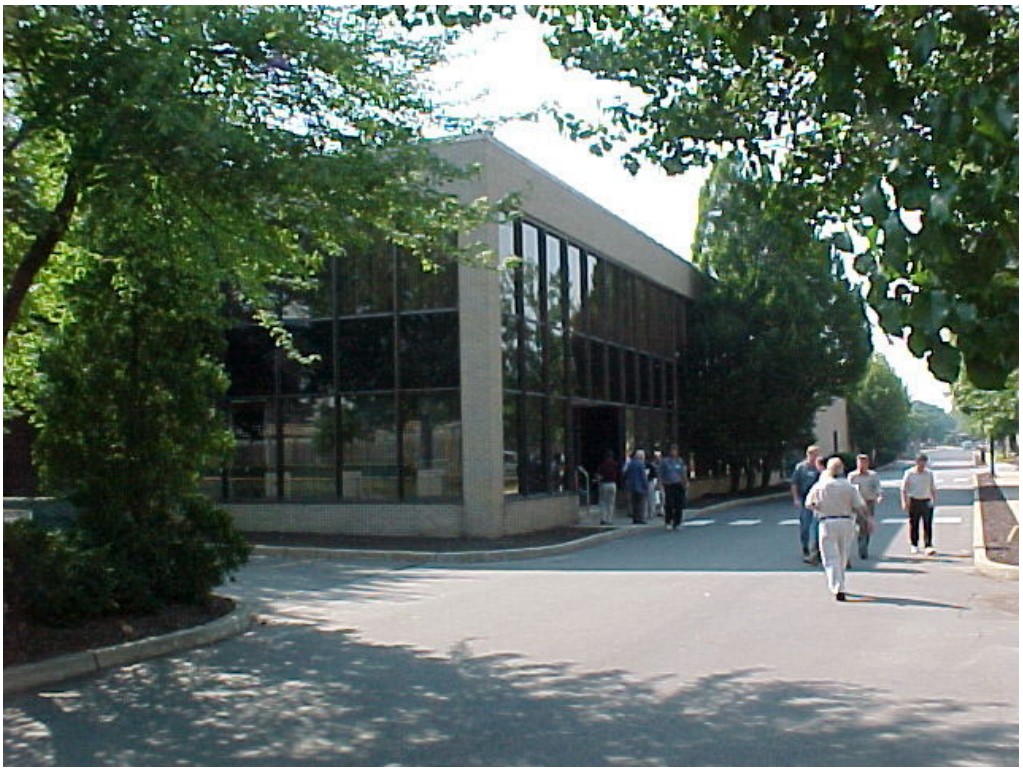
Duratek

Final Status Survey Report
Bristol-Myers Squibb
Former Radiopharmaceutical
Production Facility

Rev. 0 September 2003



Prepared for:
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DURATEK, INC.

FINAL STATUS SURVEY REPORT

for the

Bristol-Myers Squibb
Former Radiopharmaceutical Production Facility

REVISION 0
September 2003

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PREFACE

In August of 2002, Duratek Services, Inc. (Duratek) was awarded a contract to perform a decommissioning and final status survey (FSS) of the Bristol-Myers Squibb former radiopharmaceutical production facility. A facility characterization was performed prior to the decommissioning and FSS. The FSS included surveys of Building 124, Building 122, Building 83 Decay Tanks and the surrounding environs.

This document reports the results of the sampling and measurements collected by Duratek during the FSS.

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1.0 INTRODUCTION

The Bristol-Myers Squibb (BMS) Final Status Survey Report (FSS) has been prepared using the guidance provided in applicable regulatory guidance documents including NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), (Ref.1-1), and NUREG-1757 (Ref.1-2). The FSS was performed according to the Final Status Survey Plan, PL-DTK-02-022 (Ref.1-3). This plan was submitted December 16, 2002 to the Nuclear Regulatory Commission (NRC) and the New Jersey Department of Environmental Protection (NJDEP) and the FSS Plan was incorporated into the BMS License No. 29-00139-02 via Amendment No. 104.

1.1 Background & Site Description

E. R. Squibb & Sons, a wholly owned subsidiary of Bristol-Myers Squibb (BMS), operated a radiopharmaceutical manufacturing facility at its New Brunswick, NJ facility. The site map is shown in Figure 1-1 and the areas to be decommissioned are shown in Figure 1-2. This facility was operated under the requirements of a Nuclear Regulatory Commission (NRC) Materials license (No. 29-00139-02). The former radiopharmaceutical manufacturing facility was permanently shutdown in June of 2001 following the decision to cease operations and to decontaminate and decommission (D&D) the facility. Duratek Services, Inc. (Duratek) was awarded a contract by BMS to perform a characterization of the facility. During the fourth quarter of 2001 and the first quarter of 2002, Duratek performed a characterization survey of the former radiopharmaceutical manufacturing facility and the surrounding environs to accurately assess the extent of radiological contamination and to determine the methods and costs associated with the decommissioning.

The NRC license under which the facility was operated and is still maintained also authorizes BMS to possess and use radioactive materials at three other BMS sites in central New Jersey. Therefore, the goal of the final status survey was not the termination of BMS's radioactive materials license. Instead, it is expected that NRC will concur in writing that the buildings and outside areas associated with the final status survey are unconditionally released and are no longer subject to the requirements of the NRC license. (The NRC license was amended in July 2001 to reflect the shutdown of the radiopharmaceutical facility. The amendment resulted in the references to the facility's operation being removed and the reduction in radioisotope quantity limits.)

BMS also has a radioactive materials license issued by the State of New Jersey's Department of Environmental Protection (NJDEP). The State of New Jersey has regulatory authority over the possession and use of accelerator-produced radioisotopes and naturally occurring radioactive materials (NORM). Specifically, the BMS radiopharmaceutical manufacturing facility processed and used 57Co and 85Sr. In addition 54Mn was used in research but not manufacturing. As with the NRC license, the NJDEP license is for the four BMS sites including the New Brunswick, NJ site. Therefore, termination of the NJDEP license is not planned. Instead, concurrence with the unconditional release of the facilities and surrounding areas from the requirements of the license is anticipated.

The E. R. Squibb and Sons, Inc. facility is located between Georges Road, U.S. Rt. 1 and College Farm Road in New Brunswick, Middlesex County, New Jersey. The surrounding land is residential, light commercial, industrial, and agricultural. The Agricultural College of Rutgers University borders the site on the northeast. The Raritan River Railroad borders the property on the southwest. A security fence surrounds the facility and access to the property is restricted.

Geographically, the site can be represented at 40 degrees, 28 minutes, and 25 seconds North; and 74 degrees, 28 minutes, and 25 seconds West. The topography of the site is relatively flat. Elevations near the center of the site are close to 120 feet above sea level, while elevations near either end of the site are approximately 105 feet above sea level.

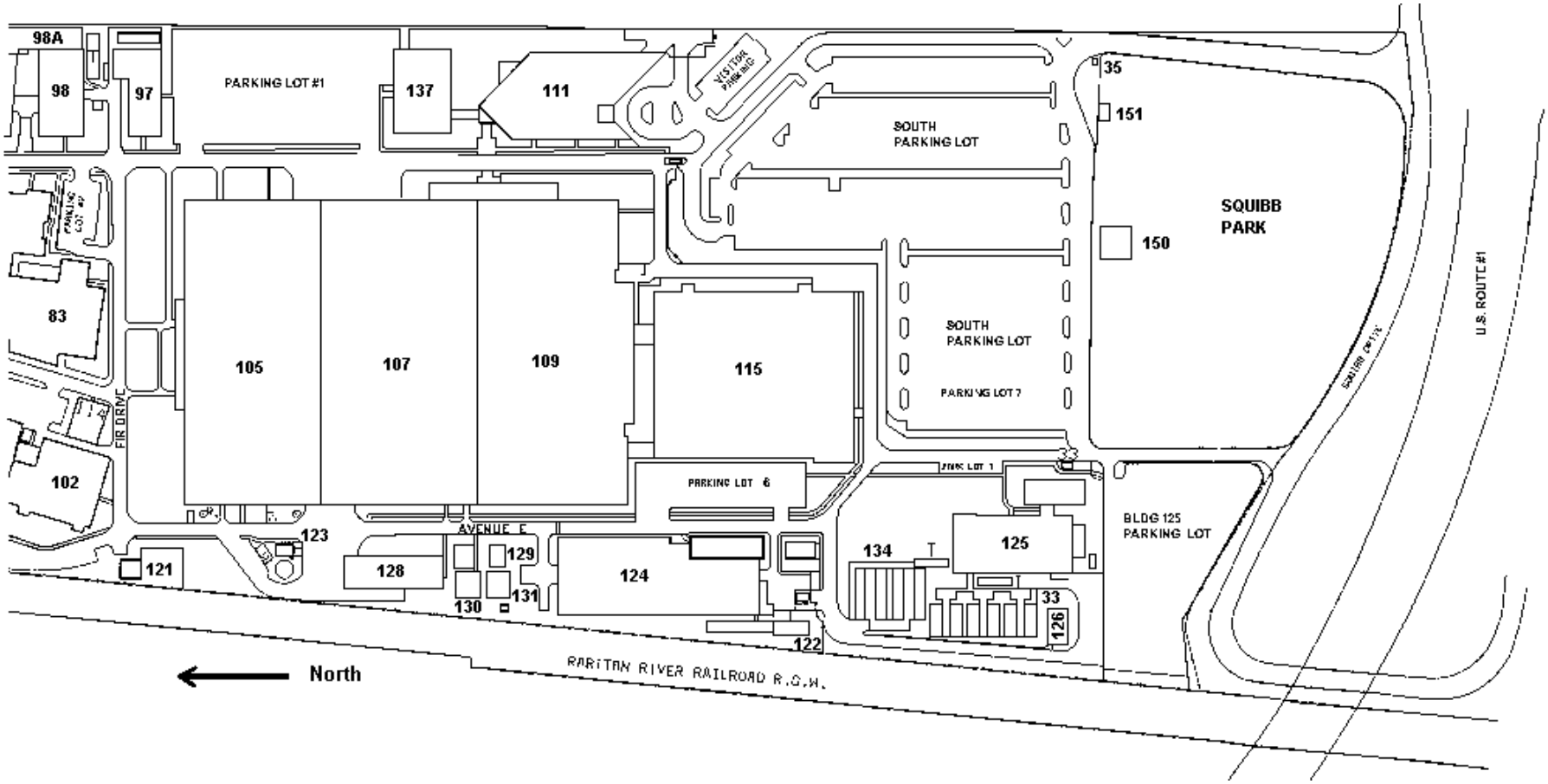


Figure 1-1: Bristol-Myers Squibb Site

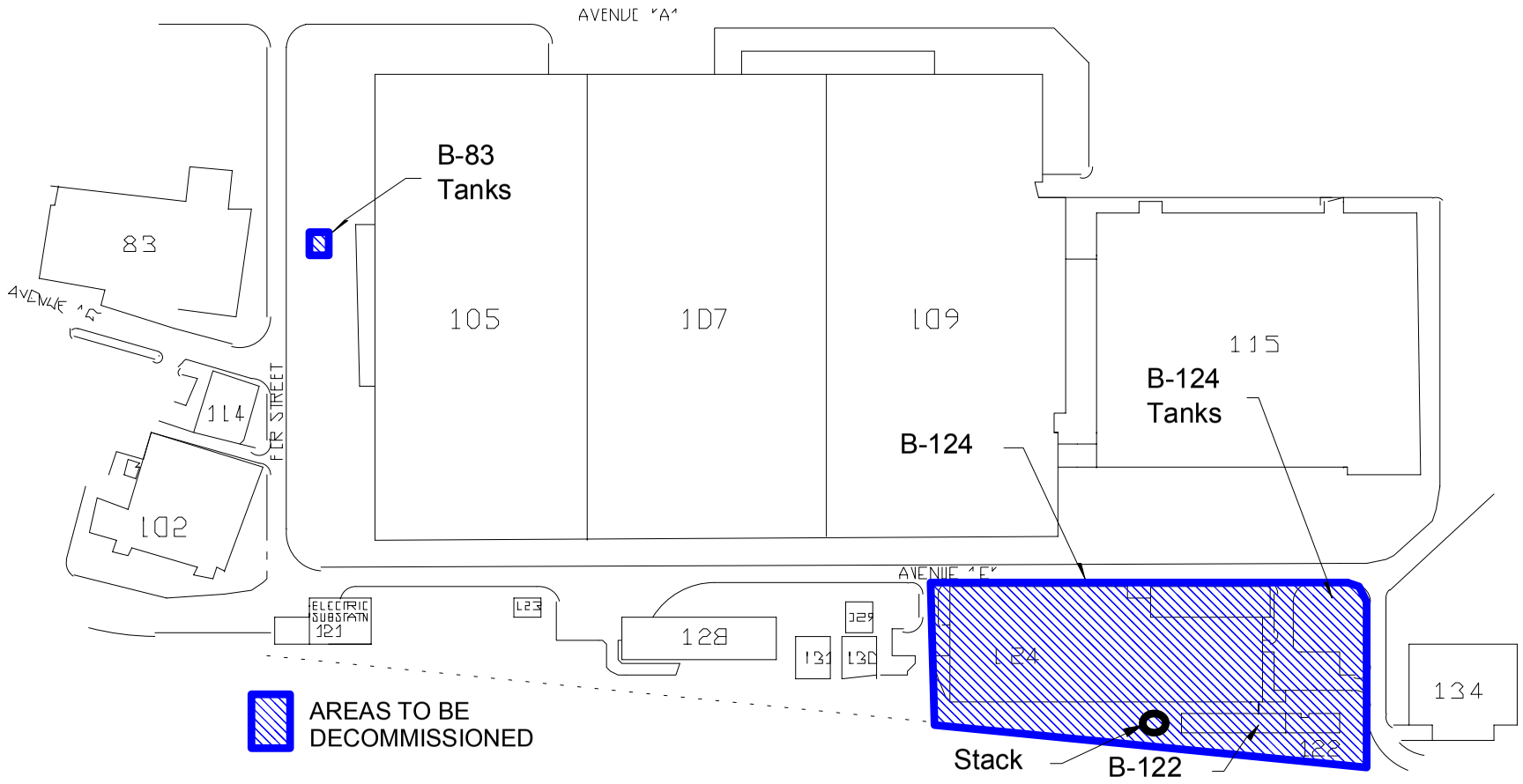


Figure 1-2: Areas to be Decommissioned

1.2 Historical Site Information

This section provides historical site information obtained from the Historical Site Assessment (HSA) that was performed as part of the site characterization. The full HSA which includes additional information was included as part of the Characterization Survey Report (Ref. 1-4).

E. R. Squibb & Sons, a wholly owned subsidiary of Bristol-Myers Squibb Company (BMS), voluntarily committed to a radiological decommissioning of parts of the E. R. Squibb & Sons site in New Brunswick, NJ (25 miles southwest of Newark), formerly used as a radiopharmaceutical manufacturing facility. The scope of the decommissioning project was limited to Buildings 124 and 122 and the effluent tanks for Buildings 124 and 83.

1.2.1 Facility Description

The facility was constructed and began licensed activities in 1964/1965 and terminated operations on June 29, 2001. License amendment 99 was approved by the NRC to reduce possession limits and remove the requirement for a Radiological Contingency Plan due to the reduced possession quantities The radiopharmaceutical manufacturing plant (Building 124) and its storage facility (Building 122) were utilized for the processing, storage and decay of radioactive materials generated during the manufacture of radiopharmaceuticals. Both structures are located at the southwest end of the New Brunswick 80.1-acre site and occupy approximately 1.75 acres. Four effluent tanks used to support manufacturing operations were located south of Building 124. Also included in this decommissioning project were two effluent tanks used to support R&D work in Building 83. Figure 1-2 shows the location of these facilities.

