for U-238 (ANL, 2003) and calculated for uranium ore using individual DCGLs and expected activity fractions from NCRP 94 (NCRP, 1987).
- (7) NRC Guidelines and 10 CFR 835 limits for U-238 and natural uranium are for alpha radiation only.

**Table 6-2**  
**Available Survey Instrument Information <sup>(1)</sup>**  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Instrument	Survey	Measurement Type	Probe	Meter	Probe Area (cm <sup>2</sup> ) <sup>(2)</sup>	Average Instrument Efficiency	Lower Limit of Detection (LLD) (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Scanning MDA (dpm/100cm <sup>2</sup> )
Exposure Rate	Army, 1993	Ambient Gamma Exposure Rate	Ludlum Model 19		-- <sup>(4)</sup>	N/A <sup>(5)</sup>	N/A	N/A
Onsite Smear Counting	Army, 1993	Gross Alpha	Nuclear Measurements PC-5 Gas Proportional Counters		N/A	Alpha SN 7633: 34.4 % SN 7634: 33.4 %	Alpha SN 7633: 5.54 dpm SN 7634: 6.03 dpm	N/A
Offsite Smear Counting	Army, 1993	Gross Alpha/Beta	Tennelec Model LB5100		N/A	N/A	Alpha: 0.4 Beta: 1.5	N/A
Gamma Scanning	NRC, 1994	Gamma	Eberline Model SPA-3    Eberline Model 2"x2" NaI                    ESP-2		20.4	N/A	N/A	N/A
Exposure Rate	NRC, 1994	Ambient Gamma Exposure Rate	Ludlum Model 19		--	N/A	N/A	N/A
Offsite Smear Counting	NRC, 1994	Gross Alpha/Beta	Tennelec Model LB5100 - Series II		N/A	23%	N/A	N/A

Notes:

(1) Available instrument information summarized from **Appendix 6.A, 6.B, and 6.C**.

(2) cm<sup>2</sup> = square centimeters.

(3) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters.

(4) "--" = not applicable.

(5) N/A = information not available.

**Table 6-3**  
**Exposure Rate Measurements**  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Warehouse 356 Location <sup>(1)</sup>	Measurement (uR/hr) <sup>(2)</sup>	Warehouse 357 Location <sup>(3)</sup>	Measurement (uR/hr)
A	16	at door entrance	13
A2	18	middle of C section	14
B	15	north west corner section C	24
B2	16	north wall middle	19
C	15	in office	12
C2	17		
D	15	Average:	16
D2	15	Maximum:	24
E	15		
E2	16		
F	14		
F2	16		
G	14		
G2	17		
H	15		
H2	22		
I	17		
J	14		
K	15		
L	13		
HE1	19		
HE2	14		
HE3	14		
Average:	16		
Maximum:	22		
Reported Instrument Background:	15		

Notes:

(1) Measurement locations in Warehouse 356 Section D are shown in **Appendix 6.A**.

(2) uR/hr = microRoentgens per hour.

(3) Warehouse 357 is an unaffected area of similar construction to Warehouse 356.

**Table 6-4**  
**Offsite Smear Analytical Results** <sup>(1,2,3)</sup>  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Sample ID	Location <sup>(4)</sup>	Gross count per 100cm <sup>2</sup> <sup>(5)</sup>		Net count rate (dpm/100cm <sup>2</sup> ) <sup>(6)</sup>	
		Alpha	Beta	Alpha	Beta
41	A1C4	1	33	0.0	0.5
42	A2D5	0	32	-0.1	0.4
43	B1C3	0	29	-0.1	0.3
44	B2C4	1	25	0.0	0.1
45	C1A5	2	26	0.1	0.1
46	C2C2	0	29	-0.1	0.3
47	D1E2	2	26	0.1	0.1
48	D2B4	1	19	0.0	-0.3
49	E1A2	3	38	0.1	0.7
50	E2A2	1	26	0.0	0.1
51	F1B3	0	29	-0.1	0.3
52	F2C2	2	31	0.1	0.4
53	G1B3	2	26	0.1	0.1
54	G2B2	4	34	0.2	0.5
55	H1D3	3	21	0.1	-0.2
56	H2C3	2	33	0.1	0.5
57	HE1A2	3	18	0.1	-0.3
58	HE2D2	1	27	0.0	0.2
59	HE3E2	2	29	0.1	0.3
60	I1E4	3	23	0.1	-0.1
61	J1E4	1	32	0.0	0.4
62	K1D3	2	35	0.1	0.6
63	L1D1	1	22	0.0	-0.1
Instrument Background		1	24	0.05	1.2

Notes:

- (1) Analysis performed by US Army Laboratory at Fort Belvoir, VA.
- (2) Smear samples collected over a 100 cm<sup>2</sup> area.
- (3) 10 CFR 835, Appendix D, removable contamination limits: natural uranium, U-235, U-238, and assoc. decay products - 1,000 dpm/100cm<sup>2</sup>; natural thorium - 200 dpm/100cm<sup>2</sup>. Also from "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material" (NRC, 1987).
- (4) Smear measurement locations are shown in **Appendix 6.A**.
- (5) Samples had a 20 minute count time.
- (6) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters. Net count rate includes subtraction of background.

**Table 6-5**  
**Onsite Smear Counting Results <sup>(1,2,3)</sup>**  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Location <sup>(4)</sup>	Instrument Number <sup>(5)</sup>	Result (dpm) <sup>(6)</sup>	LLD (dpm) <sup>(7)</sup>
A1-1	7634	<LLD	6.03
A1-2	7634	<LLD	6.03
A1-3	7634	<LLD	6.03
A1-4	7634	<LLD	6.03
A1-5	7633	<LLD	5.54
A2-1	7634	<LLD	6.03
A2-2	7633	<LLD	5.54
A2-3	7634	<LLD	6.03
A2-4	7633	<LLD	5.54
A2-5	7634	<LLD	6.03
B1-1	7633	<LLD	5.54
B1-2	7634	<LLD	6.03
B1-3	7633	<LLD	5.54
B1-4	7634	<LLD	6.03
B1-5	7633	<LLD	5.54
B2-1	7634	<LLD	6.03
B2-2	7633	<LLD	5.54
B2-3	7634	<LLD	6.03
B2-4	7633	<LLD	5.54
B2-5	7634	<LLD	6.03
C1-1	7633	<LLD	5.54
C1-2	7634	<LLD	6.03
C1-3	7633	<LLD	5.54
C1-4	7634	<LLD	6.03
C1-5	7633	8.72	5.54
C2-1	7634	<LLD	6.03
C2-2	7633	5.81	5.54
C2-3	7634	<LLD	6.03
C2-4	7633	<LLD	5.54
C2-5	7634	<LLD	6.03
D1-1	7633	<LLD	5.54
D1-2	7634	<LLD	6.03
D1-3	7633	<LLD	5.54
D1-4	7634	<LLD	6.03
D1-5	7633	5.81	5.54
D2-1	7634	<LLD	6.03
D2-2	7633	<LLD	5.54
D2-3	7634	<LLD	6.03
D2-4	7633	8.72	5.54
D2-5	7634	<LLD	6.03
E1-1	7633	<LLD	5.54
E1-2	7634	<LLD	6.03
E1-3	7633	<LLD	5.54

Location	Instrument Number	Result (dpm)	LLD (dpm)
G2-1	7633	<LLD	5.54
G2-2	7634	<LLD	6.03
G2-3	7633	<LLD	5.54
G2-4	7634	<LLD	6.03
G2-5	7633	<LLD	5.54
H1-1	7634	<LLD	6.03
H1-2	7633	<LLD	5.54
H1-3	7634	<LLD	6.03
H1-4	7633	<LLD	5.54
H1-5	7634	<LLD	6.03
H2-1	7633	<LLD	5.54
H2-2	7634	<LLD	6.03
H2-3	7633	<LLD	5.54
H2-4	7634	<LLD	6.03
H2-5	7633	<LLD	5.54
I-1	7634	<LLD	6.03
I-2	7633	<LLD	5.54
I-3	7634	<LLD	6.03
I-4	7633	5.81	5.54
I-5	7634	<LLD	6.03
J-1	7633	<LLD	5.54
J-2	7634	<LLD	6.03
J-3	7633	5.81	5.54
J-4	7634	<LLD	6.03
J-5	7633	8.72	5.54
K-1	7634	<LLD	6.03
K-2	7633	5.81	5.54
K-3	7634	<LLD	6.03
K-4	7633	<LLD	5.54
K-5	7634	<LLD	6.03
L-1	7633	<LLD	5.54
L-2	7634	<LLD	6.03
L-3	7633	<LLD	5.54
L-4	7634	<LLD	6.03
L-5	7633	<LLD	5.54
M-1	7633	<LLD	5.54
M-2	7634	<LLD	6.03
N-1	7633	<LLD	5.54
N-2	7634	<LLD	6.03
O-1	7633	<LLD	5.54
O-2	7634	<LLD	6.03
P-1	7633	<LLD	5.54
P-2	7634	<LLD	6.03

**Table 6-5**  
**Onsite Smear Counting Results** <sup>(1,2,3)</sup>  
**Warehouse 356**  
**License Termination Report**  
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Location <sup>(4)</sup>	Instrument Number <sup>(5)</sup>	Result (dpm) <sup>(6)</sup>	LLD (dpm) <sup>(7)</sup>
E1-4	7634	<LLD	6.03
E1-5	7633	<LLD	5.54
E2-1	7634	<LLD	6.03
E2-2	7633	<LLD	5.54
E2-3	7634	<LLD	6.03
E2-4	7633	<LLD	5.54
E2-5	7634	<LLD	6.03
F1-1	7633	<LLD	5.54
F1-2	7634	<LLD	6.03
F1-3	7633	<LLD	5.54
F1-4	7634	<LLD	6.03
F1-5	7633	<LLD	5.54
F2-1	7634	<LLD	6.03
F2-2	7633	<LLD	5.54
F2-3	7634	<LLD	6.03
F2-4	7633	<LLD	5.54
F2-5	7634	<LLD	6.03
G1-1	7634	<LLD	6.03
G1-2	7633	<LLD	5.54
G1-3	7634	<LLD	6.03
G1-4	7633	<LLD	5.54
G1-5	7634	<LLD	6.03

Location	Instrument Number	Result (dpm)	LLD (dpm)
Q-1	7633	5.81	5.54
Q-2	7634	<LLD	6.03
R-1	7633	<LLD	5.54
R-2	7634	<LLD	6.03
WA1-1	7633	<LLD	5.54
WA2-1	7634	<LLD	6.03
WA2-2	7633	<LLD	5.54
WB2-1	7634	<LLD	6.03
WC2-1	7633	<LLD	5.54
WD2-1	7634	<LLD	6.03
WE2-1	7633	5.81	5.54
WF2-1	7634	<LLD	6.03
WG2-1	7633	5.81	5.54
WH2-1	7634	<LLD	6.03
WH2-2	7633	<LLD	5.54
WH1-1	7634	<LLD	6.03
WI-1	7633	<LLD	5.54
WJ-1	7634	<LLD	6.03

Notes:

- (1) Analysis performed onsite by Army personnel during 1993 survey.
- (2) Smear samples collected over a 100 cm<sup>2</sup> area.
- (3) 10 CFR 835, Appendix D, removable contamination limits: natural uranium, U-235, U-238, and assoc. decay products - 1,000 dpm/100cm<sup>2</sup>; natural thorium - 200 dpm/100cm<sup>2</sup>. Also from "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material" (NRC, 1987).
- (4) Smear sampling locations shown in **Appendix 6.A**.
- (5) NMC PC-5 gas proportional counters 7633 and 7634 were used for onsite smear counting.
- (6) The reported result is for gross alpha + beta. "<LLD" = the result was below the LLD (lower limit of detection) and not reported.
- (7) The reported instrument-specific LLD is listed.