The manufacturing, processing and quality control of radiopharmaceuticals were conducted on the ground floor in the rear of the Building 124 production plant. A storage facility, Building 122 is located in the rear of the production plant.

Unrestricted administrative offices are located on the first and second floor in front of the plant away from the normal manufacturing operations. There are no elevators, one dumbwaiter and stairways located in the unrestricted office area and in the machine room.

The facility design was such that movement of supplies, equipment and materials into processing areas did not interfere with adjacent work areas. The layout provided for easy access for purposes of maintenance and efficiency of operation. No unnecessary movement of materials was permitted through areas in which exposure to radiation could occur. Personnel movement in the facility did not require passage through radiation areas to gain access to non-radioactive materials areas.

Clean areas, radiation areas and high radiation areas were situated and segregated so that personnel received no unnecessary exposure. This layout also provided for contamination control. A personnel monitoring area and a protective clothing change room was located adjacent to the radioactive materials area. Shower and locker room facilities were also provided. The layout of the facility was such that the products progressed in sequence of operations from the manufacturing, filling and packaging areas to the final holding area for shipment. The loading dock is adjacent to the holding area. By use of conveyor belts and by judiciously locating the various stations in the complete manufacturing process, contact with and handling of any radioactive material was minimal.

The manufacturing facility was equipped with several hot cells (caves), which were constructed of steel, concrete and lead, and were used in the production processes. They served as primary containments. Leaded glove boxes and hoods were used to manufacture and fill radiopharmaceuticals of different concentrations. Additional shielding, when necessary, was provided in glove boxes and fume hoods to shield the bulk material to maintain radiation levels on the outside of enclosures as low as practicable. Rooms and glove boxes were provided with ventilation to protect operators from volatile radioactive material.

Holding tanks, waste and storage facilities for radioactive materials decay were remotely located, and were not in the normal path of travel for personnel or equipment. Four ten thousand-gallon holding tanks were utilized to decay liquid effluent from the manufacturing facility. The four tanks were located below grade in a concrete vault south of Building 124. Radioactive solid waste from R&D and manufacturing was stored and processed by compaction in Building 122.

The manufacturing areas were serviced by a non-recirculating air-conditioned supply system utilizing all outside air introduced through a pre-filter and a high efficiency particulate filter. A general system exhausted the various spaces through filtration equal to that of the supply system. Fume hoods, wherein particulate matter was the expected contaminant, wee exhausted through a roughing filter and a HEPA filter followed by two 1" high efficiency carbon filters.

Each of the 12 fume hood system filter banks serviced from one to five fume hoods or other ancillary equipment. Each fume hood system had a manual air bypass to be used during filter changes.

Each glove box filter bank serviced up to five glove box units or similar equipment. Each glove box system had access to an auxiliary system offering identical filtration. There were no bypasses to allow passage of unfiltered exit air. There were 11 glove box systems and six auxiliary systems available for use during filter changes or maintenance.

Filtration for the hot cells was accomplished by employing two identical exhaust systems. One was in continuous operation, while the other exhaust system served as an auxiliary system when the primary was shut down for decay prior to filter changes and/or maintenance. Each system was filtered by three Flanders roughing, three Flanders HEPA, and nine 1" equivalent MSA activated charcoal filters. There were no bypasses to allow passage of unfiltered cave system air. The ventilation from the caves in room 172, 174 and 175 passed under the concrete floor slab to a collector before entering the main exhaust system. All exhaust systems were discharged to the effluent exhaust stack.

1.2.2 License History

A review of the history for License No. 29-00139-02 was performed from the original issue date of March 26, 1956 through Amendment No. 99. Licensed activities for manufacturing and processing in Buildings 124 and 122 began 1964/1965. The original license covered research and development and processing for distribution to AEC licensed users. The license was eventually changed to authorize use for:

- Research and development as defined in 10 CFR 30.4.
- Possession, use, and processing incident to the manufacture of radiochemicals and radiopharmaceuticals.
- Storage prior to distribution of manufactured radiochemicals and radiopharmaceuticals.
- Packaging and distribution of manufactured radiochemicals and radiopharmaceuticals to persons authorized to receive the licensed material pursuant to the terms and conditions of a specific license issued by the NRC or an Agreement State.

Throughout the license history, the license format changed and amendments were issued which changed the maximum possession limits for byproduct material with Atomic Nos. 3-83 and exceptions for individual radionuclide possession quantities. Table 1-1 highlights some of the historical changes for the significant radionuclides.

Table 1-1: History of NRC License No. 29-00139-02

ISOTOPE	Maximum License Quantity/Time Frame
P-32	30 Ci (1957) 10 Ci (1963) 20 Ci (1965) 25 Ci (1967)

ISOTOPE	Maximum License Quantity/Time Frame
P-32	25 Ci (1971) 10 Ci (1972) 20 mCi (amend. No.61)
Cr- 51	1 Ci (1963) 5 Ci (1967) 2 Ci (1970) 4 Ci (1971) 2 Ci (1971) 2 Ci (1972) 50 mCi (1984) Note: After license change, Cr-51 was used in possession quantities for isotopes with atomic numbers between 3-83.
Co-60	200 mCi (1957) 100 mCi (1961) 3 Ci (1963) 1 Ci (1966) 200 mCi (1971) 50 mCi (1972)
Se-75	5 Ci (1977) 5 Ci (1986)
Sr-90	50 mCi (1957) 500 mCi (1960) 3 Ci (1963) 0 Ci (1965) Although Sr-90 was in the early license, it's use was in R&D and not in the manufacturing facility. Note: Sr-90 is also a potential contaminant in the Molybdenum-generator feedstock.
Mo-99/Tc99m	50 Ci (1965) 120 Ci (1966) 300 Ci (1967) 500 Ci (1968) 800 Ci (1969) 1500 Ci (1975) 2000 Ci (1977) 500 Ci (1991) 0 Ci (1998) (For manufacturing purposes) Continued to use Tc-99m for QC testing in possession quantities for isotopes with atomic numbers between 3-83.
I-125	25 Ci (1963) 10 Ci (1967) 5 Ci (1971)
I-131	30 Ci (1957) 100 Ci (1963) 200 Ci (1970) 150 Ci (1971)
Cs-137	Most likely millicurie quantities but always less than the maximum quantity for isotopes between atomic numbers 3-83. Used to manufacture reference standards for source calibrators. Note: Cs-137 is also a potential contaminant in the Molybdenum-generator feedstock.

ISOTOPE	Maximum License Quantity/Time Frame
Ir-192	50 Ci (1963) 100 Ci (1967) 50 Ci (1970) 50 Ci (1971) 0 (1972)
Hg-197	20 Ci (1965) 40 Ci (1967) 10 Ci (1970) 10 Ci (1971) 20 Ci (1972) 20 Ci (1975) 0 Ci (1977)
Hg-203	5 Ci (1965) 20 Ci (1966) 60 Ci (1966) 30 Ci (1970) 20 Ci (1971)
Au-198	30 Ci (1957) 250 Ci (1963) 400 Ci (1967) 200 Ci (1971) 0 Ci (1977)
Fe-59	100 mCi (1963) 200 mCi (1967) 400 mCi (1970) 0 Ci (1977)
Co-58	50 mCi (1963) 0 Ci (1966) Most likely used in R&D and not manufacturing.

While there were curie quantities of H-3 and C-14 in the license, they were primarily used in the R&D facilities. However, there is some evidence that small amounts of H-3 and C-14 may have been used in Building 124 in the 1960's for research activities.

The State of New Jersey regulates the use of accelerator produced radioactive materials. Table 1-2 shows the State licensed isotopes and maximum possession quantities.

Table 1-2: New Jersey State License No. NJSL-10071/00/0047

ISOTOPE	MAXIMUM POSSESSION QUANTITY
Co-57	50 millicuries
Sr-82/85 generators	15/75 Curies
Tl-201	15,000 millicuries

1.2.3 Production Quantities

Various radionuclides in significant quantities were processed and stored in isolated areas within these facilities. Products and possession quantities changed throughout the years. Although the license authorizes the possession and use of various nuclides in significant quantities, in more recent years typical production operations were limited to the use of approximately five isotopes with maximum inventories ranging from 0.05 to 150 Curies. Specific isotopes and possession quantities normally possessed and processed are in Table 1-3 as follows:

Table 1-3: Possession Quantities Normally Possessed & Processed

Isotope	Maximum Inventory	Form
I-131	150 Curies	Sodium Iodine
Sr-82	15 Curies	Strontium Chloride
Sr-85	75 Curies	Strontium Chloride
Cr-51	5 Curies	Sodium Chromate
Co-57	0.05 Curies	Cobalt Chloride

1.2.4 Bulk Material Purchases

Bulk materials were either reactor or accelerator produced and purchased from suppliers such Cintichem, Nordion, GE, etc. The following is a partial listing of isotopes and their suppliers:

- Gold and Phosphorus were obtained from Cintichem.
- The early Molybdenum was obtained from a GE reactor in California
- The late Molybdenum was obtained from Nordion or Cintichem.
- Iodine was obtained from Nordion (used to be AECL) or Cintichem.
- Selenium was obtained from a GE reactor in California.
- Strontium was obtained from LASL or Nordion. LASL obtained the strontium from various places including Russia and South Africa.

As a result of the production process, some of the radionuclides may have long lived contaminants or impurities. Table 5-4 contains information on impurities from more recent Certificates of Analysis. Certificates of Analysis and/or QC data were not available for early (1960's-1980's) products.

Table 5 4: INFORMATION FROM CERTIFICATES OF ANALYSIS

Radionuclide	Maximum Inventory	Form	Impurities
I-131	150 Curies	Sodium Iodine	I-130 (<0.1%)
Sr-82 (1)	15 Curies	Strontium Chloride	mCi/mCi Sr-82: mCi/mCi Sr-85 (<5) mCi/mCi Rb-83 (<0.15) mCi/mCi Rb-84 (<0.15) mCi/mCi Sr-83 (0.0015)
Cr-51	5 Curies	Sodium Chromate	mCi/mCi Co-60 (0.000003) mCi/mCi Eu-156 (0.00014)
I-125			I-126 (<0.005%) Cs-134/137 (<0.0001%)
Mo-99 (2)	2000 Curies	Sodium Molybdate (fission) Non-volatile.	uCi/mCi Mo-99: uCi/mCi Ru-103 (<0.05) uCi/mCi Sr-89 (<0.0006) uCi/mCi Sr-90 (<0.000015) uCi/mCi Te-132 (<0.05)

Radionuclide	Maximum Inventory	Form	Impurities
Tl-201		Thallium Chloride	Tl-200 (<1.0%) Tl-202 (<2.7%) Pb-203 (0.25%)

Note (1): In the 1990's there was a bad batch of Sr-82/85 received from LASL that was produced in Russia that had many impurities.
Note (2): In the earlier years of production, Molybdenum had more impurities than in later years.

1.2.5 Products Manufactured

Various products were manufactured throughout the years and included some of the following:

- Rubratope capsules (Co-57)
- Rubratope capsules (Co-60)
- Tresitope (I-125)
- Iridium seeds (Ir-192)
- Cobatope reference standards (Co-57)
- Cobatope reference standards (Co-60)
- Ferrous citrate (Fe-59 injection)
- Chromic phosphate (P-32)
- Thallous chloride (Tl-201 injection)
- Albumotope (I-131 injection)
- Albumotope (I-125 injection)
- Albumotope LS (I-131 lung scanning particles)
- Aureotope diagnostic injection (Au-198)
- Aureotope therapeutic injection (Au-198)
- Chromablin (Cr-51)
- Chromotope sodium injection (Cr-51)
- Hipputope injection (I-131)
- Iodotope diagnostic capsules (I-131)
- Iodotope therapeutic capsules (I-131)
- Iodotope therapeutic Oral Solution (I-131)
- Phosphotope Oral Solution (P-32)
- Phosphotope Prefill Injection (P-32)
- Robengatope injection (I-131)
- Sethotope injection (Se-75)
- Cardiogen (Sr-82/85)

1.2.6 Facility Renovations

The initial facility was constructed in 1964 and was designed for the manufacturing of radiopharmaceuticals for E. R. Squibb and Sons, Inc. Several renovations occurred to accommodate operations as follows:

- Buildings 124 and 122 were expanded in the 1970's as distinguished on the exterior by the white (original) and beige (addition) colored bricks.
- Installation, rearrangement and renovation of equipment and uses of rooms. Examples include:
    - Current Locker room area used to house 3 to 4 stations with 4 autoclaves. Products in this area were I-125 and I-131. (1968 timeframe).
    - Caves were renovated, decontaminated and fixed contamination was painted over (1980's timeframe).
    - An addition was built around rooms 177 and 178.
    - Changed piping to glass in some systems.

- Removal of waste effluent tanks where offices are currently located and construction of current waste decay tanks. (1971 timeframe).
- Ventilation stack was installed and moved the airborne effluent discharge from the top of the roof through the stack. (1970/1971 timeframe).
- The roof was replaced in the 1980's. The top layer of gravel was removed and the original roofing materials are still in place.

1.2.7 Spills

There have been some spills of radioactive material outside of Building 124. In addition, there were some work activities that may have resulted in radioactive material transfer to outdoor areas, even though no such contamination was ever reported. These spills and activities include the following items:

- ^{131}I was spilled in front of the Hot Barn Door (south end of Building 122) many years ago.
- ^{32}P was spilled in the area of the Building 124 old west entrance to Building 122 in 1964. This area was paved over to prevent the spread of contamination.
- ^{32}P was spilled in the area of the storm water collection vault many years ago.
- There was equipment stored to the west of Building 122 that could have exhibited activity above background levels.
- Many years ago, manipulators were occasionally steam-cleaned prior to maintenance at the live steam outlet on the south side of Building 124. The manipulators at the time exhibited activity above background levels. Manipulators would have been used for the production of Molybdenum and iodine products.
- The B-124 effluent tanks on several occasions floated due to the infiltration of groundwater in the vaults. This caused the glass piping to break resulting in small spills on the top of the tanks but not to the environment.

The following incident was documented in a deviation report and reported to the NRC.

- In September of 1990, 30 Curies of ^{131}I was released into the vacuum system. The system was flushed with sodium hydroxide and the cave in which the work was being conducted was decontaminated. The peak stack discharge for this incident was 62% of the MPC limit for I-131.

Minor contamination events occurred which were incidental to normal manufacturing operations. Events and corrective actions were documented in deviation reports if warranted. Examples of typical events are as follows:

- Failure of H-3 sign between rooms 211 and 213 due to worker drilling through the sign.
- Effluents from the Molybdenum/Iodine caves were collected in carboys and there were small spills in the rear cave door tracks.
- There were occasional spills and contamination in the hallways during manufacturing and they were always cleaned up.
- There was a spill of Molybdenum in front of the MINITEC cave that was cleaned up.
- Iodine was manufactured in a wax form and put in capsules in a cave. When the capsules were capped the process generated some fine wax shavings. These shavings were occasionally found in the hallways.
- Occasionally products became over pressurized in the autoclaves.
- A fan belt in an exhaust system failed, airflow reversed, causing hand and foot monitors to alarm.
- There were occasional airborne problems mostly due to iodine.
- There were occasional "hang-ups" of trays on the conveyor system in the order selection area causing some spillage of I-131 product.
- Minor areas of contamination are present in the process drains and ventilation ducts exiting the caves and on equipment that will be removed and sent to an offsite processor.

1.2.8 Radwaste Handling Procedures

The compactor in Building 122 compacted waste for the New Brunswick as well as Lawrenceville and other New Jersey research sites. Normal practice in accordance with the license was to hold radioactive material with a physical half-life of less than 60 days for decay-in-storage before disposal in ordinary trash provided that:

- Waste disposed of in this manner was held for decay a minimum of ten half-lives.
- Before disposal as ordinary trash, the waste was surveyed at the container surface with the appropriate survey instrument set on its most sensitive scale and with no interposed shielding to determine that its radioactivity could not be distinguished from background. All radiation labels were removed or obliterated.

Radionuclides in waste shipments included: I-131, I-125, Mo-99, Tc-99, Cr-51, Co-57, Co-60, Cs-137, P-32, H-3, C-14, Nb-95, Ce-141, S-32, Sr-85, Ru-106, Se-75 and Mn-54.

1.2.9 Airborne Effluents

Handling of uncontained radionuclides was performed under exhaust ventilation in fume hoods or glove boxes. General room air from major handling and processing areas of B-124 was also exhausted. Exhausted process and room air from this building was passed through HEPA and charcoal filters (up to three of each in series, depending upon the radionuclides, quantities, and potentials for airborne releases) and was combined for discharge through a single stack.

All potentially contaminated air was exhausted via a plenum attached to a 98-ft. stack. Exhaust air flowing through this plenum (approximately 77,000 CFM) was isokinetically sampled continuously. Samples were changed daily Monday through Friday and most Saturdays to determine the week's average environmental air effluent concentration.

Environmental air effluents were also continuously monitored with a stack effluent monitoring system. A sample was drawn from the stack by an isokinetic sampling probe. The sample flowed first through the absolute particulate filter for gross beta determination and then through activated charcoal sampler for I-131 detection. A two-inch diameter by two-millimeter thick NaI scintillator was employed for monitoring gross beta activity and a second two-inch diameter by two-inch thick NaI scintillation detector was used for I-131 detection.

Effluent records indicated that average airborne concentrations were typically less than 25% of the MPC for I-131. Effluent records also indicated that airborne releases of I-131 typically ranged between 20 to 30 millicuries per year.

Independent stack effluent sampling performed by Oak Ridge Associated Universities during the period of 8/31/81 to 9/4/81 detected I-131 and I-125 and also trace levels of Co-57, C0-60, Se-75, Cr-51 and Mo-99. Concentrations of these trace radionuclides were less than 1% of the unrestricted average annual limit.

The state of New Jersey also studied the airborne I-131 emissions from this facility as reported in "Offsite Levels of Iodine-131 in the Environs of a Major Radiopharmaceutical Processor", New Jersey State Department of Environmental Protection Bureau of Radiation Protection, D. McCurdy et. al., April 1976. The study concluded that the radiation dose to the thyroid of an adult continuously inhaling I-131 at the levels measured would be between 0.3 mrem and 2 mrem per year depending upon the measurement year.

1.2.10 Liquids Effluents

In connection with an anticipated increase in the size of the radiopharmaceutical production facility, a new hold-up tank system for liquid effluent replaced the old system in the early 1970's. The capacity was increased to 40,000 gallons as opposed to the former 15,000-gallon system. Process liquids containing

higher concentrations of radionuclides were collected at the operation, held for decay and/or solidified, and disposed of as radwaste. Liquids with potential for low concentrations of radionuclides, e.g., glassware washing water and water from sinks in the manufacturing area, were collected in the hold-up tanks. There were four separate tanks, each having a capacity of 10,000 gallons. The tanks were sampled as necessary and released to the sanitary sewer, if contents satisfied the concentration limits for such release. Liquid generation rates permitted approximately a three-month decay of the hold-up tank effluent. The remainder of the liquid wastes from the facility was sanitary waste and was released without treatment or monitoring.

The 10,000-gallon tanks were filled one at a time. After the third hold-up tank was filled, the first tank was sampled to determine the concentration prior to release. Two 3-milliliter samples were taken after the contents of the tank were agitated for one hour. Records of assays performed on tank samples and these records indicated that no releases in excess of 10 CFR 20 Appendix B limits were made.

A 1981 NRC inspection reported that a total of 193.3 millicuries of byproduct material had been released to the sewer during 1981. The principle radionuclides were I-125, I-131, and Se-75. More recent effluent records (1994-2001) indicated releases of I-131 and I-125 ranging from 0.1 to 1.1 mCi released per year and smaller amounts of Co-57 and Cr-51.

Independent liquid effluent sampling and analysis was performed by ORAU during the period of 8/31/81 to 9/4/81. The results of their samples are included in Table 1-4 and Table 1-5.

Table 1-4: Sanitary Drain Effluents

Isotope	Concentration in microcuries/cc
Mo-99	3.8 +/- 4.2 E-8
Cr-51	2.2 +/- 2.3 E-7
I-131	0.9 +/- 1.1 E-7
Co-60	3.1 +/- 1.9 E-8

Table 1-5: Hold-Up Tank Effluents

Isotope	Concentration in microcuries/cc
Co-57	8.1 +/- 2.3 E-7
I-125	1.0 +/- 0.1 E-5
Mo-99	4.7 +/- 1.3 E-7
Se-75	5.0 +/- 0.2 E-5
Cr-51	2.6 +/- 0.5 E-5
I-131	4.8 +/- 0.2 E-5
Co-60	6.4 +/- 4.3 E-7

1.2.11 Environmental Monitoring

During manufacturing operations when possession and processing quantities of radioactive materials were in the curie range, environmental monitoring requirements included fenceline TLDs for external exposure and effluent stack monitoring for airborne releases.

In 1974, the NJDEP had an agreement with the NRC to perform environmental air monitoring at locations offsite. Very low levels of I-131 were detected at several locations less than a mile from the site.

An environmental radiological survey was performed by Oak Ridge Associated Universities from August 31-September 4, 1981 at the E. R. Squibb and Sons, Inc. facility in New Brunswick, New Jersey. Measurements taken included direct radiation levels, stack sampling, liquid effluent sampling, as well as vegetation, soil and milk samples. The results are documented in a report dated 3/25/82. No environmental concerns were identified in the survey.

1.2.12 Potential Contaminants

The radionuclides used at E. R. Squibb & Sons, Inc. were primarily short-lived radionuclides but traces of longer-lived radionuclides present as trace impurities and the production of Cs-137 and Co-60 reference standards indicate that some longer-lived nuclides are potentially present. Radionuclides with half-lives shorter than 60 days are not of concern unless they continue to be produced by a longer- lived parent radionuclide.

There were no isotopes with atomic numbers exceeding 83 or any alpha emitting radionuclides of concern. The radionuclides with long enough half-lives to be of concern are ^{54}Mn, ^{57}Co, ^{60}Co, ^{75}Se, ^{85}Sr, ^{99}Tc, ^{129}I, ^{134}Cs and ^{137}Cs.

1.2.13 Potentially Contaminated Areas

Building 124 was a radiopharmaceutical production building. It is a large (about 70,000 ft^2), two story building containing office areas, laboratories, hot cells (caves), radiopharmaceutical packaging areas, HEPA ventilation systems, mechanical rooms, machine shop, receiving area, a shipping dock and related infrastructure (sanitary sewer and process sewer). With the majority of the radioactive materials consisting of short half-lived isotopes, it is anticipated that very few areas will have activity in excess of guideline values. Areas that were anticipated to exhibit activity above background levels included the following categories:

- process caves
- some process ventilation system components
- glove boxes
- hoods and
- process drains

A detailed list of the Building 124 rooms with their operational history and equipment is contained in the characterization report HSA Attachment 1 (Ref. 1.4).

Building 122 is a radiopharmaceutical storage facility. It is a single story building of approximately 3,500 ft^2 with old and new sections. Operations in this building included the following:

- Hold-for-decay radioactive waste,
- Returned radiopharmaceutical and source package breakdown,
- Radioactive waste disposal shipment preparation, and
- Compaction of waste for licensed R&D activities.

Based on historical survey data and the decay of the short-lived isotopes, the outdoor areas have little potential to exhibit activity above background levels. The outdoor area operations and activities of interest included the following:

- Building 83 Tanks and Tank Pit: There are two 8,000 gallon below grade wastewater containment (decay) tanks located to the south of Building 83. These tanks previously received radiopharmaceutical wastewater and therefore may exhibit activity above background levels.
- Building 124 Stack: There is a 98-foot tall steel stack to the east of Building 124 that exhausts from Building 124 ventilation systems. Because of the presence of activity above background levels in portions of the facility exhausted to the stack, the stack may exhibit elevated activity.
- Building 124 Decay Tanks and Pit: The four 10,000 gallon decay tanks located adjacent to Building 124 and the pumps and equipment in the adjacent valve pit have a history of internal activity above background levels.
- Storm Water Holdup Tank: The storm water holdup tank at the north end of Building 122 does not have a history of internal activity above background levels.
- Storm Sewers: The storm sewers around Building 124 do not have a history of internal activity above background levels.

- Open Land Areas: There have been some spills of radioactive material outside of Building 124. In addition there were also some work activities that could have resulted in radioactive material transfer to outdoor areas, even though no such contamination was ever reported. These spills and activities include the following items:
- I-131 was spilled in front of the Hot Barn Door (south end of Building 122) many years ago.
- P-32 was spilled in the area of the Building 124 old west entrance to Building 122 in 1964. This area was paved over to prevent the spread of contamination.
- P-32 was spilled in the area of the storm water collection vault many years ago.
- There was equipment stored to the west of Building 122 that could have exhibited activity above background levels.
- Many years ago manipulators were occasionally steam cleaned prior to maintenance at the live steam outlet on the south side of Building 124. The manipulators at the time exhibited activity above background levels. Manipulators would have been used for the production of molybdenum and iodine products.

1.3 Decommissioning Activities

D&D activities began at the site in mid-August, 2002. These work activities were performed by Almasi Construction Co., Woodbridge, NJ, under the direction of Duratek health physics personnel and in accordance with BMS license requirements and the Duratek. Radiation Protection Program. D&D activities were largely dictated by the characterization survey results. Also, materials and equipment that could not be adequately surveyed and had a potential for residual contamination were incorporated into D&D activities. Major D&D activities included:

- Removal of the four underground Building 124 waste decay tanks (10,000-gallon), associated piping and valves and removal of the concrete vault.
- Removal of the two underground Building 83 waste tanks (8,000 gallon) and associated piping and valves and removal of the concrete vault.
- Removal of the Building 124 process vent stack.
- Removal of the major portion of the Building 124 exhaust process ventilation ducting and HEPA and charcoal filters and filter housings.
- Removal of process glove boxes and hoods.
- Removal of laboratory cabinets, countertops, and fume hoods.
- Removal of all process drain lines.
- Removal of soil under process drain lines in Building 124 Rooms 150 and 152.
- Decontamination and partial removal of hot cells.

All materials and equipment unconditionally released were released in accordance with the limits specified in Reg. Guide 1.86. Material and equipment that were not unconditionally released on site were sent offsite for either processing for disposal as radioactive waste or decontamination and/or additional surveys and unconditional release. Surveys performed during D&D activities identified one area of contamination that was not identified during the characterization survey. The Building 124 process drain piping in rooms 150 and 152 had deteriorated and some contamination leaked into the soil below the floor slab in these rooms. The contaminated soil was removed as part of the decommissioning.

REFERENCES FOR SECTION 1

1-1 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, August 2000.

1-2 NUREG- 1757, Vol. 1, Final Report, *Consolidated NMSS Decommissioning Guidance, Decommissioning Process for Materials Licensees,* September 2002.

1-3 PL-DTK-02-022, REV. 0, *Final Status Survey Plan for Radiodiagnostic Manufacturing Operations, E. R. Squibb & Sons, a wholly owned subsidiary of Bristol-Myers Squibb Company*, Rev. 0, December 2002.

1-4 *Characterization Survey Report for the Bristol-Myers Squibb Former Radiopharmaceutical Production Facility*, Rev. 1, Duratek, December 2002.

2.0 CHARACTERIZATION SURVEYS

The purpose of the characterization survey was to provide sufficient, accurate data to develop an accurate decommissioning cost estimate and for development of a safe and effective decommissioning plan. The three survey classification levels of the BMS Facility are presented in Figure 2-1 to Figure 2-4 in the following pages. The project team performed surveys according to Duratek procedures and the Characterization Survey Plan. The procedures identified survey instrument requirements, measurement and sample collection, and data reduction and evaluation methods, while the plan identified the survey protocols.

The survey protocols consisted of a mix of surface activity measurements and sampling. Based upon sample analytical results, one sample was shipped offsite for additional analyses such as low energy gamma and beta analysis (hard-to-detect radionuclides). This was a sediment sample from the Building 124 Decay Tank Valve Pit. The sample had elevated gamma activity and there was sufficient material to perform the required analyses. The sample was analyzed such that the relative abundance of all radioisotopes including the hard-to-detect radioisotopes would be known.

The characterization survey was performed during the fourth quarter of 2001 and the first quarter of 2002. The characterization survey utilized the results of the HSA investigation, and entailed the preparation of plans and the performance of a comprehensive radiation survey which included sampling for potential hazardous materials at the facility and site following guidance provided in NUREG-1575 (Ref.2-1), or MARSSIM. Based upon the information obtained from the site investigation the Characterization Survey Plan was developed. The Characterization Plan included a classification of each survey unit according to expected contamination levels as derived from the HSA Report. The classification system was based on the MARSSIM guidelines. The characterization of the former radiopharmaceutical production facility was performed according to the plan and related procedures. A total of 3,503 samples and measurements were collected or performed for the characterization survey. Less than 100 of the results of the samples and measurements were classified as elevated.

REFERENCES FOR SECTION 2

2-1 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, August 2000.