**Table 6-6**  
**NRC Smear Analytical Results <sup>(1)</sup>**  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Wipe Number	Location <sup>(2)</sup>	Gross Alpha (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Uncertainty (dpm/100cm <sup>2</sup> )
1	Floor	1.3	0.8
2	Floor	0.8	0.6
3	Floor	0.4	0.4
4	Floor	2.1	0.8
5	Floor	0.4	0.4
6	Floor	1.7	0.8
7	Floor	0.4	0.4
8	Floor	0	0
9	Floor	0.8	0.6
10	Floor	2.6	0.8
11	Floor	0.4	0.4
12	Floor	0.8	0.6
13	Floor	0.8	0.6
14	Floor	0.4	0.4
15	Floor	0.4	0.4
16	Floor	0.4	0.4
17	Floor	0.4	0.4
18	Floor	0.4	0.4
19	Floor	0.4	0.4
20	Floor	1.3	0.8
21	Floor	1.7	0.8
22	Floor	0.8	0.6
23	Floor	0.4	0.4
24	Floor	0.4	0.4
25	Floor	3.9	1.3
26	Floor	0.8	0.6
A	West Wall	1.3	0.8
B	West Wall	0.8	0.6
C	West Wall	1.3	0.8
D	West Wall	0.4	0.4
E	North Wall	0.8	0.6
F	North Wall	0.8	0.6
G	North Wall	1.3	0.8
H	North Wall	2.1	0.8
I	North Wall	0.4	0.4
J	North Wall	0.4	0.4
K	North Wall	1.7	0.8
L	North Wall	0	0
M	East Wall	0.8	0.6

**Table 6-6**  
**NRC Smear Analytical Results <sup>(1)</sup>**  
**Warehouse 356**  
**License Termination Report**  
**Seneca Army Depot Activity**

Wipe Number	Location <sup>(2)</sup>	Gross Alpha (dpm/100cm <sup>2</sup> ) <sup>(3)</sup>	Uncertainty (dpm/100cm <sup>2</sup> )
N	East Wall	0.8	0.6
O	East Wall	0.8	0.6
P	East Wall	0.4	0.4

Notes:

(1) Reprinted from NRC Closeout Inspection No. 040-00341/94-002 (**Appendix 6.C**).

(2) Specific locations of the smear samples were not listed in the Closeout Report.

(3) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters.

**Table 7-1**  
**SEAD-12 Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Building</b>	<b>Classification <sup>(1)</sup></b>	<b>Survey Phase <sup>(2)</sup></b>	<b>Building Use <sup>(3)</sup></b>
Building 800	3	II	Was a security check-point building for access into SEAD-12 via the north- northwest section of SEDA.
Building 802	3	II	Was used as an administrative office.
Building 803	1	I	Was used for the storage of removable nuclear capsules between 1957 and 1962. After the mid-1980's was used as a holding area for containerized radioactive wastes.
Building 804	1	I	Was used as a maintenance building for removable nuclear capsules between 1957 and 1962. Maintenance activities involved disassembling og nucelar cpasules for routine maintenance and cleaning, and for the verification of the integrity of the fissile materials. After the mid-1980's was occupied by the WSA Security Systems Maintenance Division.
Building 805	1	I	Was used as a storeroom between 1957 and 1962.
Building 806	2,3	II	Was used as a training center for radiological assistance team personnel. Room 1 was used as a calibrations laboratory to calibrate and function check radiation scanning instruments with sealed radioactive sources.
Building 807	3	II	Was used as a supply support shop.
Building 809	3	II	Was used for flammable storage.
Building 810	2,3	I, II	Was used as a transfer area for military items that entered and exited the WSA between 1957 and demilitarization in 1997. Only the receiving room (Room 810-1) would have had sealed military items present that could have contained radioactivie materials within them.
Building 812	2,3	I, II	Was used as the command structure for all security operations within the former WSA. Room 32 was used to store military equipment containing sealed radioactive sources as integral components.
Building 813	3	II	Was used as a storage workshop.
Building 814	3	II	Was used as a spray painting facility for painting vehicles.
Building 815	1,2,3	I, II	Until 1962, was used for inspection and testing of non-nuclear mechanical and electrical systems. Following 1992, was used to demilitarize non-nuclear components as part of the nuclear stockpile reduction effort.
Building 816	1,2,3	I, II	Until 1962, was used for inspection and testing of non-nuclear mechanical and electrical systems. Following 1992, was used to demilitarize non-nuclear components as part of the nuclear stockpile reduction effort.
Building 817	3	II	Was used as a utility building.

**Table 7-1**  
**SEAD-12 Buildings**  
**License Termination Report**  
**Seneca Army Depot Activity**

<b>Building</b>	<b>Classification <sup>(1)</sup></b>	<b>Survey Phase <sup>(2)</sup></b>	<b>Building Use <sup>(3)</sup></b>
Building 819	1,2	I	Was used as a quality assurance inspection laboratory and was used by Sandia National Laboratories under contract to the AEC between 1957 to 1962.
Building 823	3	II	Was used as a general purpose magazine depot.
Building 824	3	II	Was used as a railway loading platform.
Building 825	3	II	Was used as a non-hazardous warehouse.
Building 827	3	II	Is currently an electrical utility shed.

Notes:

- (1) Classifications are based on historical site assessment, per MARSSIM. Depending on the uses of the building, more than one survey unit classification may have been assigned.
- (2) Phase I interior survey occurred in 1999. Phase II interior survey occurred in 2001.
- (3) Building uses are summarized from the SEAD-12 Radiological Survey Report (Parsons, 2003).

**Table 7-2**  
**Comparison of LTP and SEAD-12 DCGLs**  
**License Termination Report**  
**Seneca Army Depot Activity**

Radionuclide	Building Surface		Soil	
	LTP	SEAD-12	LTP	SEAD-12
	DCGLw (dpm/100cm <sup>2</sup> ) <sup>(1)</sup>	Resident DCGLw <sup>(2)</sup> (dpm/100cm <sup>2</sup> )	DCGLw (pCi/g) <sup>(3)</sup>	Resident DCGLw <sup>(4)</sup> (pCi/g)
Ac-227	670	-- <sup>(5)</sup>	6.9	0.16
Am-241	--	39.7	--	--
Co-57	--	72600	--	9.0 <sup>(6)</sup>
Co-60	--	3060	--	0.28 <sup>(6)</sup>
Cs-137	--	12500	--	1.4 <sup>(6)</sup>
H-3	2.1E+08	7.19E+07	5800	8.0
Pa-231	1360	--	2.5	0.08
Pb-210	1790	--	5.6	0.28
Pm-147	1.7E+07	8.15E+05	46000	4935
Pu-239	4240	41	59	2.0
Ra-226	2870	1210	1.7	0.01
Ra-228	3790	--	2.2	0.24
Sm-147	57500	--	240	13.8
Sr-90	--	10600	--	--
Tc-99	--	1.48E+06	--	--
Th-228	3950	--	3.8	0.39
Th-230	16200	55	54	0.03
Th-232	3090	--	1.5	0.13
U-234	35100	--	180	3.9
U-235	18200	145	33	0.67
U-238	31600	152	98	7.4

Notes:

- (1) dpm/100cm<sup>2</sup> = decays per minute per 100 square centimeters.
- (2) SEAD-12 DCGLs were developed using residential and worker scenarios. Except where noted, the residential (the most conservative) DCGLs are listed.
- (3) pCi/g = picocuries per gram.
- (4) For SEAD-12 soils, the calculated individual soil DCGLs were divided by 10 to account for multiple radionuclides being present at once.
- (5) "--" = DCGL was not calculated for this radionuclide.
- (6) The more conservative DCGLs for Co-57, Co-60, and Cs-137 for SEAD-12 soils came from the worker scenario.

**Table 8-1**  
**Dose Contribution from Sites**  
**License Termination Report**  
**Seneca Army Depot Activity**

Site <sup>(1)</sup>	Dataset above Background <sup>(2, 3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5, 6)</sup>	Below Dose Limit?
Igloo A0201	-	10	N/A	YES
Igloo A0316	-	10	N/A	YES
Igloo A0317	Gamma	10	6.14	YES
Igloo A0508	Gamma	10	6.46	YES
Igloo A0701	-	10	N/A	YES
Igloo A0706	Alpha PH Gamma	10	6.47	YES
Igloo A0707	Gamma	10	6.06	YES
Igloo A0710	Beta PH	10	1.45	YES
Igloo A0711	Alpha PH	10	0.18	YES
Igloo A0901	Beta PH	10	1.43	YES
Igloo A0905	Beta PH	10	1.23	YES
Igloo A1108	-	10	N/A	YES
Igloo A1109	-	10	N/A	YES
Igloo B0109	-	10	N/A	YES
Igloo B0411	-	10	N/A	YES
Igloo B0501	-	10	N/A	YES
Igloo B0602	-	10	N/A	YES
Igloo B0603	-	10	N/A	YES
Igloo B0609	-	10	N/A	YES
Igloo B0610	-	10	N/A	YES
Igloo B0701	-	10	N/A	YES
Igloo B0705	-	10	N/A	YES
Igloo B0707	-	10	N/A	YES
Igloo B0708	-	10	N/A	YES
Igloo B0709	-	10	N/A	YES
Igloo B0711	-	10	N/A	YES
Igloo B0801	-	10	N/A	YES
Igloo B0802	-	10	N/A	YES
Igloo B0804	-	10	N/A	YES
Igloo B0809	Alpha PH	10	0.16	YES
Igloo B0810	Alpha PH	10	0.09	YES
Igloo B0812	-	10	N/A	YES
Igloo B0909	Gamma	10	6.71	YES
Igloo C0203	Alpha PH	10	0.06	YES
Igloo C0303	-	10	N/A	YES
Igloo C0307	-	10	N/A	YES
Igloo C0308	-	10	N/A	YES
Igloo C0401	-	10	N/A	YES
Igloo C0403	-	10	N/A	YES
Igloo C0405	-	10	N/A	YES

**Table 8-1**  
**Dose Contribution from Sites**  
**License Termination Report**  
**Seneca Army Depot Activity**

Site <sup>(1)</sup>	Dataset above Background <sup>(2, 3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5, 6)</sup>	Below Dose Limit?
Igloo C0406	-	10	N/A	YES
Igloo C0407	-	10	N/A	YES
Igloo C0408	-	10	N/A	YES
Igloo C0501	-	10	N/A	YES
Igloo C0503	-	10	N/A	YES
Igloo C0504	-	10	N/A	YES
Igloo C0505	-	10	N/A	YES
Igloo C0508	-	10	N/A	YES
Igloo C0510	-	10	N/A	YES
Igloo C0511	-	10	N/A	YES
Igloo C0513	-	10	N/A	YES
Igloo C0603	-	10	N/A	YES
Igloo C0604	-	10	N/A	YES
Igloo C0605	-	10	N/A	YES
Igloo C0606	-	10	N/A	YES
Igloo C0608	-	10	N/A	YES
Igloo C0701	-	10	N/A	YES
Igloo C0706	-	10	N/A	YES
Igloo C0707	-	10	N/A	YES
Igloo C0708	-	10	N/A	YES
Igloo C0801	Gamma	10	6.09	YES
Igloo C0803	Gamma	10	6.21	YES
Igloo C0807	-	10	N/A	YES
Igloo C0809	-	10	N/A	YES
Igloo C0901	Gamma	10	6.34	YES
Igloo C0902	Gamma	10	6.31	YES
Igloo C0906	Gamma	10	6.22	YES
Igloo C0908	-	10	N/A	YES
Igloo C0908	Gamma	10	6.20	YES
Igloo C0910	-	10	N/A	YES
Igloo D0104	-	10	N/A	YES
Igloo D0105	-	10	N/A	YES
Igloo D0107	Beta PH	10	1.46	YES
Igloo D0108	Gamma	10	6.12	YES
Igloo D0110	-	10	N/A	YES
Igloo D0113	-	10	N/A	YES
Igloo D0206	-	10	N/A	YES
Igloo D0207	-	10	N/A	YES
Igloo D0305	-	10	N/A	YES
Igloo D0306	Gamma	10	6.14	YES
Igloo D0312	Gamma	10	6.22	YES
Igloo D0401	-	10	N/A	YES