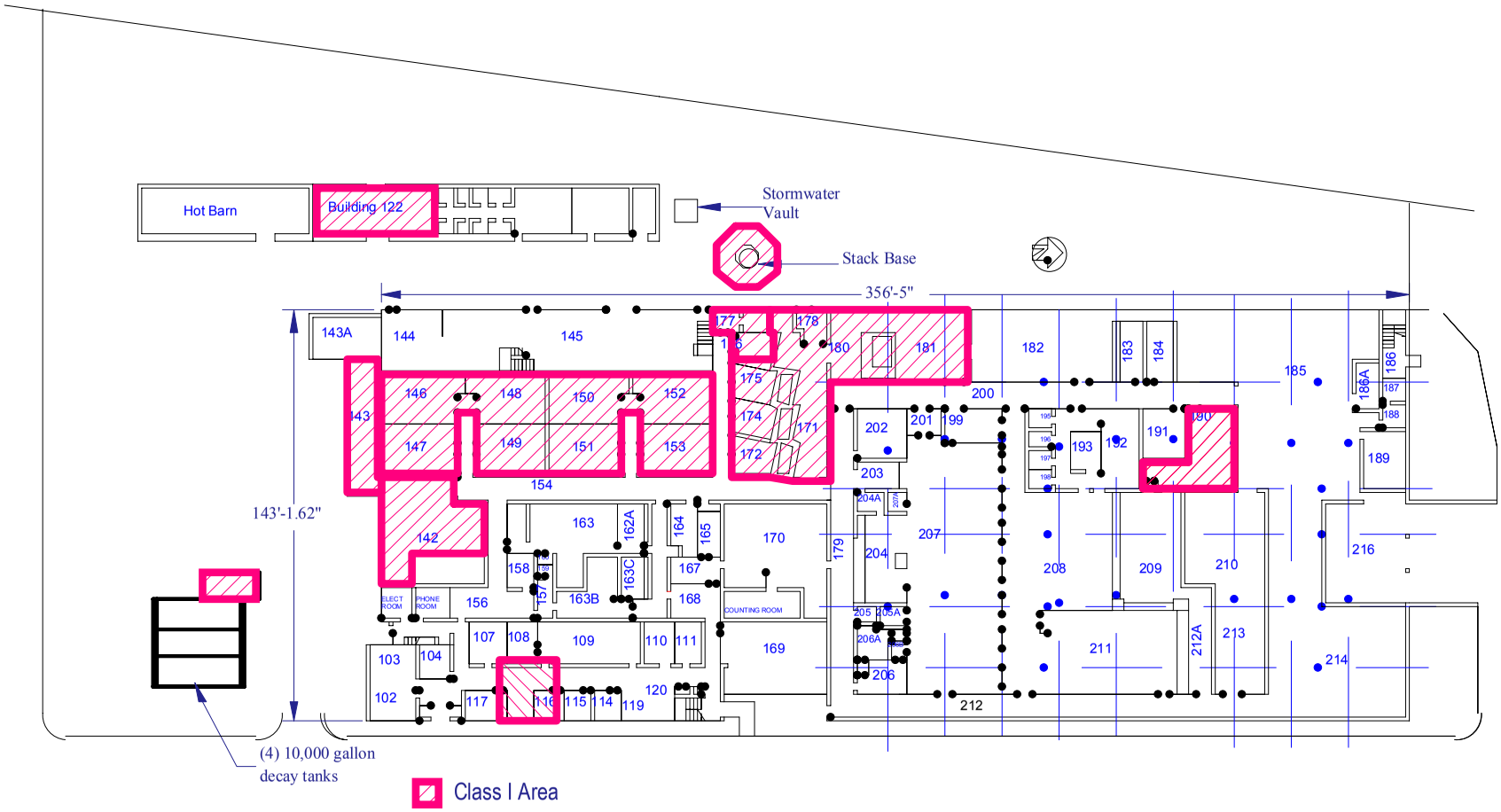


Figure 2-1: BMS B-124 First Floor Class I Areas

(In Color)

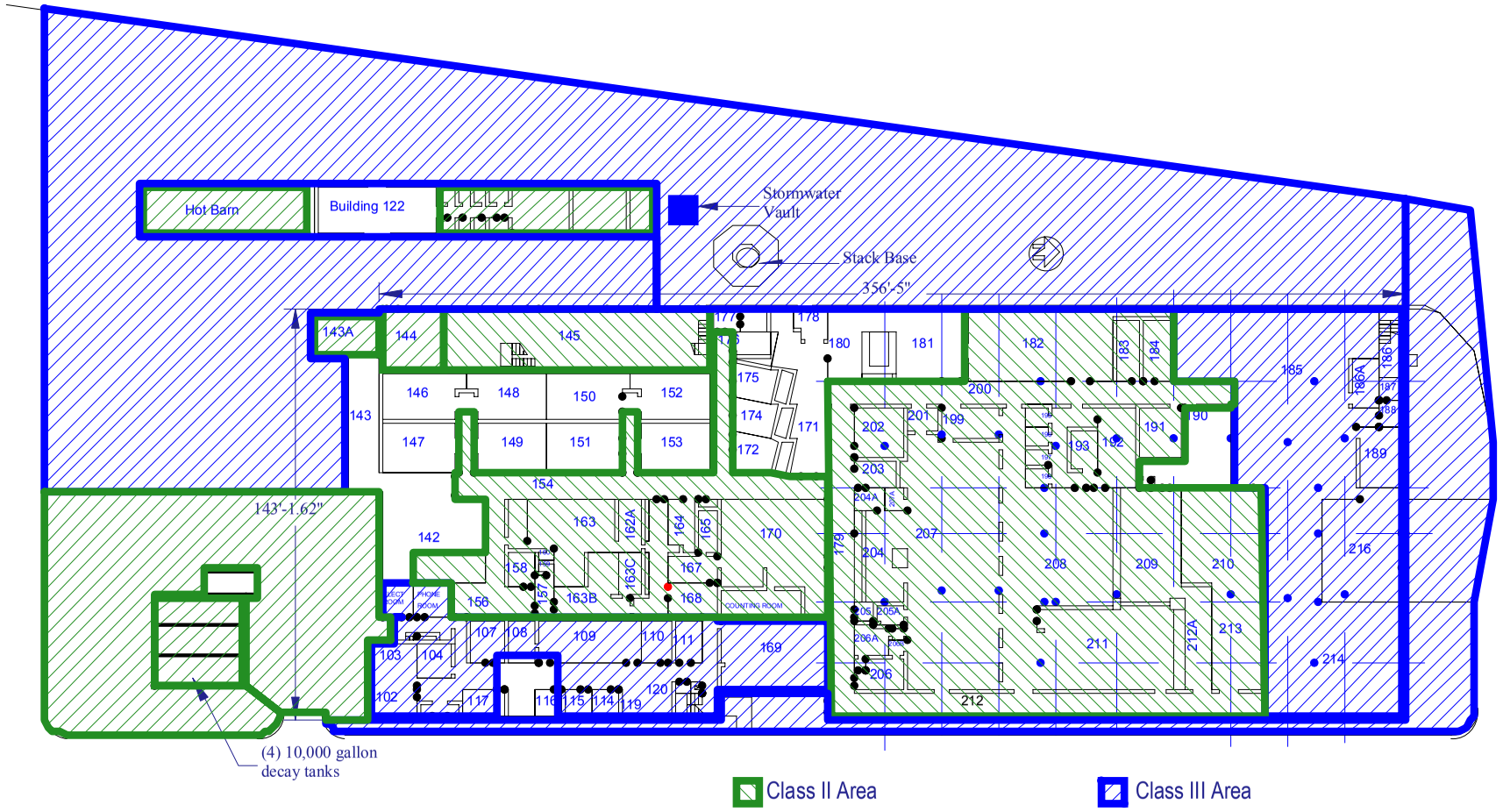


Figure 2-2: BMS First Floor Class II and Class III Areas

(In Color)

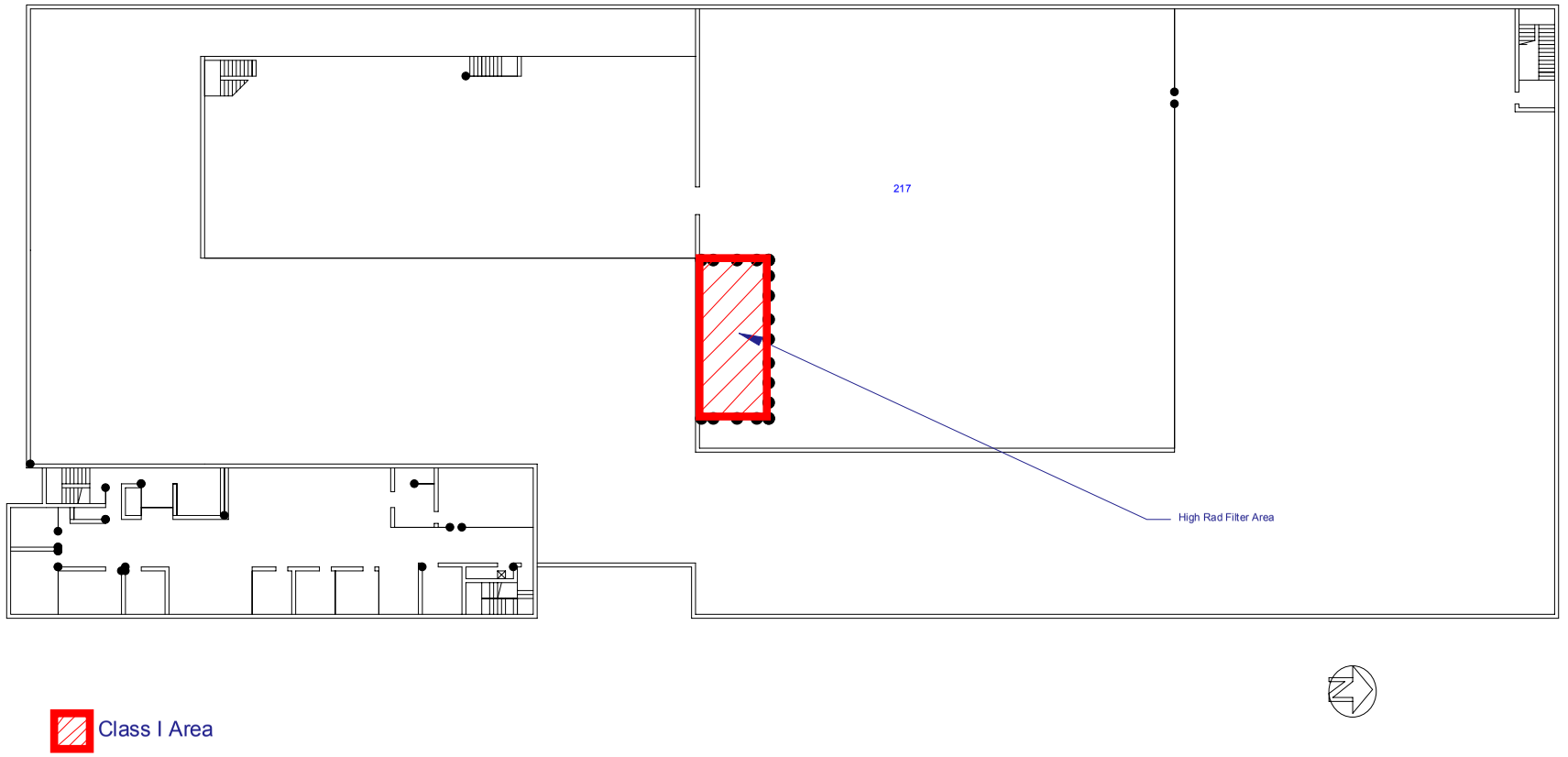


Figure 2-3: BMS B-124 second Floor Class I Areas

(In Color)

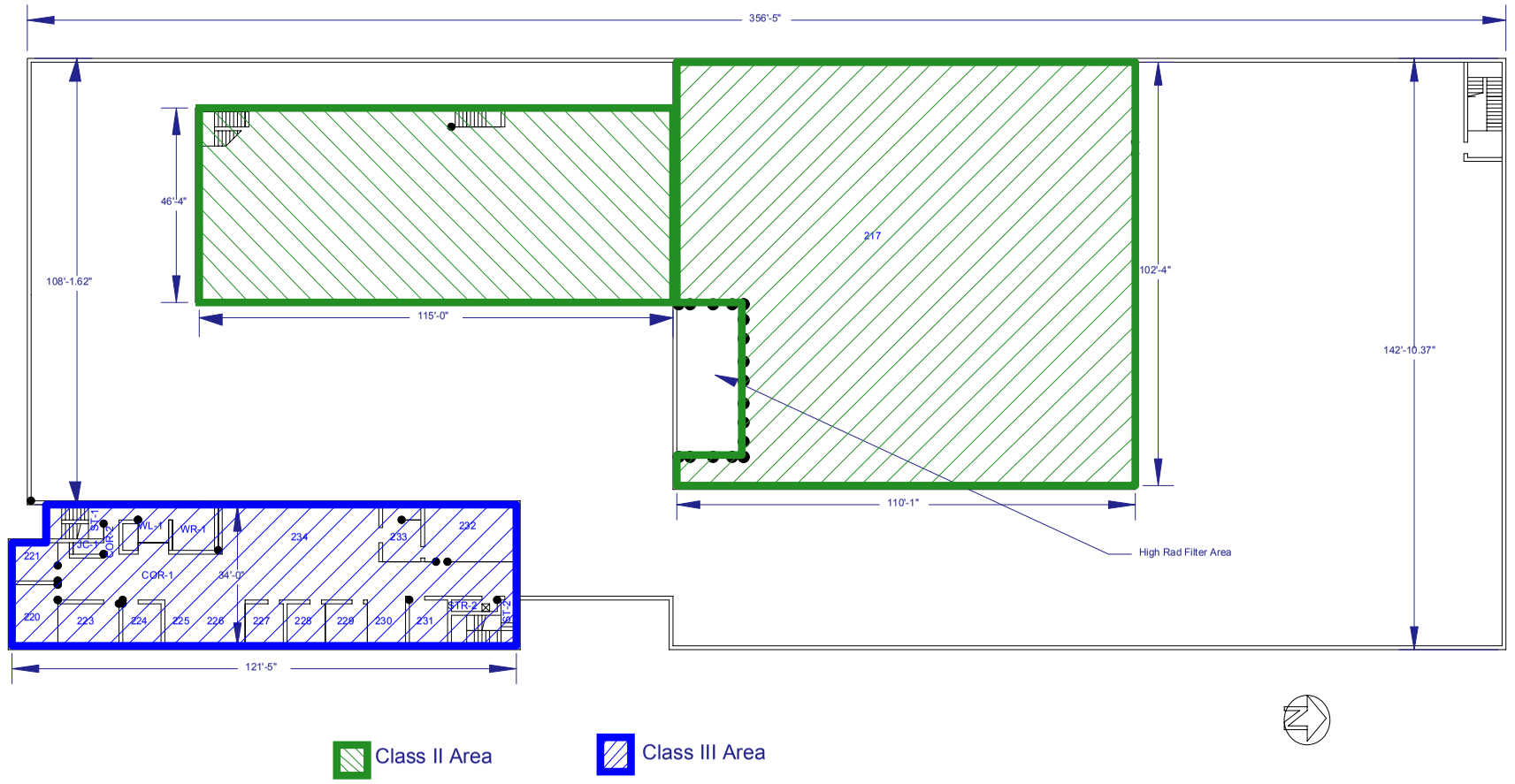


Figure 2-4: BMS B-124 Second Floor Class II and Class III Areas

(In Color)

2.1 Characterization Survey Design

The guidance contained in NUREG 1575, MARSSIM, provided for the classification of the site into either Impacted or Non-Impacted Areas. Areas with some potential for contamination were classified as impacted. Areas that had no reasonable potential for contamination were classified as non-impacted.

The impacted areas were further divided into one of three classifications:

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

For the purpose of this survey, the site was pre-classified based on initial walk-downs by Duratek engineering staff, and from previous experience with other similar sites. This classification did not affect the level or intensity of the survey, but rather the types of measurements and samples that were performed. For example, it may be reasonable to perform direct measurements on the interior of a cave that has been emptied and the contents decayed; however, a similar type of survey would be impractical in an active cave. In the latter case exposure rate measurements were more useful.

2.2 Characterization Survey Packages

Survey packages were developed for each of the survey areas for the BMS facility and site. These survey packages provided the survey technicians with specific sampling and measurement instructions. The survey packages developed for the characterization were as presented in Table 2-1 below.

Table 2-1: BMS Characterization Survey Packages

Survey Package No.	Survey Area Description
Class 1 Structures survey areas/units of building surfaces consist of the following	
A0100	Building 124 Cave Areas (Rooms 171 – 178, 180, and 181)
A0200	Building 124 Stack
A0300	Building 124 Tanks & Tank Valve Pit
A0400	Building 83 Buried Wastewater Tank Pit
A0500	Building 124 Southwest Lab Areas (Rooms 146-153)
A0600	Building 124 Former Decay Tank Area below floor slab (Rooms 108, 109, 116 and 118 plus the associated hall area)
Class 2 Structures survey areas/units of building surfaces consist of the following	
A0700	Building 124 South-central Lab Areas (Rooms 142-145, 154, 156 – 160, 162A, 163, 163B, 163C, 164, 165, 167, 168, & 170).
A0800	Building 124 North Lab Areas (Rooms 179, 182, 183, 184, 190 – 213, and 217).
A0810	Building 124 Second Floor Vent Systems Area

Survey Package No.	Survey Area Description
A0900	Building 122 Interior (Rooms 219 – 222)
Class 3 Structures survey areas/units of building surfaces consist of the following	
A1000	Building 124 North Shipping Areas
A1100	Building 124 South Office Areas except for former tank area included under Class 1.
A1200	Building 124 Exterior
Background Surveys	
B0100	Buildings
B0200	Soils
Class 1 Systems survey areas/units at the site consist of the following	
C0100	Building 124 Ventilation Systems
C0200	Building 124 Drains
Class 2 Environs/open land areas/units at the site consist of the following	
E0100	Soil samples Outside Building 83 & Building 124 Tank Vaults at depths greater than 12-inches.
Class 2 Environs/open land areas/units at the site consist of the following	
E0200	Building Exterior Open Land Areas (Buildings 122, 124, and Building 83)
Tritium and Carbon-14 Surveys for All Areas	
H0100	Removable Contamination Survey for All Areas

2.3 Survey Instrumentation

Careful selection and use of instruments ensured sensitivities were sufficient to detect the identified primary radionuclides at the minimum detection requirements.

Table 2-2 provides a list of the instruments, types of radiation detected and calibration sources used during the characterization survey. The hard-to-detect radionuclides, which include low energy beta emitters such as ^{129}I, could not be measured using these field instruments. These radioisotopes were quantified through offsite laboratory analysis.

Duratek used the Ludlum Model 2350-1 Data Logger with a variety of detectors for direct measurements of total alpha and beta surface activity as well as exposure rate measurements. The Data Logger is a portable micro-processor computer based counting instrument capable of operation with NaI(Tl) gamma scintillation, gas-flow proportional, GM and ZnS scintillation detectors. The Data Logger has the capability to retain in memory the survey results and instrument/detector parameters for up to 1000 measurements. This data was then downloaded to a personal computer for subsequent reporting.

The selection of detectors was based upon the survey to be performed, the surface contour and the survey area size. The project team normally used the 126-cm^2 gas-flow proportional detector for direct alpha and beta measurements and a 1" x 1" Sodium Iodide (NaI) gamma scintillation detector for exposure rate measurements.

In addition to the standard detector systems, Duratek has developed a series of GM and gas-proportional detectors that are used for direct surface measurements of the interiors of system piping. These detectors, coupled to the Model 2350-1 Data Logger, were used in performance of pipe surveys during the BMS facility characterization.

Smears for removable alpha and beta contamination measurements were collected over a 100cm^2 area and analyzed offsite by Duratek, Inc. using the Ludlum Model 2350-1 Data Logger with a Ludlum 43-68 Detector.

Isotopic quantification and identification (qualification) was performed on soil, water, sediment, and debris samples using an EG&G Instruments NOMAD High Purity Germanium (HPGe) Gamma Spectroscopy System.

Table 2-2: BMS Characterization Survey Instrumentation

Instrument/Detector	Detector Type	Radiation Detected	Calibration Source	Use
Ludlum Model 2350/43-68 4	Gas-flow proportional (126 cm^2)	Alpha or beta	^{99}Tc (β) ^{230}Th (α)	Direct measurements
Ludlum Model 2350/43-94 or 43-98	Gas-flow proportional Pipe Detector	Alpha or beta	^{99}Tc (β) ^{230}Th (α)	Direct measurements
Ludlum Model 2350/ SP-113-3m or SP-175-3m	GM Pipe Detector	Beta	^{99}Tc (β) ^{230}Th (α)	Direct measurements
Ludlum Model 2350/44-2	1" x 1" NaI Scintillator	Gamma	^{137}Cs (γ)	Gamma exposure rate
EG&G NOMAD Gamma Spectroscopy System	High Purity Germanium	Gamma	Mixed Gamma	Nuclide identification and quantification

2.4 Overview of Characterization Results

The project team performed 1,515 alpha, beta and exposure rate survey measurements and collected 1,140 smear, liquid, sediment and soil samples for analysis as defined in the survey packages to complete the BMS facility and site characterization. The totals exclude measurements collected for the background reference areas. Measurements were performed using appropriate calibrated instruments and with daily instrument quality control (QC) checks performed before and after each day's work. Table 2-3 summarizes the number types of measurements and samples performed or collected for the survey for each survey group.

Table 2-3: Total Number of Characterization Survey Measurements Performed

Survey Measurement Type	Number of Measurements and Samples				
	Survey Group A	Survey Group B	Survey Group C	Survey Group E	Total
Direct Beta	1,190	106	161	0	1,457
Removable Alpha/Beta	1,135	0	160	0	1,295
Direct Alpha	144	0	15	0	159
Removable H-3/C-14	24	0	3	0	27
Exposure Rate	243	0	60	39	342
Gamma Spec Samples	91	60	13	59	223
Total	**2,827**	**166**	**412**	**98**	**3,503**

Over the course of eleven weeks, twenty survey packages describing rooms and areas of the BMS facility and site surfaces, structures and environs were developed. Each survey package contained detailed instructions, drawings and location codes to perform or collect the 3,503 measurements performed and/or samples collected and analyzed for the characterization.

The measurements and samples collected for the radiological characterization survey consisted of direct beta measurements, direct alpha measurements, smear samples for removable alpha and beta contamination, smear samples for removable tritium and carbon-14 contamination, exposure rate measurements and soil, sediment and water samples for gamma spectrum analysis. During the hazardous material assessment, paint samples were collected for lead and PCBs in paint at the facility. The paint analysis was partly for recognition of hazardous materials that may be present for the D&D phase of work, work safety considerations and also to meet requirements for waste shipments to a waste processor or disposal facility.

Survey package instructions were developed and measurements performed for background reference areas for surfaces, structures and the environs. Direct beta background values for naturally occurring radioactive material (NORM) in asphalt, brick, ceramic tile, cinder block and concrete were determined and applied to the direct beta measurements collected at the BMS facility surfaces and structures to equate the reported beta activity to net results per 100 cm^2. Also, survey measurements and samples collected and analyzed from the environs were used to determine background values for NORM and the contribution from activity from weapons testing fallout in soil, sediment and water of the environs. These values are stated in the report **but were not applied** to results.

Survey package instructions were also developed and samples were collected and sent to a laboratory offsite for 10 CFR Part 61 radionuclide analysis. One sediment sludge sample from the Building 124 valve pit associated with the Decay Hold-Up Tanks was taken. This sample result, in addition to other onsite characterization data, was used to determine BMS site specific DCGL for clean up goals and for release of the facility and surrounding grounds for unrestricted use.

The findings of the site characterization were that the BMS facility and site, for the most part, were radiologically below the characterization release criteria and mostly free of hazardous material contamination concerns. However, some areas and locations at the BMS facility and site required decontamination before the site was suitable for release from the NRC and NJDEP. These areas are described below.

Of the 3,503 total samples and measurements collected or performed for the survey, 1,616 of them were direct measurements collected for the radiological characterization. Fifty five (55) direct beta measurement results were greater than the characterization goal of less than 50% of the characterization DCGL of 5,000 dpm/100 cm² and forty three (43) of these direct beta measurements were greater than the characterization DCGL of 10,000 dpm/100 cm². Of the 223 samples collected for gamma spectrum analysis, 1 sediment sample result was greater than the characterization DCGLs. No soil samples exceed the soil concentration DCGLs.

The areas that required remediation or further investigation and evaluation were summarized by survey package in Table 2-4: Summary of Areas with Elevated Activity. The areas, where the elevated measurements were located, are depicted in Figure 2-5 to Figure 2-10 by cross-hatching or description on each figure. The areas depicted were primarily from elevated beta activity but there were some areas with very slightly elevated alpha activity. The elevated alpha activity was due to natural background sources. There were no alpha decay radionuclides used at this facility. The only areas with significant alpha activity were the roofs on buildings 122 and 124. There was no alpha activity on other horizontal surfaces such as paved areas. The roofs on these buildings were a rubber like material that had replaced the original roofing. There were no gamma or beta emitters associated with the alpha activity. It was also determined that the alpha activity was not due to radon. The alpha activity was apparently from thorium on the roofing surface.

For the most part, the areas with elevated activity were those areas where elevated activity was expected.

Table 2-4: Summary of Areas with Elevated Activity

Survey Package (Area)	Direct Beta Activity (β/γ dpm/100 cm^2)	Direct Alpha Activity (α dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	Exposure Rates (μR/hr)
A0100 (Room 171)	Storage cabinets opposite caves: spots up to 123,000			
A0100 (Room 172 Front side of cave)	Small spot on floor inside services doors beneath lead glass window 6,560			
A0100 (Room 172 Back side of cave)	• Vent duct 5,748 • Table top in cave 24,785 • Cave Floor 138,651 • Cave Structure 16,870 • Cave Wall 11,722 • Shield door track 31,724	Table top in cave 20.2		
A0100 (Room 174 Front side of cave)	Electrical conduit in service panel beneath lead glass window 30,682			
A0100 (Room 174 Back side of cave)	• Floor in front of shield door 1,014,820 • Cave Structure 137,714 • Vent duct 63,365 • Cave Wall 20,849 • Shield door track 63,183	• Floor in front of shield door 28.3 • Cave Wall 28.3	Floor in front of shield door 11,358 β	
A0100 (Room 175 Front side of cave)			Above false ceiling 28.3 α	
A0100 (Room 175 Back side of cave)	• Top of transfer table 22,078 • Cave floor 133,388 • Cave Structure 15,922 • Vent duct 5,853 • Cave Wall 7,374 • Shield door tracks 7,170			
A0100 (Room 180)	• Floor near MINITEC tank pit 6,134		MINITEC tank pit floor 24,264 β	Minitec tank pit floor 141 μR/hr

Survey Package (Area)	Direct Beta Activity (β/γ dpm/100 cm^2)	Direct Alpha Activity (α dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	Exposure Rates (μR/hr)
	• MINITEC tank pit floor 2,899,134 • Capped pipe in shallow pit 12,907			
A0100 (Room 181)	Counter/Sink area 36,824			Inside Minitec cave about 10 mR/hr on filling machine
A0200 (Stack)		Stack wall 20.4	Stack wall 28.4 α	
A0400 (B-83 tanks)	Motor Operated Valve 7,293	Floor in pit 24.8	Upper pit wall 42.6 α	
A0500* (Room 146)	Work bench drawer 12,905			
A0500* (Room 147)	Fume hood 5,455			
A0500* (Room 151)	• Fume hood 45,515 • Fume hood 41,092 • Fume hood 14,980 • Fume Hood 111,510	Fume Hood 28.3	• Fume hood 14,980 β • Fume hood 57,630 β	
A0500* (Room 152)		False ceiling 20.2		
A0700 (Room 142)	Floor area up to 307,757		• Floor up to 257,129 β • Floor up to 23 α	
A0700 (Room 143)	Floor area up to 9,915		• Floor area up to 32.9 α • Pass-thru 32.9 α	
A0700 (Room 154 Hall)			Ceiling 28.0 α	
A0700 (Room 156)			• Floor 37.7 α • Equipment 28.0 α	
A0700			Structure 23.0 α	

Survey Package (Area)	Direct Beta Activity (β/γ dpm/100 cm^2)	Direct Alpha Activity (α dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	Exposure Rates (μR/hr)
(Room 163C)				
A0700 (Room 164)	Stall 24,776			
A0700 (Room 165)			Sink/Counter 37.7 α	
A0700 (Room 168)			Equipment 23.2 α	
A0700 (Room 170)	• Counter/Sink Area 37,899 • Fume hood 260,861	Fume hood 6,935	• Counter/Sink Area 27.9 α • Floor 37.7 α • Pass-thru 42.6 α	
A0800 (Room 179 Hall)			Ceiling 23.2 α	
A0800 (Room 182)			Wall 23.4 α	
A0800 (Room 190)	• Floor under hood 11,642 • Fume hood 621,177 • Glove box 181,890		• Glove Box 19,348 β • Fume hood 15,296 β	
A0800 (Room 204)			• Floor 28.0 α • Equip/Table 32.9 α	
A0800 (Room 206A)			Floor 37.7 α	
A0800 (Room 208)			Floor 23.2 α	
A0800 (Room 209)			• False Ceiling 23.4 α • Equipment 23.2 α	
A0810 (Second floor vent systems area)			Floor 24.1 α	

Survey Package (Area)	Direct Beta Activity (β/γ dpm/100 cm^2)	Direct Alpha Activity (α dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	Exposure Rates (μR/hr)
A0900 (B-122 Interior)			Room 219 Floor 24.1 α	
A1000 (North Shipping areas)		Room 214 vent 40.5	• Room 214 Floor 23.4 α • Room 214 Ceiling 23.4 α • Room 216 Ceiling 23.4 α	
A1100 (South office areas)		Electrical Room Wall 20.6		
A1200 (B-124 Exterior)		• Roof up to 195.4 • Wall 28.5	• Wall 24.1 α • Roof up to 29.1 α	
C0100 (Vent Systems)	• EFC5 7,920 • EFC9 13,894 • EFC8 7,142	• Intake grill 49.3 • EFG3 24.1	• RGB-1 (#6) 24.1 α • FH10 (#35) 24.1 α • GB-9 (#53) 24.1 α	
C0200 (Drain Systems)	• Cave Drain Room 172 199,065 • Cave Drain Room 174 158,707 • Cave Drain Room 175 5,583 • MINITEC Tank Pit Drain 55,587		• MINITEC Tank Pit Drain 36,812 β • Room 163 Men's Shower Area Drain 27.9 α • Room 204 Drain 23.0 α • Room 206 Drain 23.0 α	
E0200 (Building exterior open land areas)				Asphalt area outside of manipulator repair shop 26 μR/hr

* Some equipment was decontaminated and removed from the site after the characterization surveys were performed and prior to the decommissioning. Those items are not listed in this table.

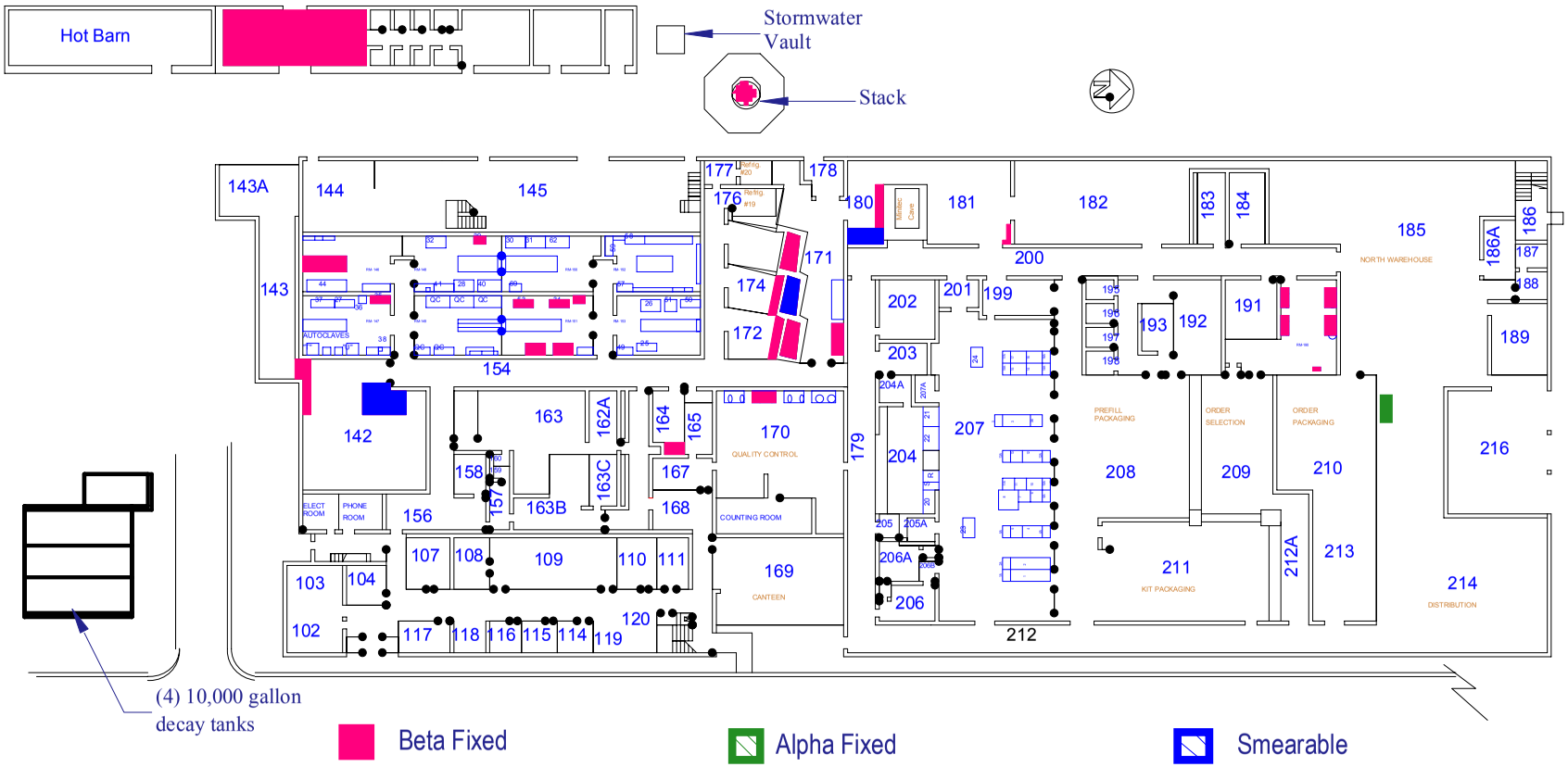


Figure 2-5: BMS Building 124 First Floor Area
(In Color)