**Table 8-1**  
**Dose Contribution from Sites**  
**License Termination Report**  
**Seneca Army Depot Activity**

Site <sup>(1)</sup>	Dataset above Background <sup>(2, 3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5, 6)</sup>	Below Dose Limit?
Igloo D0406	Gamma	10	6.39	YES
Igloo D0407	Gamma	10	6.27	YES
Igloo D0413	Gamma	10	6.32	YES
Igloo D0601	Gamma	10	6.20	YES
Igloo D0604	Beta PH Gamma	10	7.66	YES
Igloo D0607	-	10	N/A	YES
Igloo D0704	Gamma	10	6.04	YES
Igloo D0705	Gamma	10	6.16	YES
Igloo D0711	-	10	N/A	YES
Igloo D0712	-	10	N/A	YES
Igloo D0801	-	10	N/A	YES
Igloo D0805	-	10	N/A	YES
Igloo E0103	Gamma	10	6.39	YES
Igloo E0105	Gamma	10	6.28	YES
Igloo E0112	Gamma	10	6.10	YES
Igloo E0211	-	10	N/A	YES
Igloo E0301	-	10	N/A	YES
Igloo E0302	-	10	N/A	YES
Igloo E0303	Gamma	10	6.28	YES
Igloo E0312	-	10	N/A	YES
Igloo E0402	-	10	N/A	YES
Igloo E0410	-	10	N/A	YES
Igloo E0411	-	10	N/A	YES
Igloo E0413	-	10	N/A	YES
Igloo E0504	Gamma	10	6.31	YES
Igloo E0506	-	10	N/A	YES
Igloo E0508	Gamma	10	6.33	YES
Igloo E0510	Gamma	10	6.06	YES
Igloo E0512	-	10	N/A	YES
Igloo E0602	Alpha PH	10	0.57	YES
Igloo E0604	Alpha PH	10	0.20	YES
Igloo E0609	-	10	N/A	YES
Igloo E0610	-	10	N/A	YES
Igloo E0702	-	10	N/A	YES
Igloo E0706	-	10	N/A	YES
Igloo E0711	-	10	N/A	YES
Igloo E0801	-	10	N/A	YES
Igloo E0802	-	10	N/A	YES
Building 5	-	10	N/A	YES
Building 306	Alpha FM	10	0.064	YES
Building 612	Beta HH	10	0.634	YES
Building 2073	Alpha FM	10	0.0163	YES

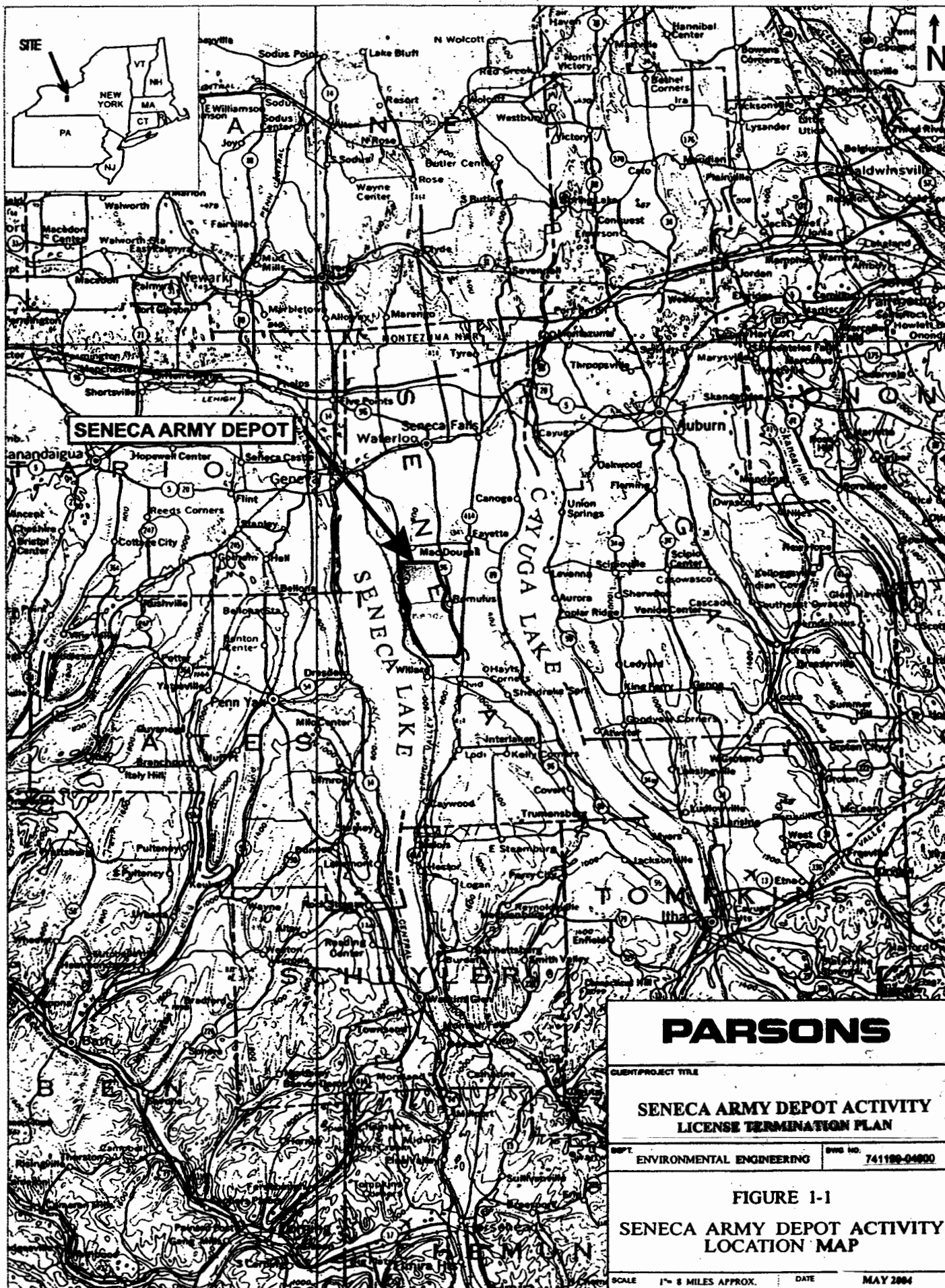


**Table 8-1**  
**Dose Contribution from Sites**  
**License Termination Report**  
**Seneca Army Depot Activity**

Site <sup>(1)</sup>	Dataset above Background <sup>(2, 3)</sup>	Dose Limit (mrem/yr) <sup>(4)</sup>	Dose Contribution (mrem/yr) <sup>(5, 6)</sup>	Below Dose Limit?
Building S-2084	Alpha FM	10	0.0222	YES
Warehouse 356 <sup>(7)</sup>	N/A	10	1.62	YES

Notes:

- (1) All sites listed except for Warehouse 356 conducted activities under SUC-1275 and SUC-1380. Warehouse 356 conducted activities under STC-133 and was removed from that license in 1994.
- (2) Datasets above background determined by WRS test (refer to Sections 3 through 6).  
Instruments: PH = alpha/beta phoswich detector; FIDLER = low-energy gamma scintillator;  
Beta HH = beta handheld gas proportional; Alpha FM = alpha gas proportional floor monitor.
- (3) A "-" indicates that there were no data sets within the site that were above background.
- (4) The dose limit of 10 mrem/yr was established in the *Seneca Army Activity Depot License Termination and License Release Plan* (ANL, 2003).
- (5) The calculated dose contribution is the dose limit multiplied by ratio of the maximum survey unit measurement to the equivalent DCGLw.
- (6) N/A = Not applicable because there were no survey units within the site that were greater than the background datasets (i.e., no contribution to above-background dose).
- (7) Maximum reported measurement above background at Warehouse 356 was used to calculate dose. Warehouse 356 meets current criteria for site release.



**PARSONS**

CLIENT/PROJECT TITLE

**SENeca ARMY DEPOT ACTIVITY  
LICENSE TERMINATION PLAN**

DEPT. ENVIRONMENTAL ENGINEERING

DWG NO. 741189-04800

FIGURE 1-1

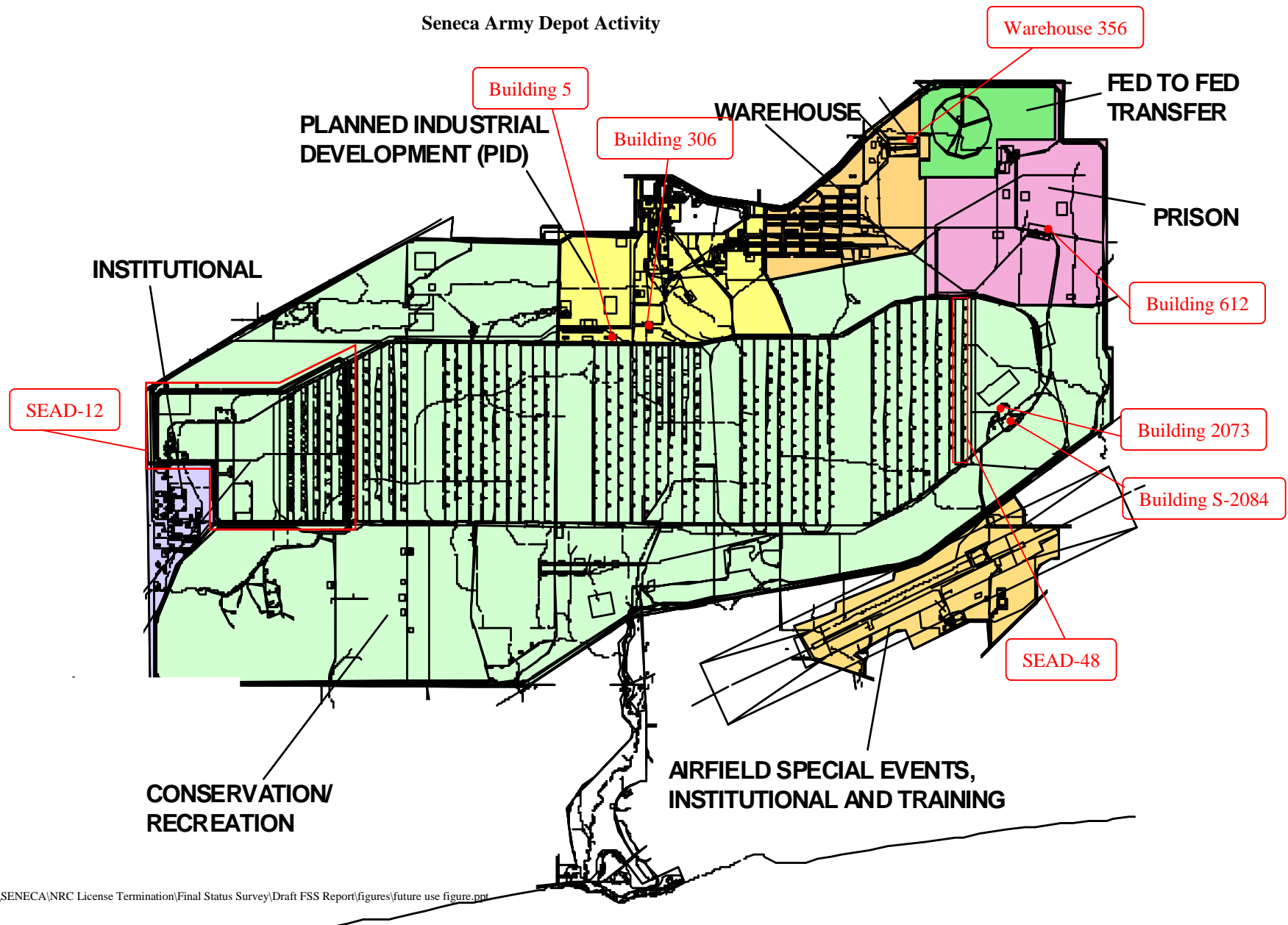
**SENeca ARMY DEPOT ACTIVITY  
LOCATION MAP**

SCALE 1" = 5 MILES APPROX.