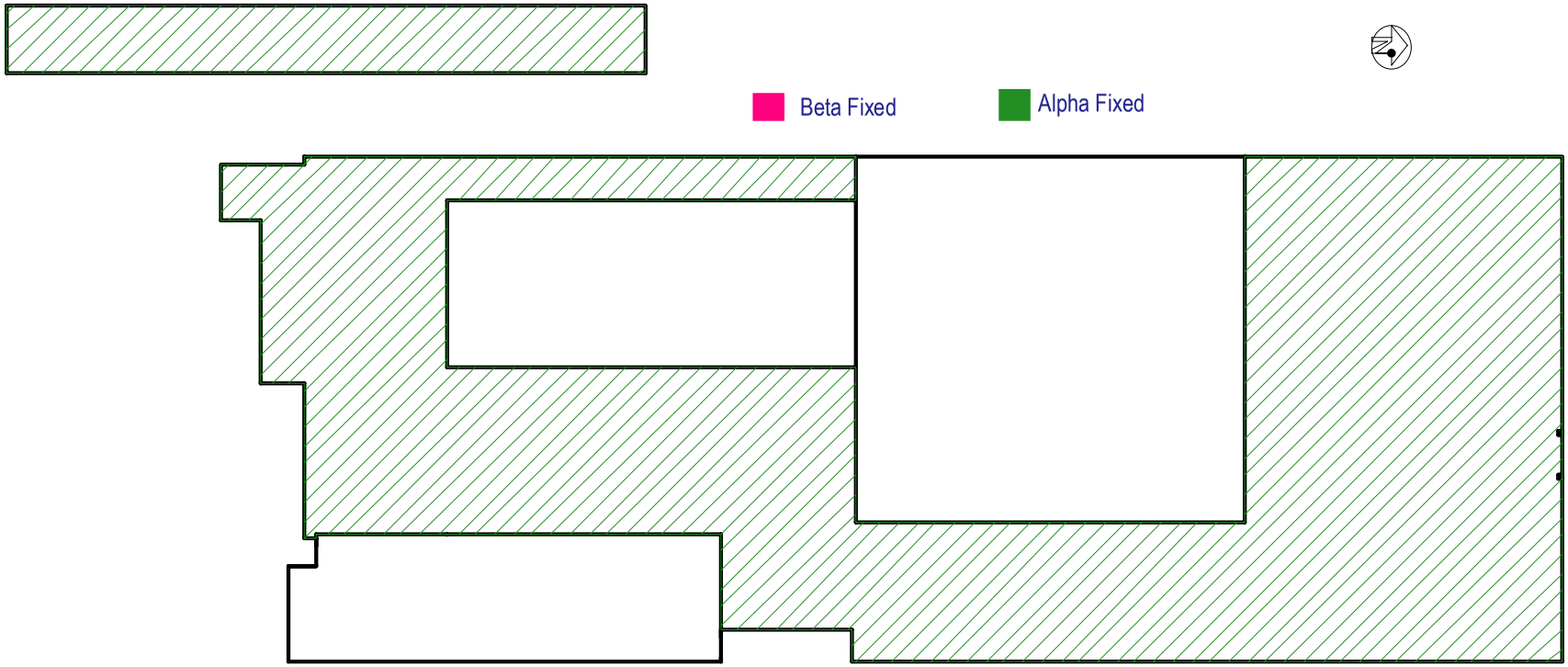


Figure 2-6: BMS Buildings 122 and Building 124 Roof Areas
(In Color)

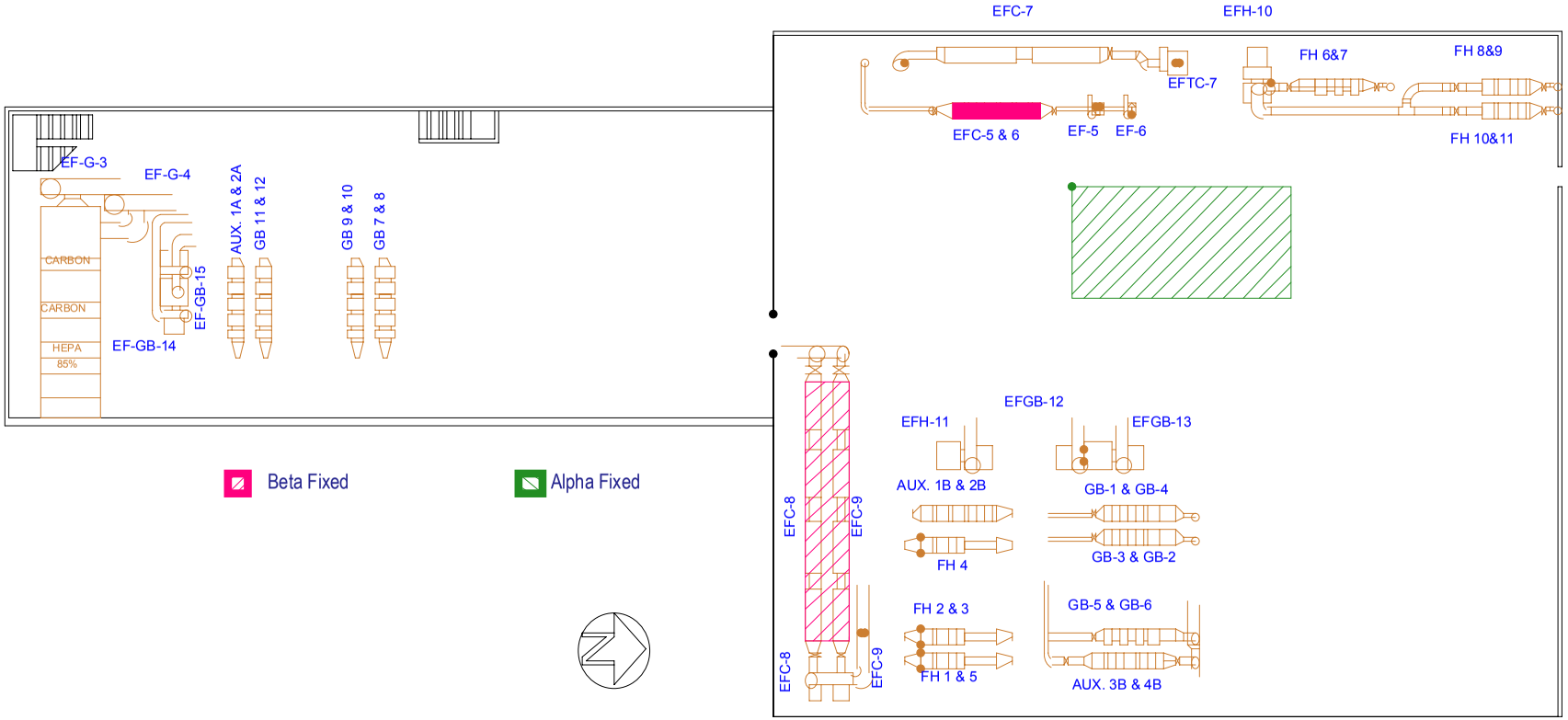


Figure 2-7: BMS Buildings 124 Second Floor Ventilation Area
(In Color)

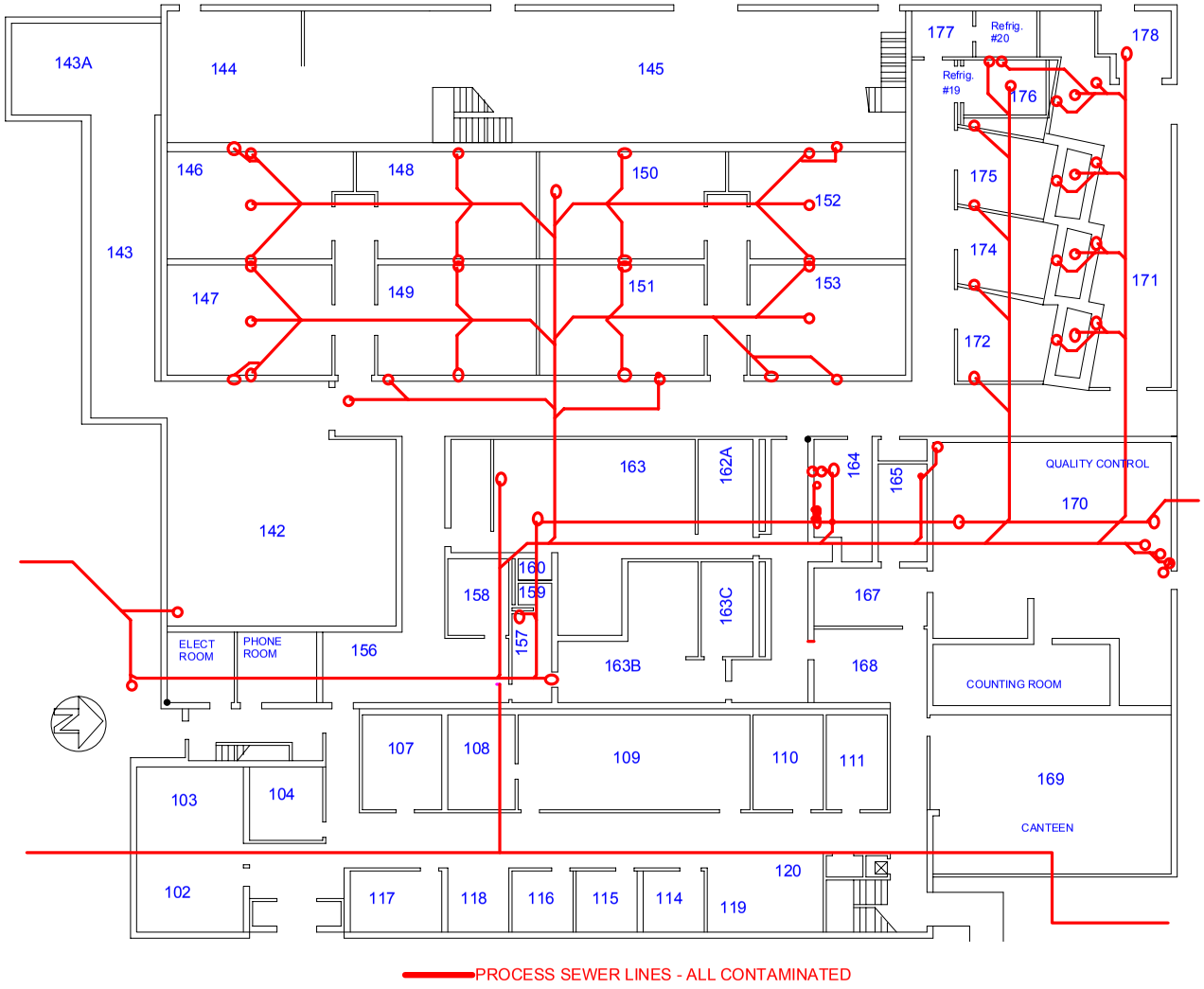


Figure 2-8: Building 124 South End Process Drain Area
(In Color)

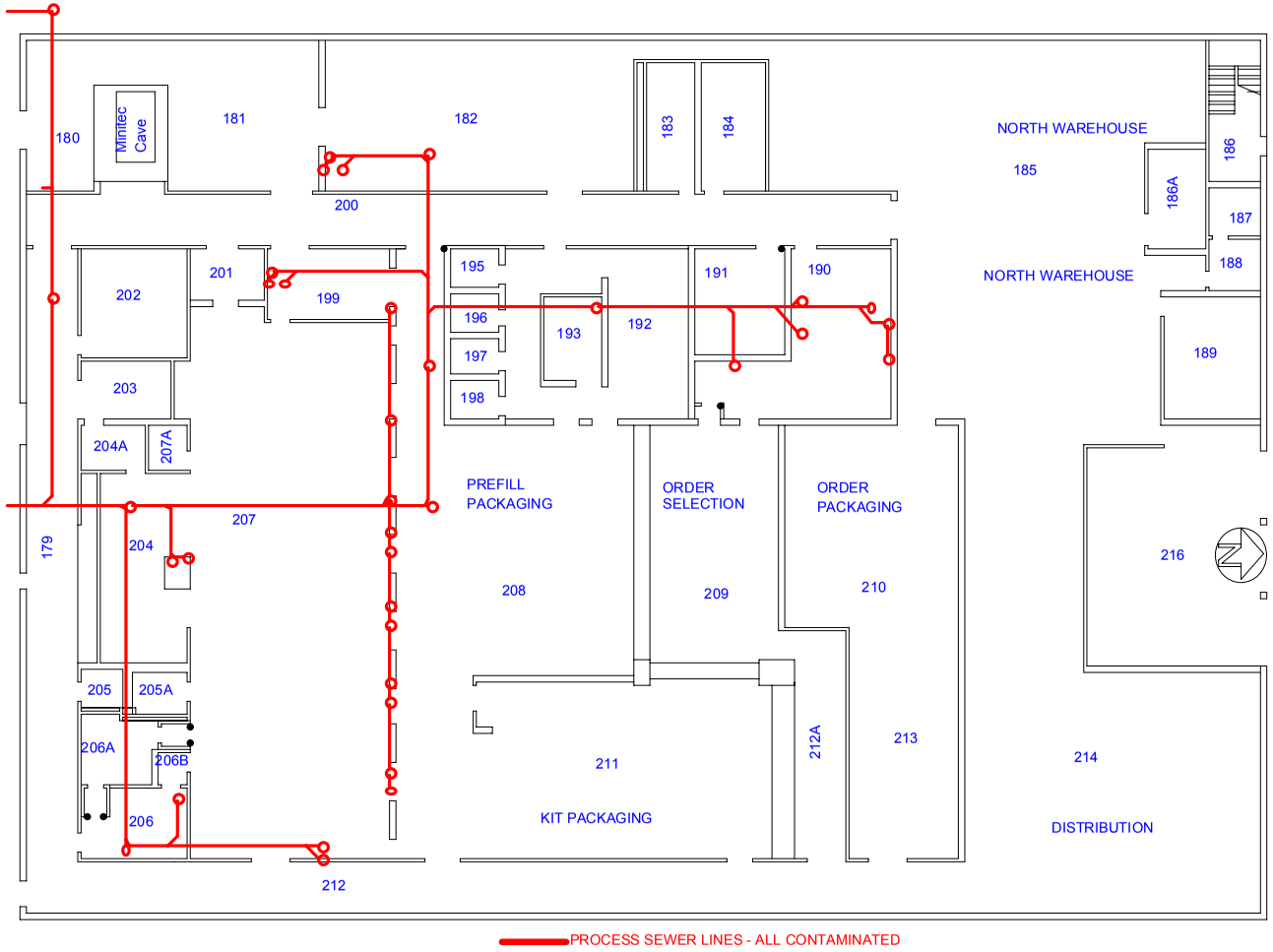


Figure 2-9: Building 124 North End Process Drain Area

(In Color)

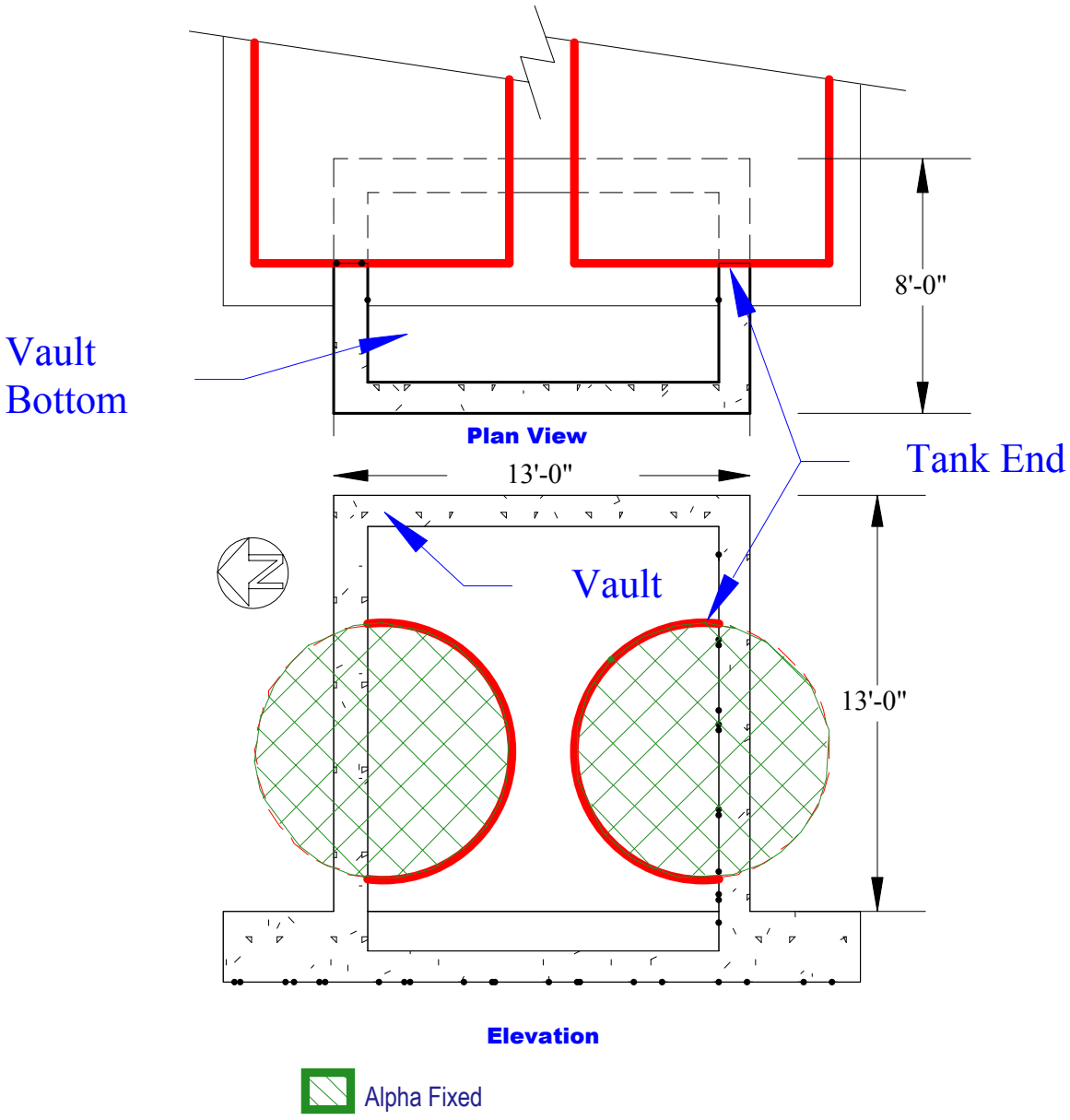


Figure 2-10: BMS Building 83 Decay Tank Area
(In Color)

REFERENCES FOR SECTION 2

2-1 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, August 2000.

3.0 REMEDIAL ACTION SURVEYS

The purpose of the remedial action survey was to 1) support remediation activities, 2) determine when a site or survey unit is ready for the final status survey, and 3) provide updated estimates of site-specific parameters to use for planning the final status survey.

The remedial action support surveys served to monitor the effectiveness of the decontamination efforts that were used to reduce residual radioactivity to acceptable levels. These surveys were used to guide the cleanup in a real-time mode. The remedial action support surveys typically relied on beta surface scans followed by direct beta measurements.

Note these surveys were not used to provide information to be used to demonstrate compliance with the DCGLs; they were but an interim step in the compliance demonstration process. Areas that were determined to satisfy the DCGLs on the basis of the remedial action support survey were later surveyed in detail during the final status survey.

3.1 Instrumentation and Investigation Levels Utilized

Survey instrumentation and techniques were selected based on the detection capabilities for the known and suspected contaminants and DCGLs to be achieved. The same instrumentation was used for the characterization and for the final the status survey.

An investigation level (the level below which there is an acceptable level of assurance that the established DCGLs have been attained) of 25% of the established DCGL was used for surface and soil measurements. The radionuclide with the lowest surface activity limit was Co-60 with a NRC screening level of 7,100 dpm/100 cm^2. A survey investigation level equivalent to 1,775 dpm/100 cm^2 was utilized for the remedial action surveys.

3.2 Overview of Remedial Action Survey Results

The contamination at this facility was primarily contained within equipment (gloveboxes and hoods), process ventilation systems and ducts, process drains, process drain tanks and the process vent stack. These items were all removed during the decommissioning.

The major D&D activities that took place on site included the following:

- Removal of the four underground Building 124 (B-124) 10,000 gallon waste decay tanks and associated piping and valves and the concrete vault
- Removal of the two underground B-83 8,000 gallon waste tanks and associated piping and valves and the concrete vault and pad
- Removal of the B-124 vent stack
- Removal of the major portion of the B-124 exhaust ventilation ducting and HEPA and charcoal filters and filter housings
- Removal of laboratory cabinets, countertops, and fume hoods
- Removal of all process and sewer drain lines
- Decontamination and partial removal of hot cells

The most common type of survey performed at this facility was a surface scan performed after equipment was removed to verify that contamination was not spread during the equipment removal process. The surveys found that removal of equipment did not result in the spread of contamination.

There were several areas of the facility where decontamination of surfaces was required. In these areas routine remedial action surveys were performed during the decontamination process. These areas included the three Iodine Caves (hot cells), the MINITEC Cave (hot cell), the tank and valve pit associated with the MINITEC Cave, and a few places on the floors in Building 124 and Building 122.

3.2.1 Building Floor Remediation & Survey

The building concrete floor surfaces were decontaminated by grinding the concrete surfaces to remove a thin contaminated concrete layer. Remedial action surveys were performed to verify that the decontamination process was completed satisfactorily. The areas remediated included:

- South warehouse (Room 142), a one-foot square area on the floor against the west wall
- Maintenance shop (Room 143), a one square foot area on the floor against the south wall
- Hallway 200, a two square foot area on the floor against the south wall
- Building 122 Room 221, a two square foot area on the floor
- Building 122 Hot Barn, a two square foot area on the floor

3.2.2 MINITEC Cave Remediation & Survey

The cave was constructed with a concrete floor slab over a three-foot tall basement area. There were also pipe running in a chase from the basement to the tank and valve pit. In addition in the upper part of the cave there two were vent passages built into the cave concrete walls.

The cave equipment, shield doors and windows were removed then the upper MINITEC Cave walls and ceiling were wiped down to decontaminate them. The cave concrete floor was completely removed. There were drain holes drilled through cave floor that allowed contamination into the basement area that was too deep to be removed by grinding. Portions of the floor and lower walls were removed to a depth of about 4-inches using electric chipping hammers. Remedial action surveys were performed to verify that the decontamination process. There were two areas of the cave that could not be decontaminated. These were the pipe chase running from the basement to the tank and valve pit, and the two vent pipes built into the cave concrete walls. These areas were decontaminated as much as possible and then grouted in place to immobilize any contamination. These grouted pipes were removed and shipped offsite for disposal.

3.2.3 MINITEC Cave Tank and Valve Pit

The tank and valve pit were of bare concrete construction. The floor and walls were decontaminated by removing concrete to a depth of about 4-inches using electric chipping hammers. Remedial action surveys were performed to verify that the decontaminate process was completed satisfactorily. After the remediation it was noted that groundwater penetrated into tank pit when rainwater raised the local water table. At other times the pit was dry. The water in the pit was sampled, analyzed and released to the sanitary sewer using the standard BMS water release protocols. There was no evidence of residual activity in the pit or in the water leaking into the pit.

3.2.4 Iodine Caves

The cave equipment, shield doors and windows were removed then the upper iodine cave walls and ceiling were wiped down to decontaminate them. There were “S” shaped tubes that passed through the south wall of each cave. Some of these tubes were contaminated and were partially removed in order to decontaminate the area. Portions of the stainless panel window surround were removed in order to decontaminate the area. There were process drains in the floor of each cave and in the floor just south of each cave wall that were removed as part of the process drain pipe removal. There were also ventilation ducts through the floor of each cave that were removed during the decontamination of the caves. As a result of the drain and vent duct remediation, most of the floor in each cave was removed. In addition portions of the floor and lower walls were further decontaminated using electric chipping hammers. However in the most eastern Iodine Cave there was still contamination at the lower edge of the east wall and into the floor at the juncture of the wall and ceiling. There was also some contamination under the support column for the cave Bi-Part door area. This required additional concrete removal at the juncture of the south cave wall and the floor and under the cave Bi-Part support column. There was a structural concern that the concrete removal in these areas would weaken the support for the upper cave structure to the point where it would not be safe. It was decided to install additional structural support before

completing the remediation in these areas. The floor was decontaminated, the floor was surveyed where the support columns were to be installed and a concrete footer was poured for the support columns. These two areas were then remediated and remedial action surveys were performed to verify that the decontamination process was completed satisfactorily.

3.2.5 Building 124 Room 150 & 152 Process Pipe Removal

During the removal of the process drain pipes in Building 124 Rooms 150 and 152 it was discovered that the drain piping had deteriorated and liquids had leaked into the soil below the floor slab in these rooms. The soils were surveyed during the pipe removal and elevated activity was found in the soil. Soil samples at the most contaminated location (Survey Point #11) were taken and analyzed by gamma spectroscopy confirmed the elevated activity levels. Cesium 137 and Co-60 activity levels were in excess of the soil screening values. These results are presented in Table 3-1.

Table 3-1: Room 150 Soil Activity at Survey Point #11

Sample Depth* (inches)	Co-60 Activity (pCi/g)	Cs-137 Activity (pCi/g)
0-6"	2.8	34
6-9"	3.5	56
9-12"	3.9	54
12-15"	6.8	37
15-18"	5.1	22
18-21"	2.7	12
21-24"	2.4	7.1
24-27"	1.4	9
27-30"	0.7	2.4

* Depth measured from soil surface after drain pipe removed (this is depth below the bottom of drain pipe).

A characterization plan for the soils in this area was then prepared (Ref. 3-1); and characterization soil samples were taken and analyzed. These samples established that the activity that leaked from these pipes did not migrate beyond the immediate vicinity of the deteriorated pipes. The sample locations are presented in Figure 3-1. There were 10 sample locations in the initial plan plus one liquid sample location (point # 11). Two additional sample locations were added close to point #11, which was the location with the highest soil activity. The results from these additional characterization samples are presented in Figure 3-2 and Figure 3-3.

The water sample from point #11was analyzed for radionuclide information only, as the gamma spec instrument used was calibrated for soils only, not water. The activity indicated by this analysis was 0.296 pCi/g Co-60 and 0.292 pCi/g Cs-137. The sample most likely included some suspended solids, as it was not filtered through a submicron filter.

The contaminated soil was removed as part of the decommissioning. During the remediation, remedial action surveys of these soils were performed to guide the remediation.

Soil was removed to a depth estimated to be sufficient to remove the contaminated soil then Micro-R measurements were taken and the remaining soil was sampled for field screening analysis. The analytical results from this sampling provided the required remediation guidance in a timely manner. The field screening results were shown to be accurate when an NJDEP certified laboratory analyzed the final survey sample results and confirmed that the soil remediation was adequate.