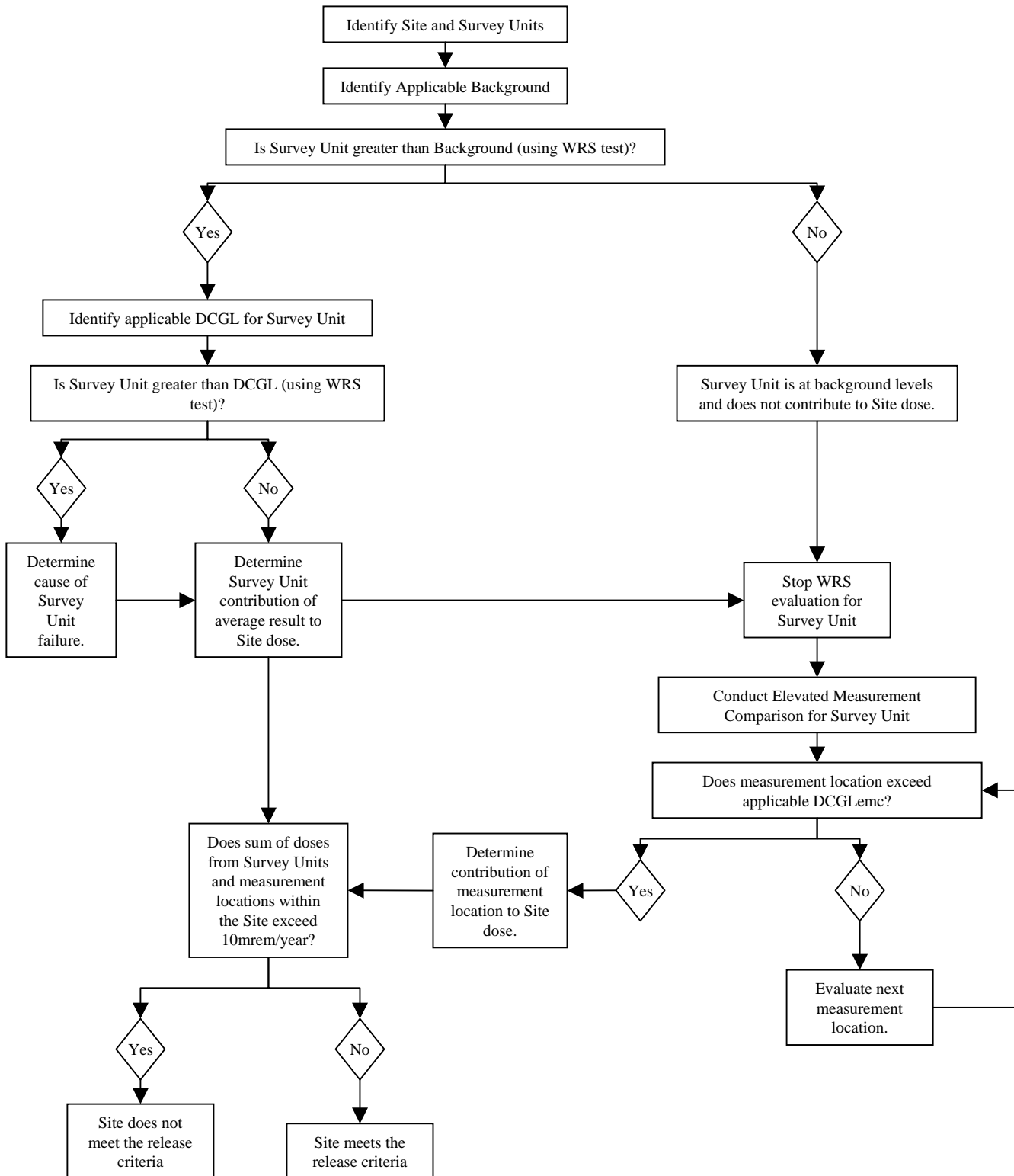
DATE

MAY 2004

Figure 1-2  
 Future Land Use Map for SEDA  
 License Termination Report  
 Seneca Army Depot Activity



**Figure 2-1**  
**Site/Survey Unit Evaluation Process**  
**License Termination Report**  
**Seneca Army Depot Activity**



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LEGEND

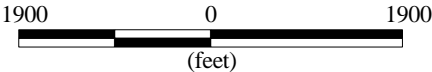
SEDIGLOO- NOT INCLUDED IN RADILOGICAL SURVEY

SEDIGLOO- INCLUDED IN RADILOGICAL SURVEY  
A0201

SEDIGLOO- BACKGROUND IGLOO- FOR RADILOGICAL SURVEY  
C0912

BUILDING INCLUDED IN RADILOGICAL SURVEY

NOTE:  
PLEASE SEE FIGURES 3-1a THROUGH 3-1e  
FOR A LARGER VIEW OF THE  
IGLOOS INCLUDED IN THE  
RADILOGICAL SURVEY.



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SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION REPORT

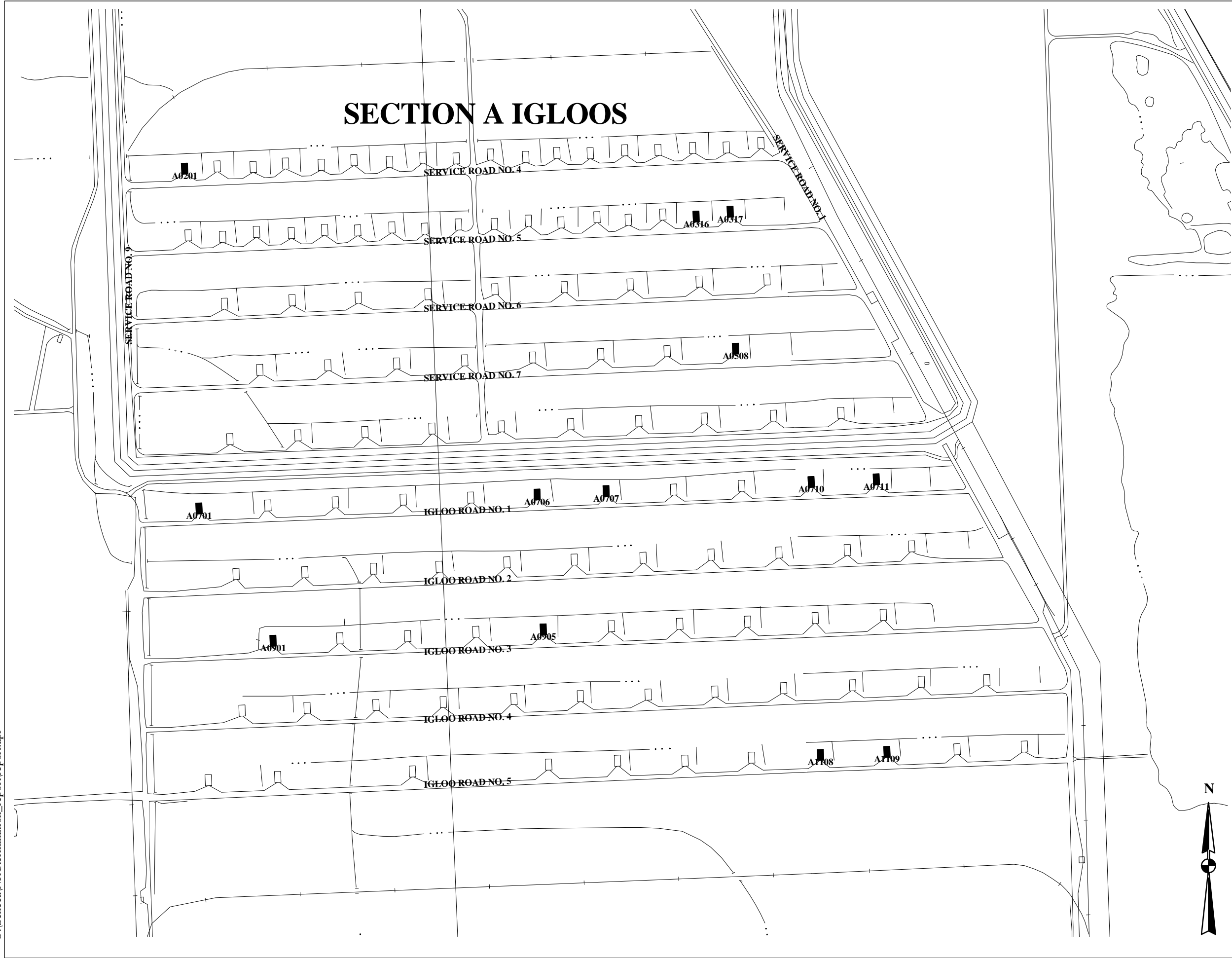
FIGURE 3-1  
LOCATION OF D.U. STORAGE  
IGLOOS AND BUILDINGS

SCALE  
1:1900

DATE  
JUNE 2004

REV  
SHEET 1 OF 1

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**LEGEND**

SEDA IGLOO- NOT INCLUDED IN RADIOLOGICAL SURVEY

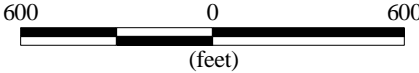
A0201

SEDA IGLOO- INCLUDED IN RADIOLOGICAL SURVEY

A0201

SEDA BACKGROUND IGLOO- FOR RADIOLOGICAL SURVEY

BUILDING INCLUDED IN RADIOLOGICAL SURVEY



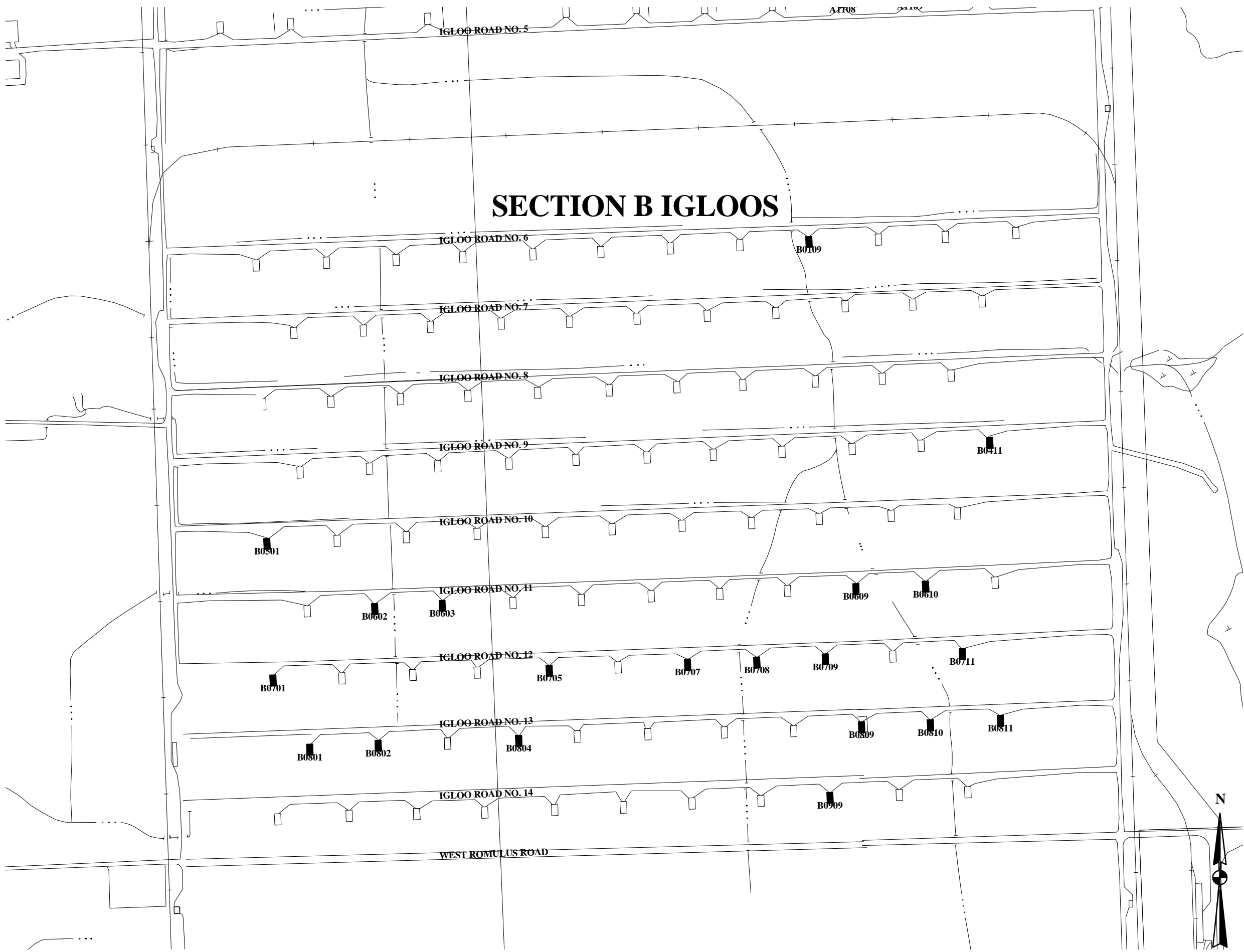
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NRC LICENSE TERMINATION REPORT





FIGURE 3-1a  
LOCATION OF SECTION A  
D.U. STORAGE IGLOOS

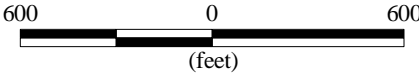
SCALE 1:600	DATE JUNE 2004	REV SHEET 1 OF 1
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LEGEND

-  SEDA IGLOO- NOT INCLUDED IN RADIOLOGICAL SURVEY
-  SEDA IGLOO- INCLUDED IN RADIOLOGICAL SURVEY
-  SEDA BACKGROUND IGLOO- FOR RADIOLOGICAL SURVEY
-  BUILDING INCLUDED IN RADIOLOGICAL SURVEY



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SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION REPORT

FIGURE 3-1b  
LOCATION OF SECTION B  
D.U. STORAGE IGLOOS

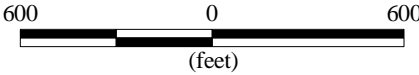
SCALE 1:600	DATE JUNE 2004	REV SHEET 1 OF 1
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**LEGEND**

- SEDA IGLOO- NOT INCLUDED IN RADIOLOGICAL SURVEY
- SEDA IGLOO- INCLUDED IN RADIOLOGICAL SURVEY  
A0201
- SEDA BACKGROUND IGLOO- FOR RADIOLOGICAL SURVEY  
A0201
- BUILDING INCLUDED IN RADIOLOGICAL SURVEY



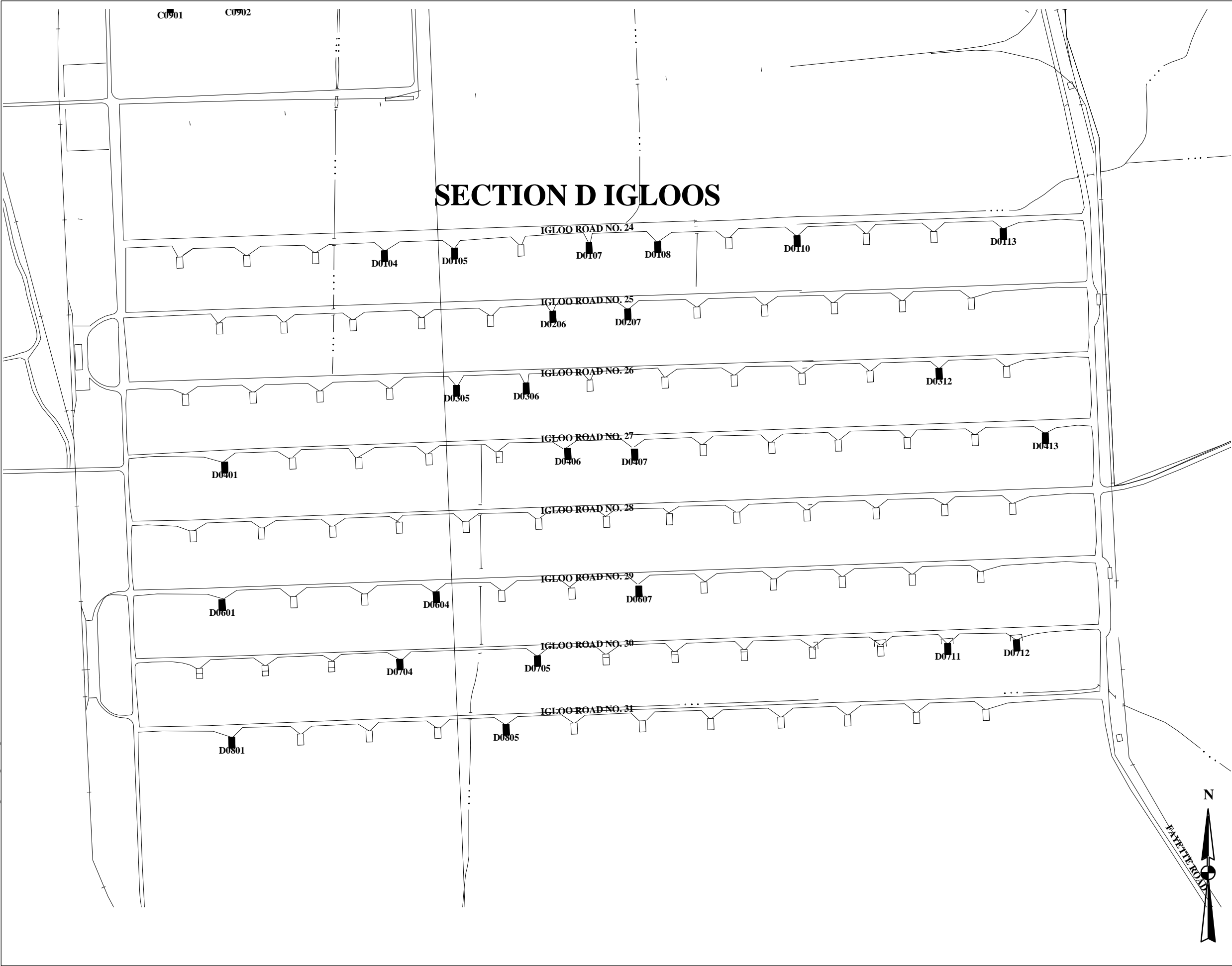
**PARSONS**

SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION REPORT

FIGURE 3-1c  
LOCATION OF SECTION C  
D.U. STORAGE IGLOOS

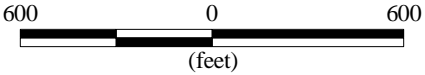


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LEGEND

- SEDIGLOO- NOT INCLUDED IN RADIOLOGICAL SURVEY
- SEDIGLOO- INCLUDED IN RADIOLOGICAL SURVEY
- SEDIGLOO- BACKGROUND IGLOO- FOR RADIOLOGICAL SURVEY
- BUILDING INCLUDED IN RADIOLOGICAL SURVEY



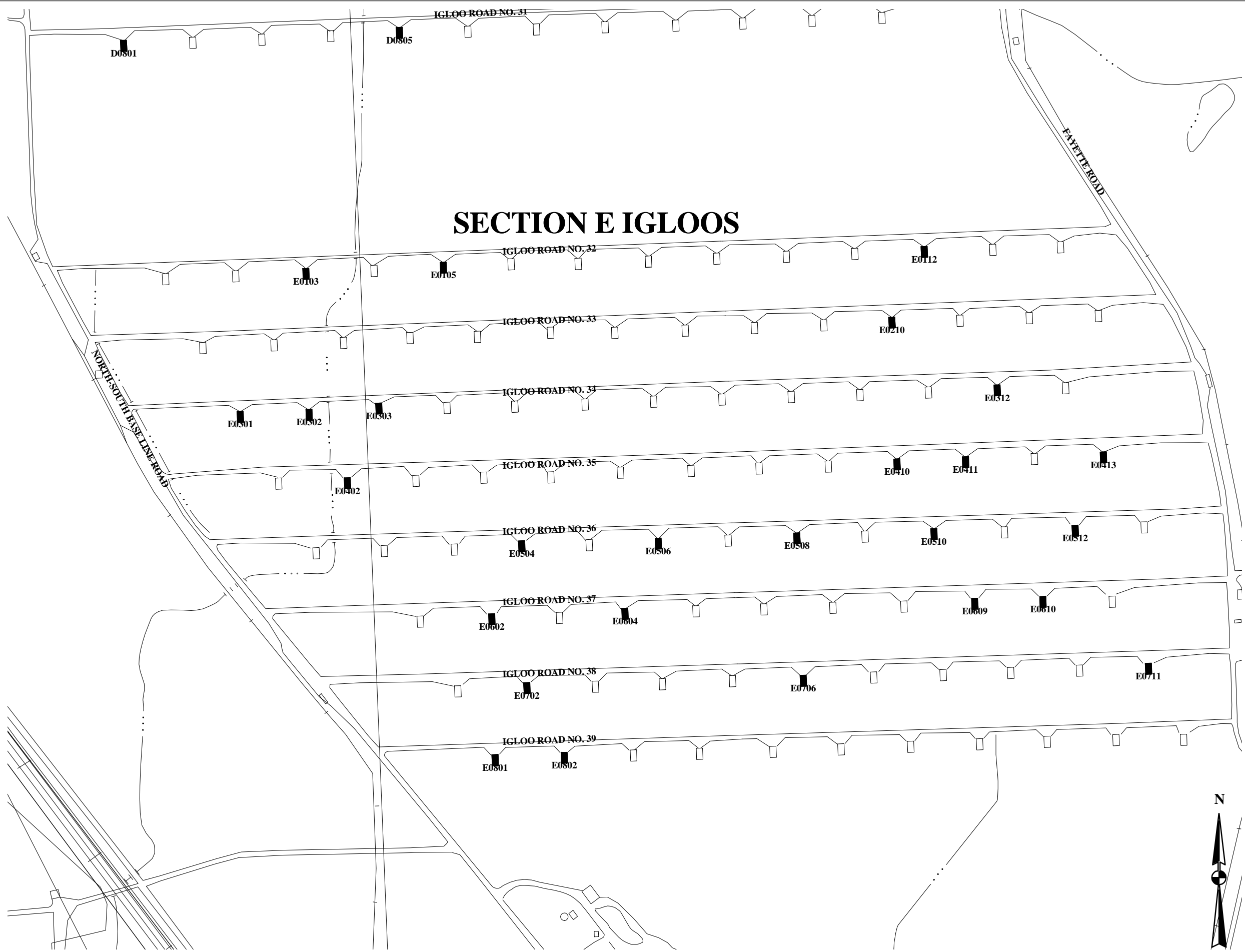
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SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION REPORT

FIGURE 3-1d  
LOCATION OF SECTION D  
D.U. STORAGE IGLOOS

SCALE 1:600	DATE JUNE 2004	REV SHEET 1 OF 1
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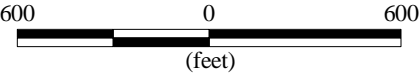
LEGEND

SEDA IGLOO- NOT INCLUDED IN RADIOLOGICAL SURVEY

SEDA IGLOO- INCLUDED IN RADIOLOGICAL SURVEY

SEDA BACKGROUND IGLOO- FOR RADIOLOGICAL SURVEY

BUILDING INCLUDED IN RADIOLOGICAL SURVEY



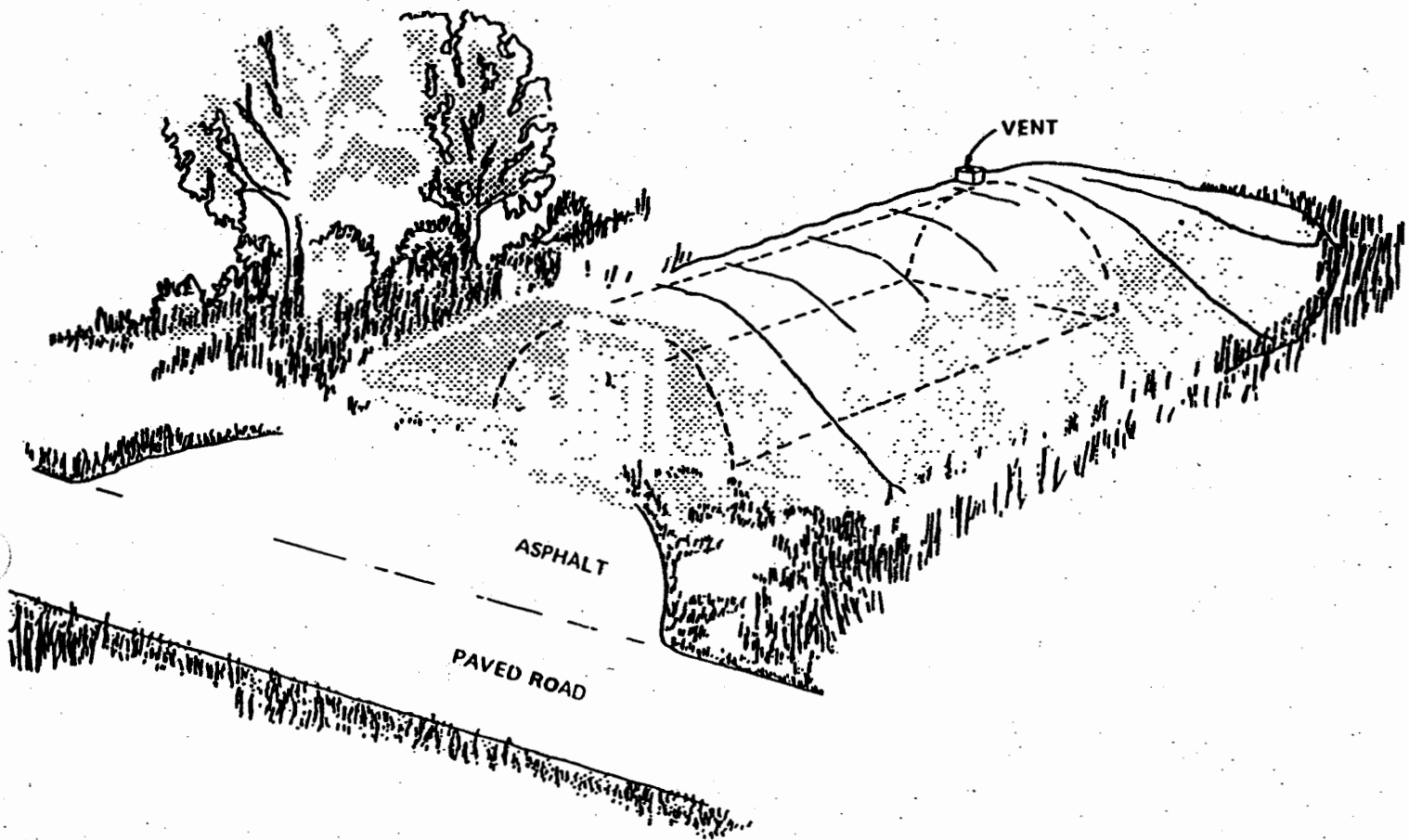
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SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION REPORT

FIGURE 3-1e  
LOCATION OF SECTION E  
D.U. STORAGE IGLOOS

SCALE 1:600	DATE JUNE 2004	REV SHEET 1 OF 1
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**FIGURE 3-2**  
**TYPICAL BUNKER CONFIGURATION**  
**LICENSE TERMINATION PLAN**  
**SENECA ARMY DEPOT ACTIVITY**



Note: This figure was taken from the Preliminary Engineering and Environmental Evaluation of the Remedial Action Alternatives For the Seneca Army Depot Site, Ford, Bacon & Davis Utah, November 1981.

ASPHALT IGLOO ROAD NO. 39

GRASS & VEGETATION

CONCRETE  
ENTRANCE  
PAD

FLOOR  
DRAINS

ASPHALT APRON

MOUNDED EARTH

DRAIN TROUGHS

MOUNDED EARTH  
(APPROXIMATE)

GRASS & VEGETATION

MOUNDED EARTH

MOUNDED EARTH

AIR  
VENT

NOTES:  
-THE APPROXIMATE DIMENSIONS OF THE  
SEAD-48 IGLOOS ARE 81 FEET IN LENGTH  
BY 26.8 FEET IN WIDTH.

**PARSONS**

CLIENT/PROJECT FILE

SENECA ARMY DEPOT ACTIVITY  
LICENSE TERMINATION PLAN

DEPT.  
ENVIRONMENTAL ENGINEERING

DWG NO. 741199-04000

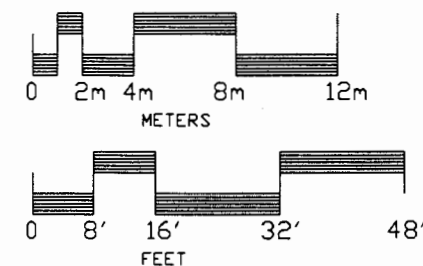
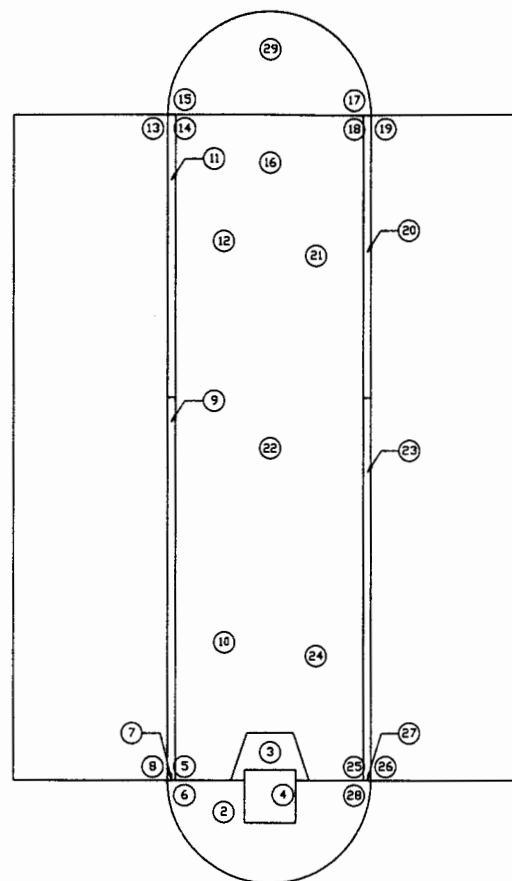
FIGURE 3-3  
SCHEMATIC DRAWING OF TYPICAL  
IGLOO STRUCTURE

SCALE 1 INCH = 20 FEET

DATE MAY 2004

**DU STORAGE IGLOOS ARE CLASS 3 SURVEY AREAS  
30 DIRECT MEASUREMENTS AND BIASED SCANS**

MEASUREMENT #	DESCRIPTION
1	DOOR THRESHOLD
2	SAFETY PLACARD
3	AREA IN FRONT OF DOOR
4	DOOR HANDLE
5	DIRECT CORNER
6	WALL SURFACE
7	EAST DRAIN
8	WALL SURFACE
9	DRAIN TROUGH
10	FLOOR
11	DRAIN TROUGH
12	FLOOR
13	WALL SURFACE
14	CORNER
15	WALL SURFACE
16	FLOOR
17	WALL SURFACE
18	CORNER
19	WALL SURFACE
20	DRAIN TROUGH
21	FLOOR
22	FLOOR
23	DRAIN TROUGH
24	FLOOR
25	CORNER
26	WALL SURFACE
27	WEST DRAIN
28	WALL SURFACE
29	AIR VENT ON CEILING
30	AIR VENT ON DOOR



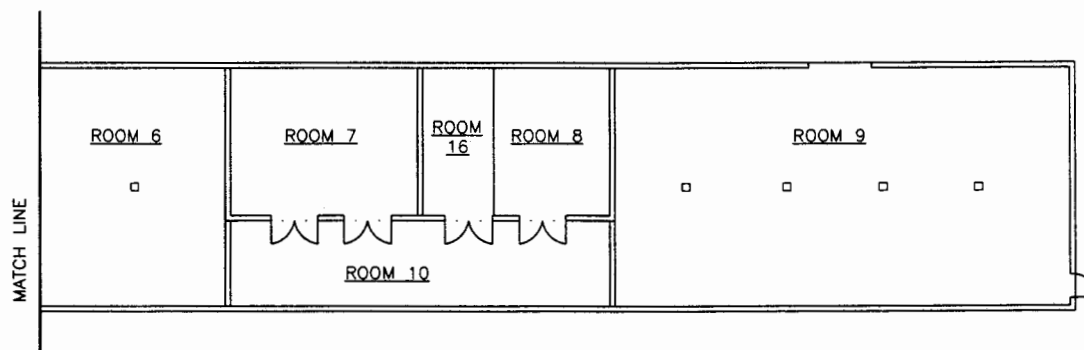
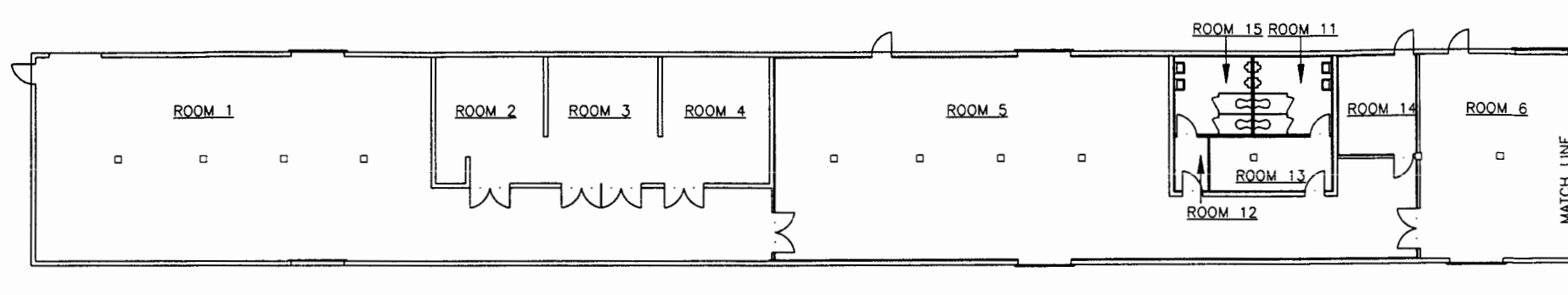
**PARSONS**

CLIENT/PROJECT TITLE  
**SENECA ARMY DEPOT ACTIVITY  
 LICENSE TERMINATION PLAN**

PROJECT  
 ENVIRONMENTAL ENGINEERING 731199-04000

**FIGURE 3-4  
 DU STORAGE IGLOO  
 SAMPLING LOCATIONS**

DATE 17-198 MAY 1994



ROOMS 1-10 AND 16 ARE CLASS II SURVEY AREAS  
2m x 2m GRIDS, 50% COVERAGE

- FLOORS
- WALL SURFACES BELOW 2 METERS
- HORIZ. SURFACES ABOVE 2M ABOVE FLOOR WHERE PARTICLES WOULD DEPOSIT

1m x 1m GRIDS, 10% COVERAGE

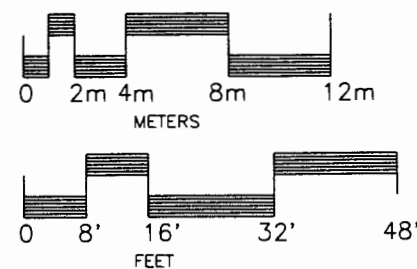
- CEILINGS (SUSPENDED & NON-SUSPENDED)
- UPPER WALLS (ABOVE 2 METERS)

ROOMS 11-15 ARE CLASS III SURVEY AREAS

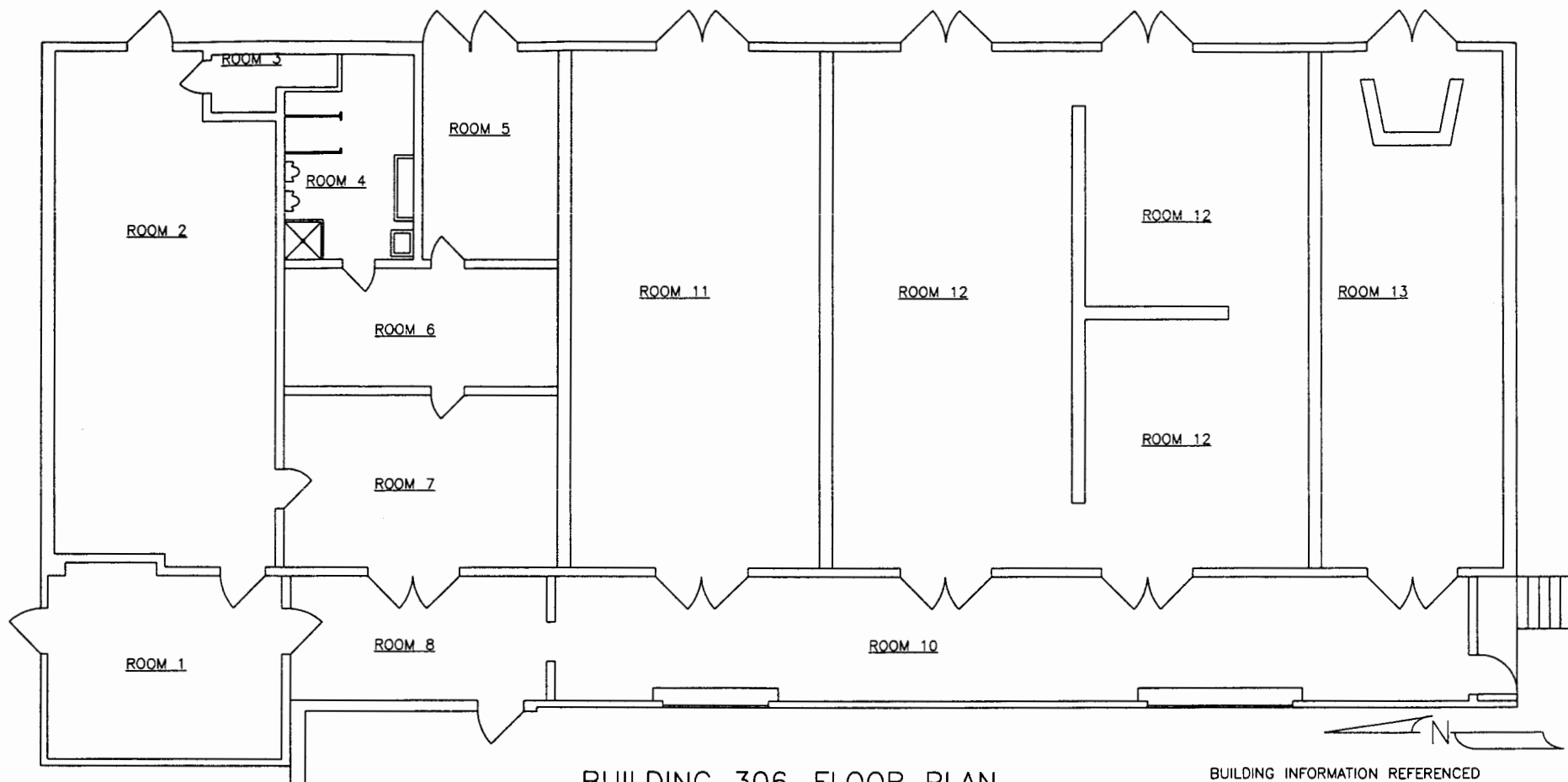
- 30 DIRECT MEASUREMENTS

## BUILDING 5-FLOOR PLAN

BUILDING INFORMATION REFERENCED  
FROM OFFICE OF FACILITIES ENGINEER,  
SENECA ARMY DEPOT DRAWING 33-81  
SHEET A-1.



<b>PARSONS</b>	
SENeca ARMY DEPOT ACTIVITY LICENSE TERMINATION PLAN	
ENVIRONMENTAL ENGINEERING	DATE: 05-11-2004
FIGURE 4-1 FLOOR PLAN - BUILDING 5	
DATE: MAY 2004	



**BUILDING 306-FLOOR PLAN**

**ROOMS 1-9 ARE CLASS II SURVEY AREAS**

- 30 DIRECT MEASUREMENTS

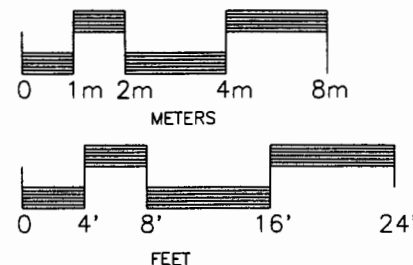
**ROOMS 10-13 ARE CLASS II SURVEY AREAS**  
2m x 2m GRIDS, 50% COVERAGE

- FLOORS
- WALL SURFACES BELOW 2 METERS
- HORIZ. SURFACES ABOVE 2M ABOVE FLOOR WHERE PARTICLES WOULD DEPOSIT

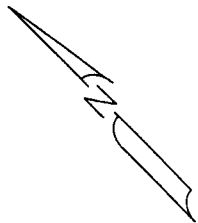
**1m x 1m GRIDS, 10% COVERAGE**

- CEILINGS (SUSPENDED & NON-SUSPENDED)
- UPPER WALLS (ABOVE 2 METERS)

BUILDING INFORMATION REFERENCED  
FROM OFFICE OF FACILITIES ENGINEER,  
SENECA ARMY DEPOT DRAWING NO. 5-85  
SHEET 2 OF 2.



<b>PARSONS</b>	
DEVELOPER TITLE	
<b>SENECA ARMY DEPOT ACTIVITY LICENSE TERMINATION PLAN</b>	
DEPT ENVIRONMENTAL ENGINEERING	DATE 7/1/99-12/2002
<b>FIGURE 4-2 FLOOR PLAN - BUILDING 306</b>	
DATE MAY 2004	

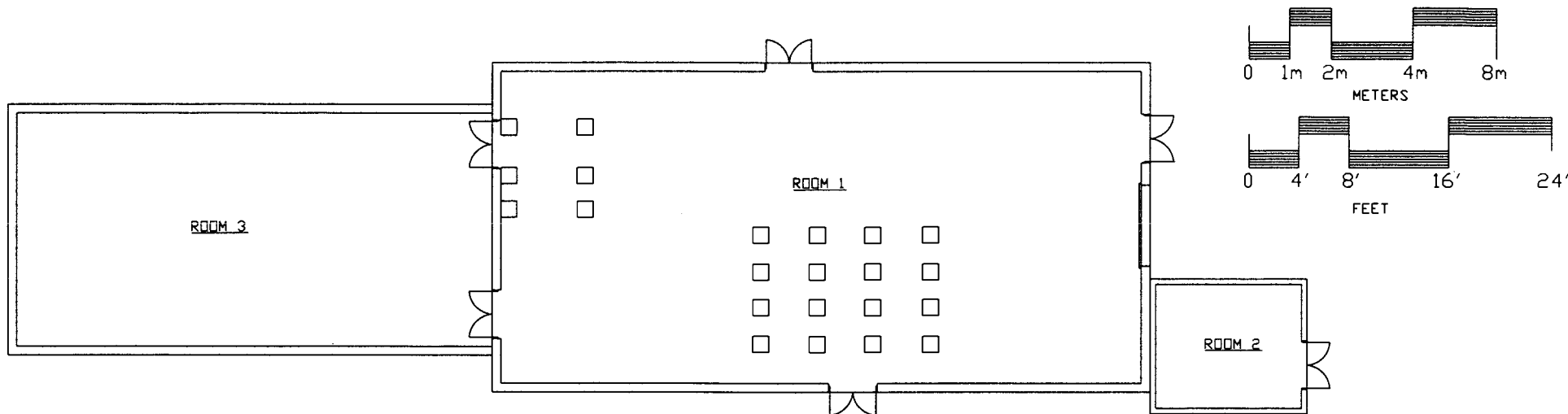


ENTIRE BUILDING IS A CLASS II SURVEY AREA  
2m x 2m GRIDS, 50% COVERAGE

- FLOORS
- WALL SURFACES BELOW 2 METERS
- HORIZ. SURFACES ABOVE 2M ABOVE FLOOR WHERE PARTICLES WOULD DEPOSIT

1m x 1m GRIDS, 10% COVERAGE

- CEILINGS (SUSPENDED & NON-SUSPENDED)
- UPPER WALLS (ABOVE 2 METERS)

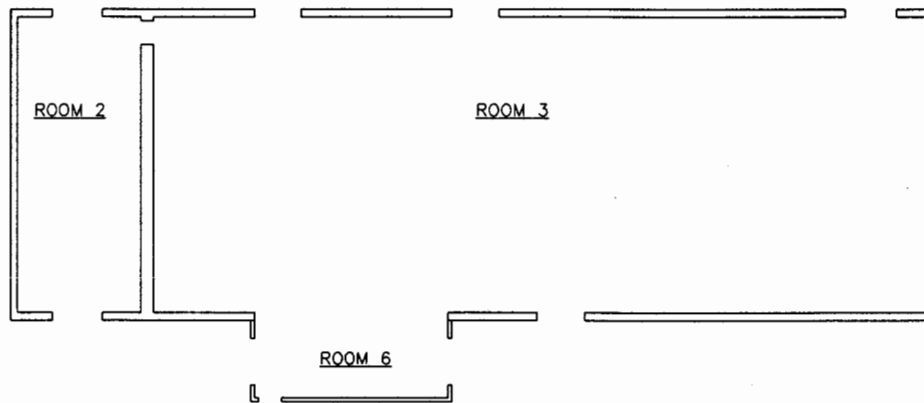
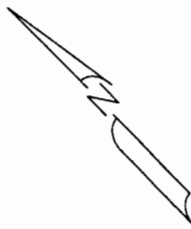


## BUILDING 2073-FLOOR PLAN

BUILDING INFORMATION REFERENCED  
FROM OFFICE OF FACILITIES ENGINEER  
SENECA ARMY DEPOT DRAWING NO. 23-86  
SHEET A-1.

<b>PARSONS</b>	
SENeca ARMY DEPOT ACTIVITY LICENSE TERMINATION PLAN	
ENVIRONMENTAL ENGINEERING	DATE: 05-11-2004
<b>FIGURE 4-3 FLOOR PLAN - BUILDING 2073</b>	
CALC: [ ]	DATE: MAY 2004





BUILDING 2084—FLOOR PLAN

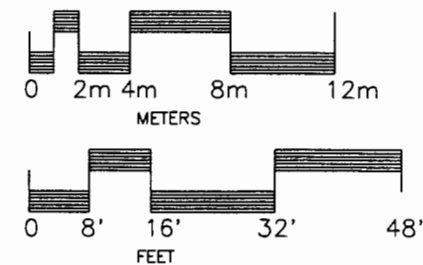
BUILDING INFORMATION REFERENCED  
FROM DEPOT FACILITIES DIVISION,  
SENECA ORDNANCE DEPOT, ROMULUS, NY  
DRAWING 13-62.

ENTIRE BUILDING IS A CLASS II SURVEY AREA  
2m x 2m GRIDS, 50% COVERAGE

- FLOORS
- WALL SURFACES BELOW 2 METERS
- HORIZ. SURFACES ABOVE 2M ABOVE  
FLOOR WHERE PARTICLES WOULD  
DEPOSIT

1m x 1m GRIDS, 10% COVERAGE

- CEILINGS (SUSPENDED & NON-SUSPENDED)
- UPPER WALLS (ABOVE 2 METERS)



**PARSONS**

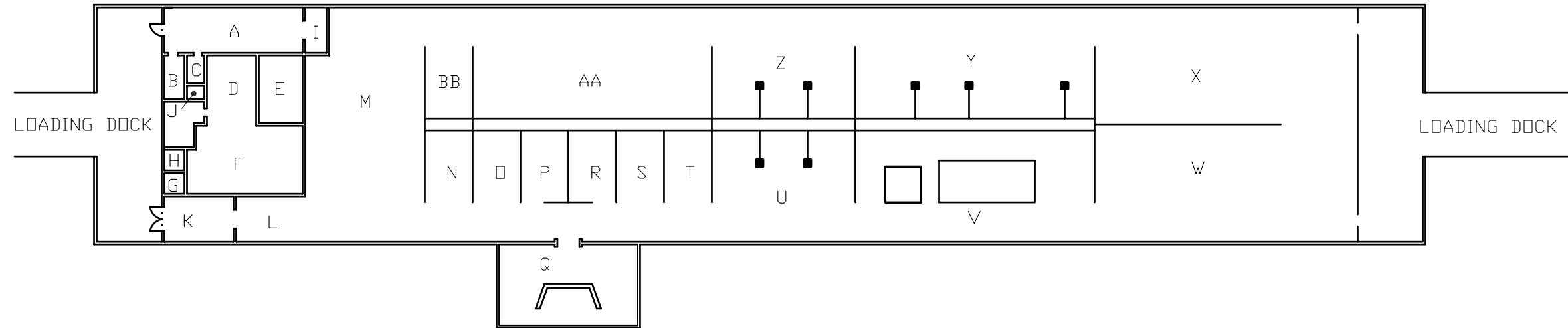
PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY  
LICENSE TERMINATION PLAN

DESIGN ENVIRONMENTAL ENGINEERING DATE 7/1/99-01002

FIGURE 4-4  
FLOOR PLAN - BUILDING S-2084

SCALE 1"=10' DATE MAY 2004



ALL ROOMS ARE CLASS I SURVEY AREAS

2m x 2m GRIDS, 100% COVERAGE

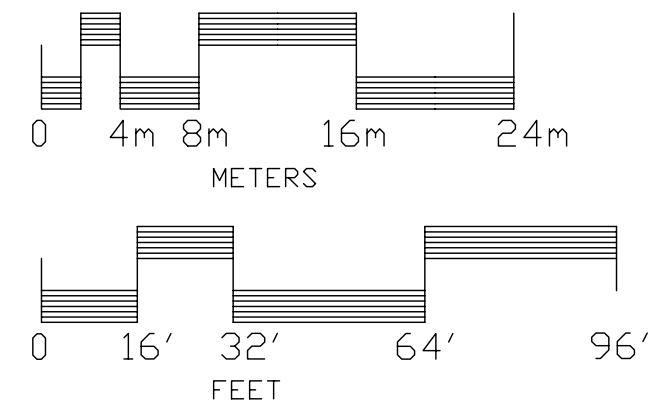
- FLOORS
- WALL SURFACES BELOW 2 METERS  
HORIZ. SURFACES ABOVE 2M ABOVE  
FLOOR WHERE PARTICLES WOULD  
DEPOSIT

1m x 1m GRIDS, 10% COVERAGE

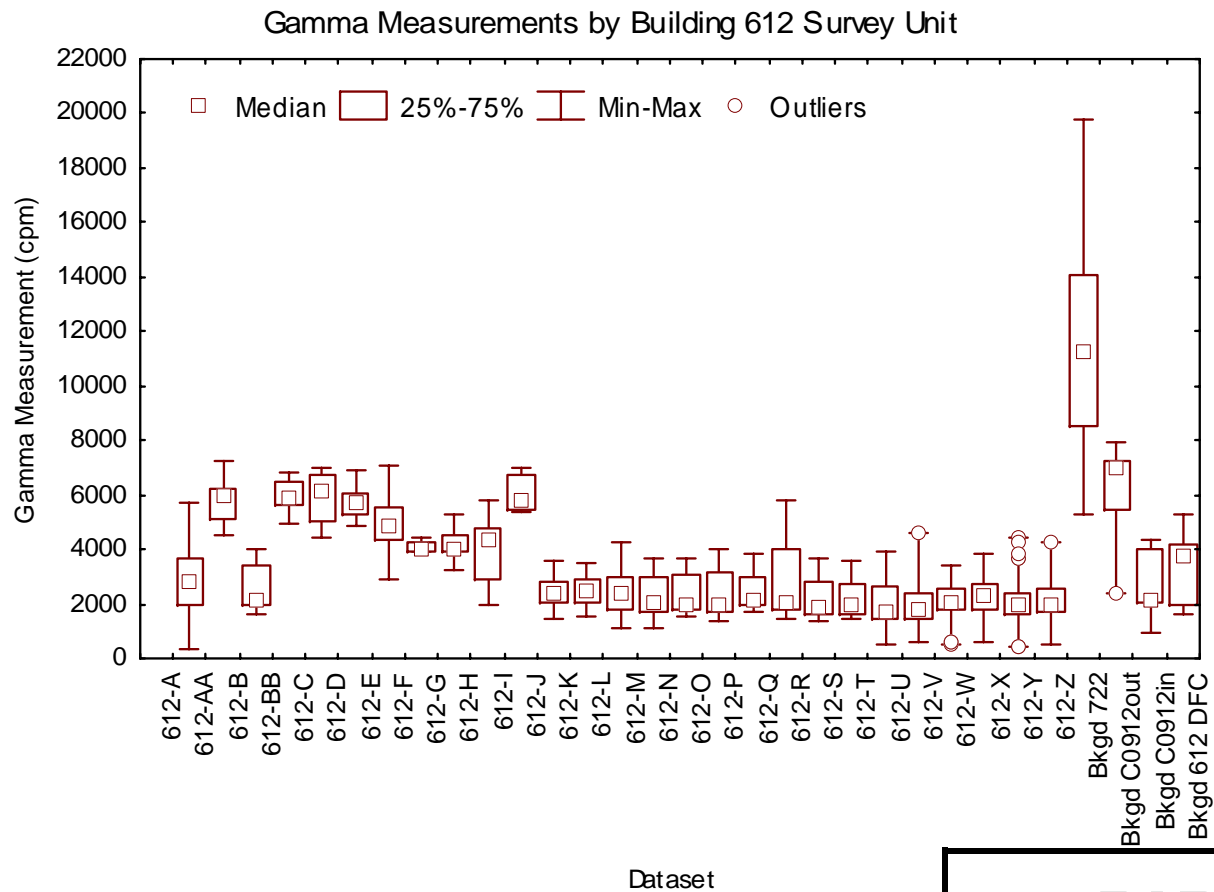
- CEILINGS (SUSPENDED & NON-SUSPENDED)
- UPPER WALLS (ABOVE 2 METERS)

## BUILDING 612-FLOOR PLAN

BUILDING INFORMATION REFERENCED  
FROM FIGURE 5-4 OF THE SENECA ARMY  
LICENSE TERMINATION PLAN (ANL, 2003)



PARSONS		
CLIENT/PROJECT TITLE		
SENECA ARMY DEPOT ACTIVITY NRC LICENSE TERMINATION		
DEPT.	ENVIRONMENTAL ENGINEERING	DWS NO. 741199-04000
FIGURE 5-1 BUILDING 612 FLOOR PLAN		
SCALE	1"=32'	DATE JUNE 2004
		REV A



Dataset

**PARSONS**

SENECA ARMY DEPOT ACTIVITY  
LICENSE TERMINATION REPORT

**FIGURE 5-2**  
**BOX-AND-WHISKER PLOTS**  
**BUILDING 612 GAMMA**  
**MEASUREMENTS**

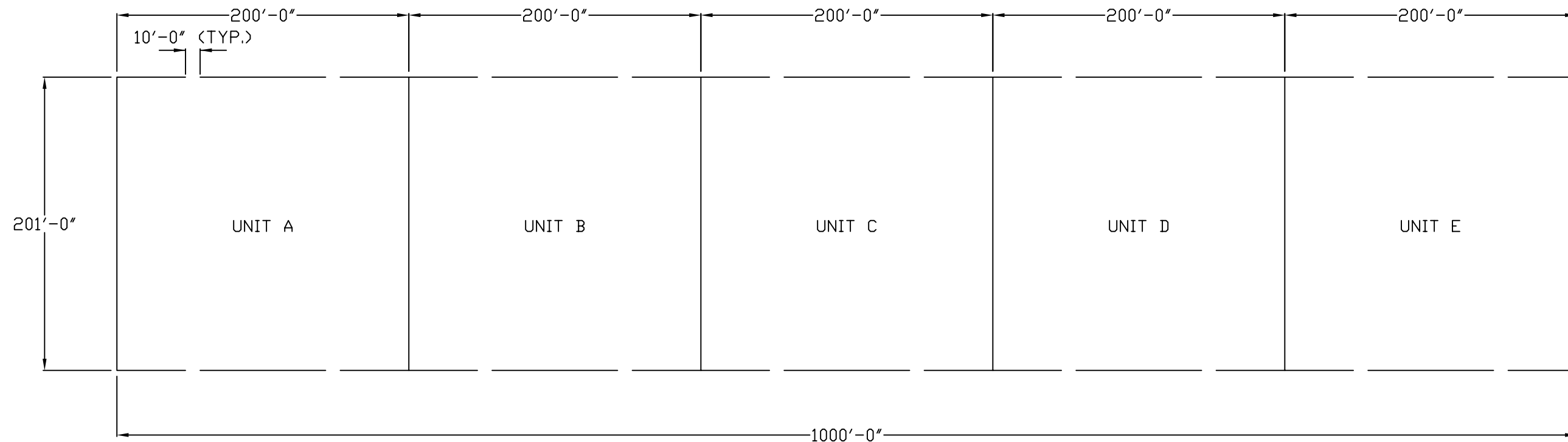
Background datasets:

Building 722

Igloo C0912 with open or "out" energy window

Igloo C0912 with closed or "in" energy window

Daily function check background measurements

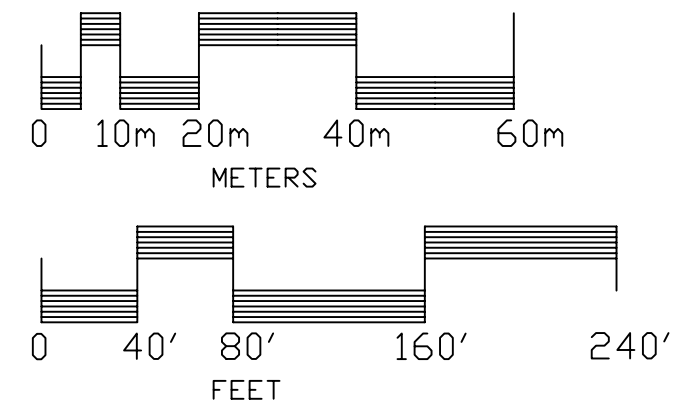


## WAREHOUSE 356-FLOOR PLAN

BUILDING INFORMATION REFERENCED  
FROM FIGURE 5-3 OF THE SENECA ARMY  
LICENSE TERMINATION PLAN (ANL, 2003)

### NOTES:

ENTIRE BUILDING IS CLASS III.



**PARSONS**

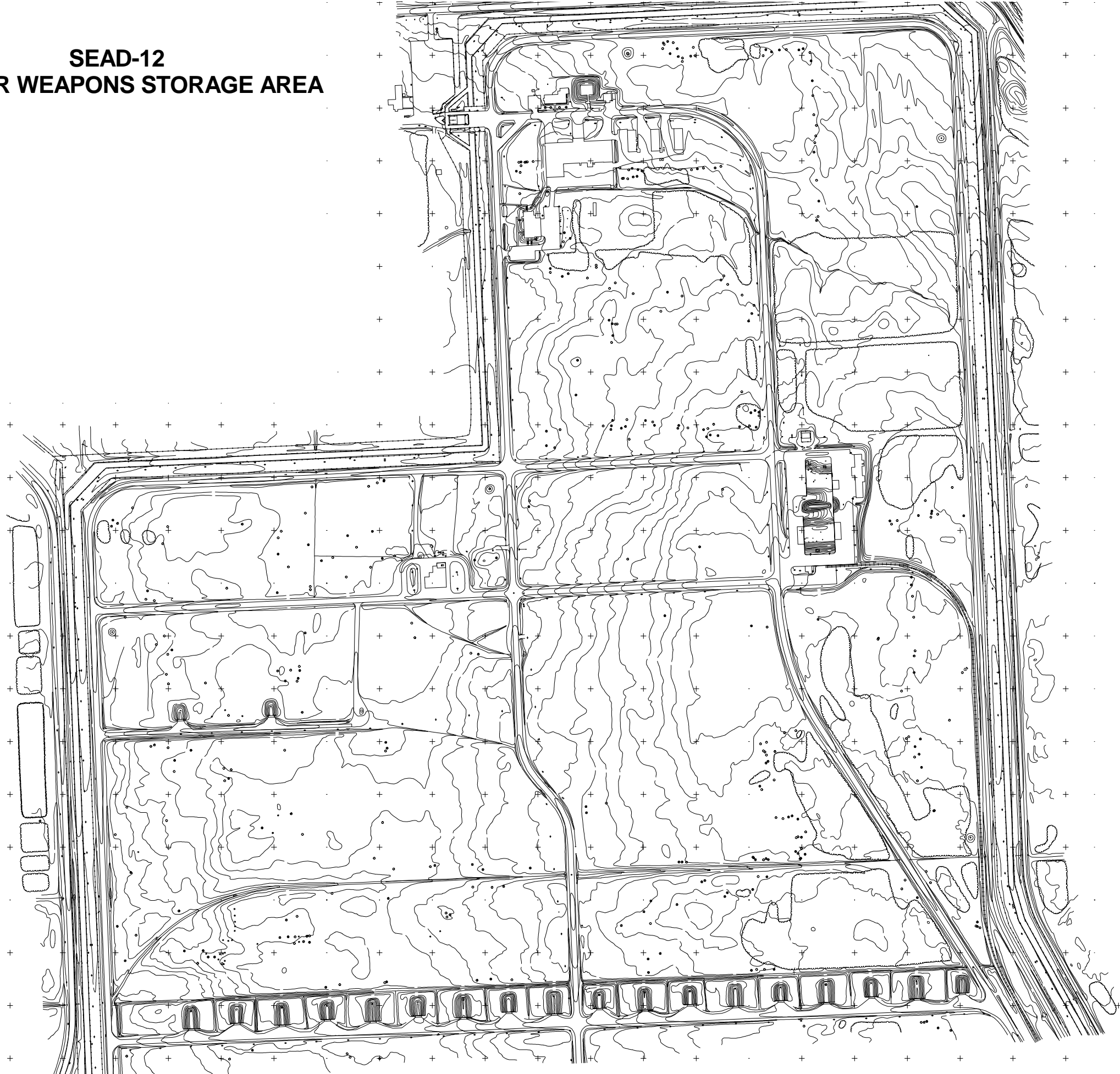
CLIENT/PROJECT TITLE  
SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION

DEPT. ENVIRONMENTAL ENGINEERING DWS NO. 741199-04000

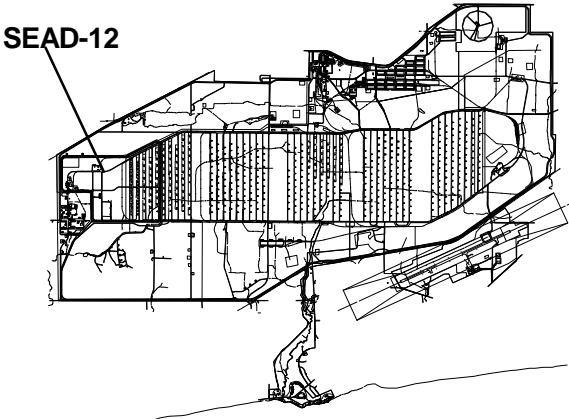
FIGURE 6-1  
WAREHOUSE 356  
FLOOR PLAN

SCALE 1"=80'-0" DATE JUNE 2004 REV A

**SEAD-12  
FORMER WEAPONS STORAGE AREA**



**LEGEND**



**PARSONS**

**SENECA ARMY DEPOT ACTIVITY  
NRC LICENSE TERMINATION**

**FIGURE 7-1  
SEAD-12  
SITE MAP**

1" = 150'

JUNE 2004