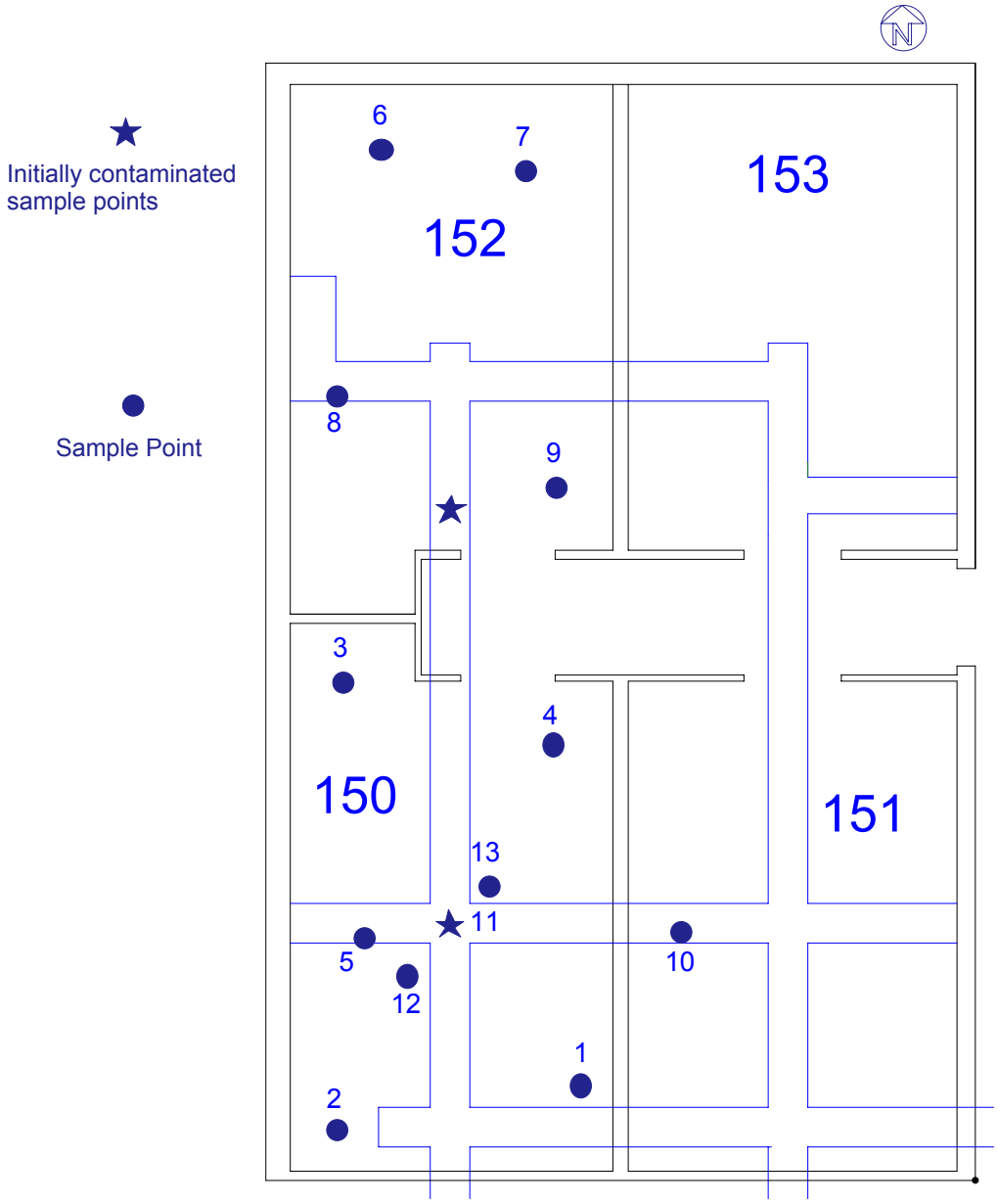


Figure 3-1: Room 150 & 152 Soil Characterization Sample Locations

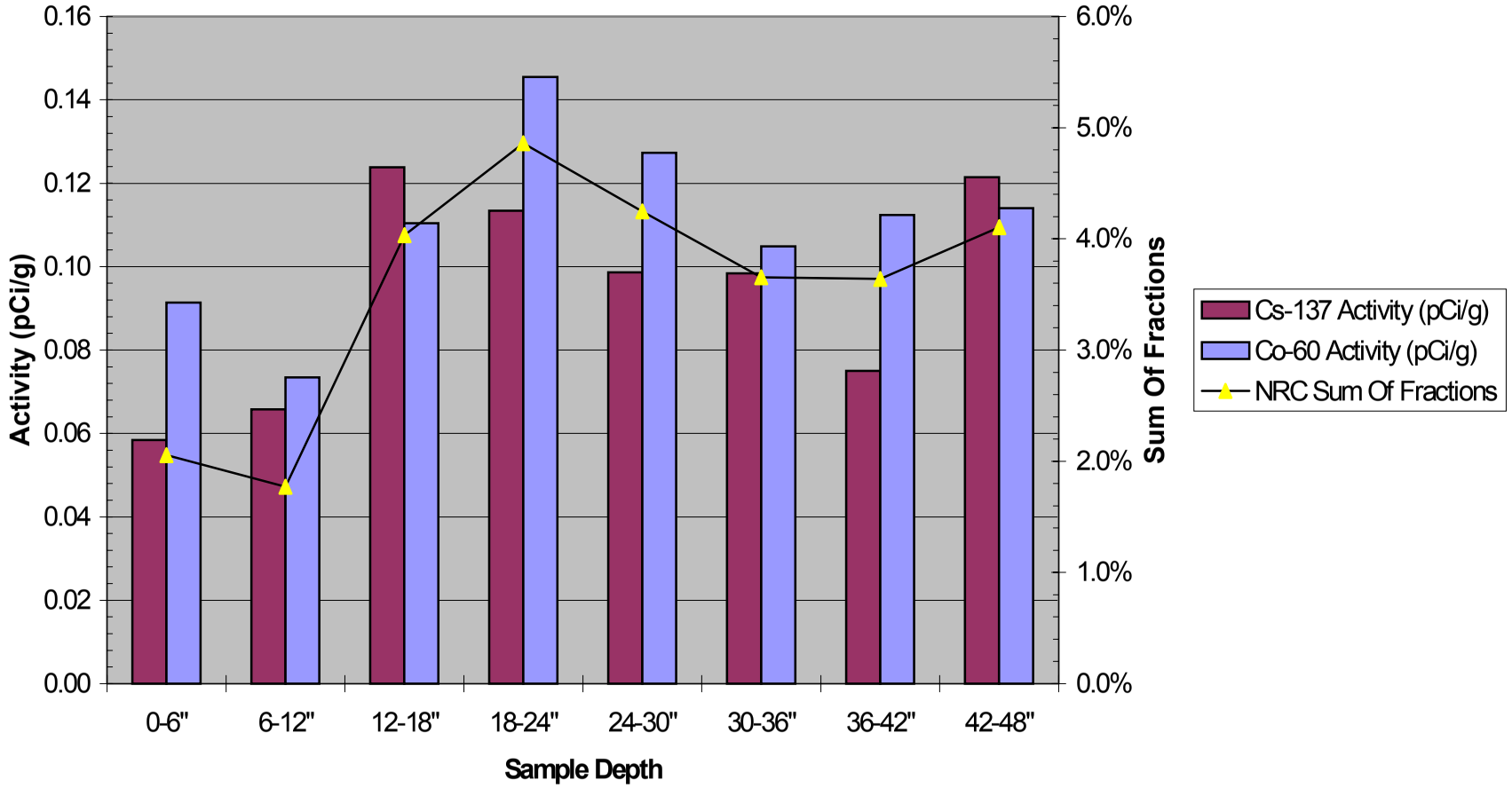


Figure 3-2:Characterization Averaged Soil Sample Results 1 to 10 in Rooms 150 & 152

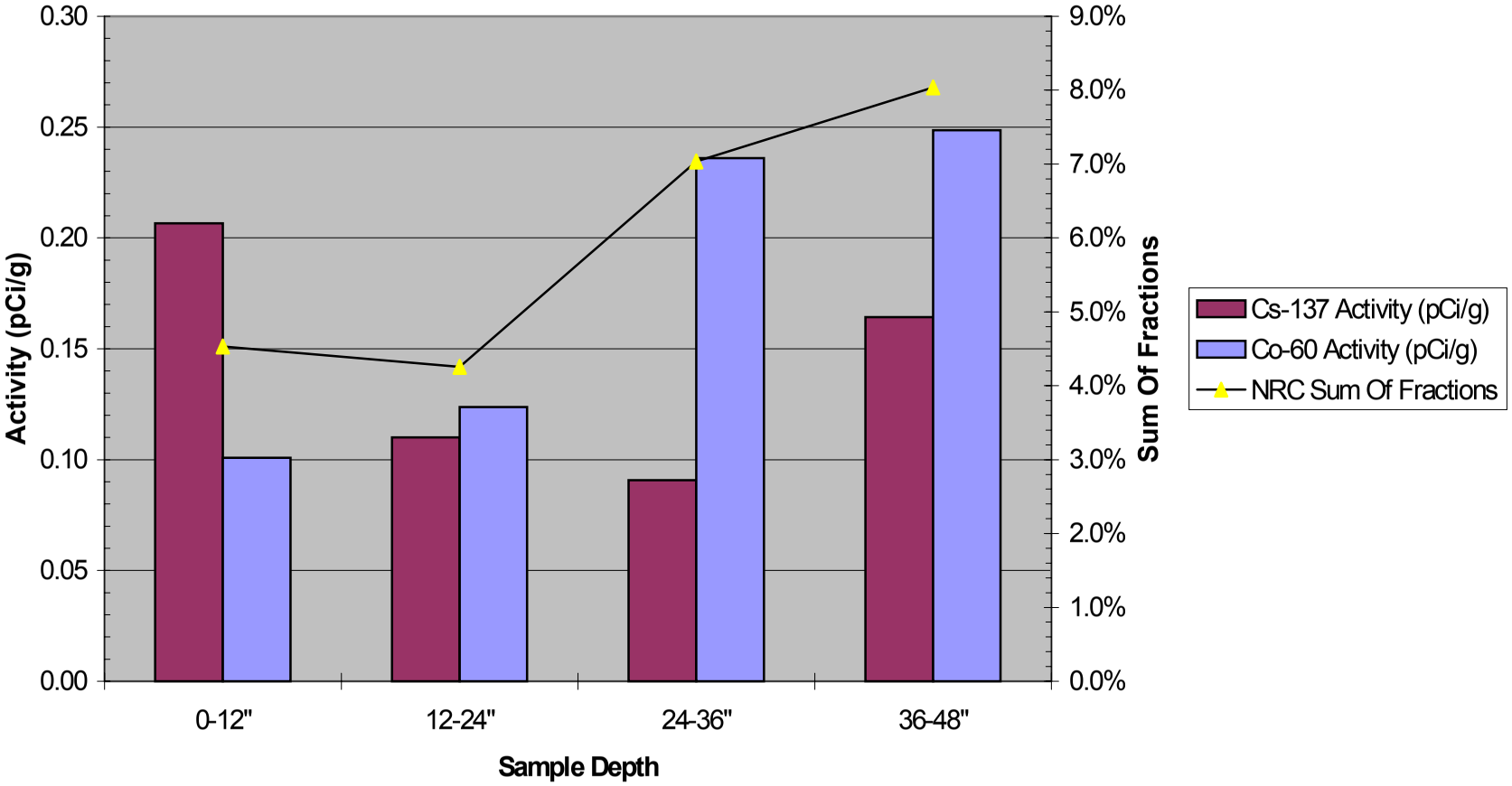


Figure 3-3: Characterization Averaged Soil Sample Results 12 & 13 in Rooms 150 & 152

3.2.6 Additional Radionuclides of Concern

During the decommissioning process some radionuclides not previously noted were found during the performance of the remedial action surveys. The MINITEC cave was used for the last several years in producing products containing Sr-82 (25.4 day half-life). A smear exhibiting a surface activity of about 50,000 dpm was from the process equipment in this cave was analyzed by gamma spectroscopy in the field lab. This analysis indicated the presence of Zr-88 (83.4 day half-life) and Y-88 (106.6 day half-life). These two radionuclides are impurities generated by the spallation production of Sr-82. Sr-85 (64.84 day half-life) is also produced along with Sr-82 at a Sr-85/Sr-82 ratio of about 3/2. Figure 3-4 shows the typical radionuclides produced and production ratios for the Sr-82 spallation production process (Ref. 3-2).

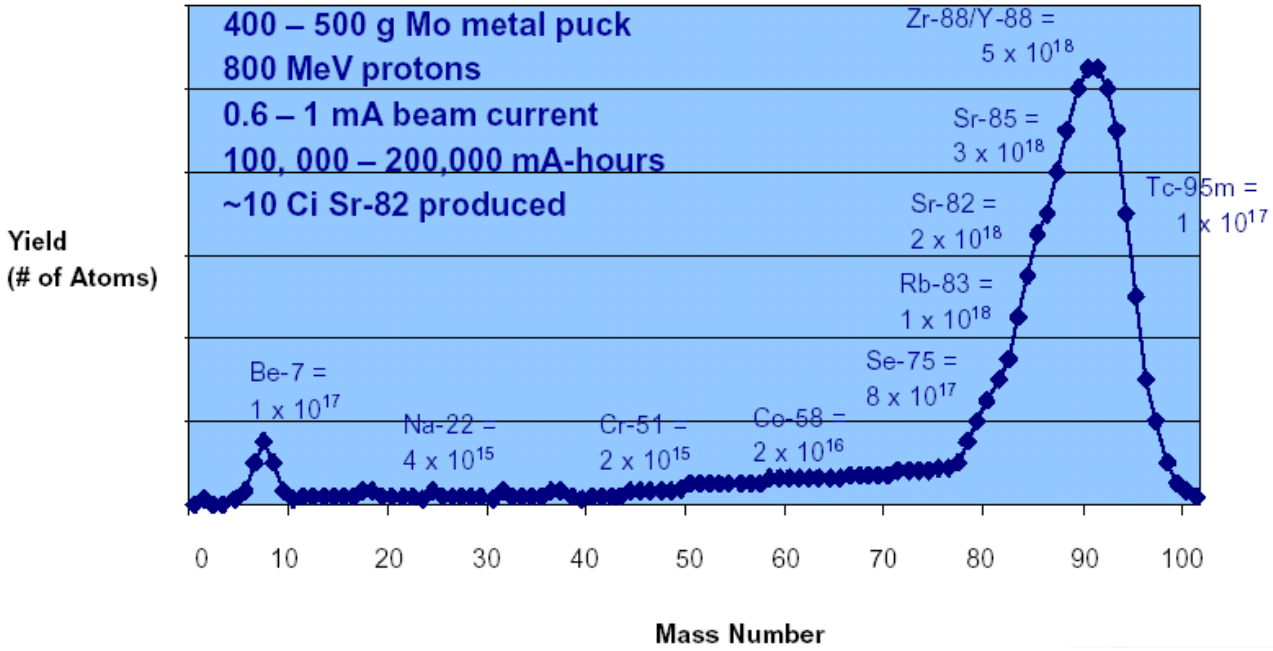
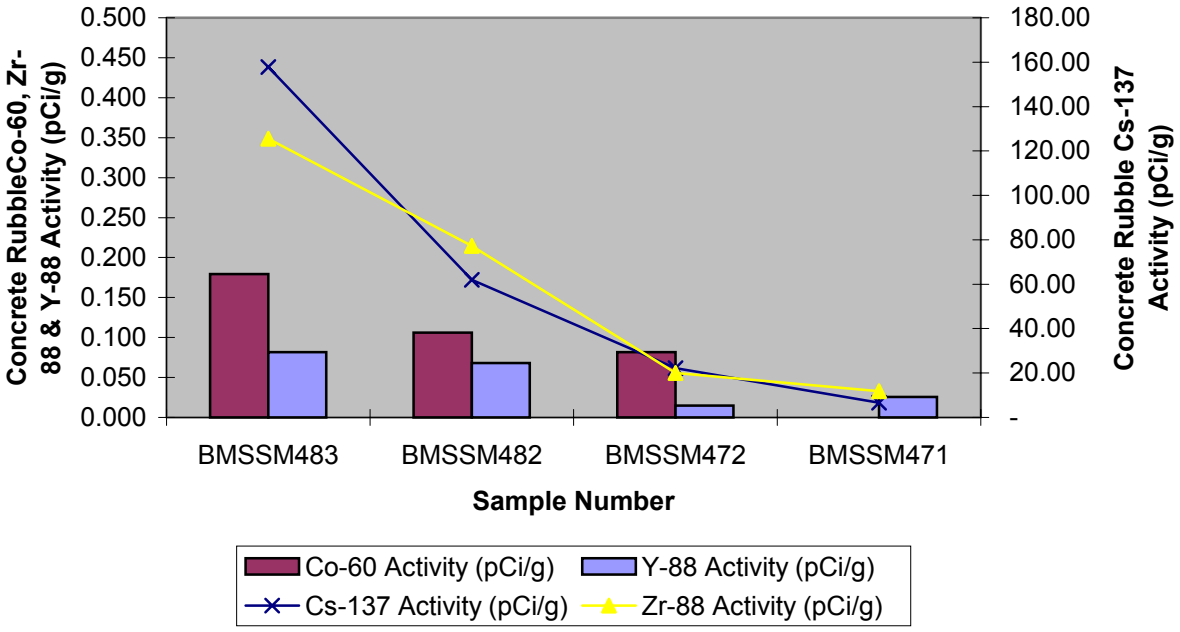


Figure 3-4: Spallation Production of Sr-82

After remediation of the MINITEC cave no traces of Zr-88 or Y-88 were found, including the slightly contaminated concrete rubble. Samples of removed concrete were analyzed using the field laboratory gamma spec instrument. The sample results were for isotopic distribution information only as the samples were not prepared to fit into the maranelli beakers for which the gamma spec system was calibrated. The results do indicate that Zr-88 and Y-88 were not present in the concrete rubble. The concrete remaining in the cave would in general have much lower activity levels than those indicated in this table. These results seem to indicate that if any short lived radionuclides penetrated the concrete, they have already decayed away and that there has been no recent penetration of short lived radionuclides into the concrete. A summary of these results is presented in Figure 3-5. Note that the Y-88 and Zr-88 activities reported are all less than MDA values.



Y-88 and Zr-88 activity levels are less than MDA

Figure 3-5: MINITEC Cave Concrete Rubble Activity

REFERENCES FOR SECTION 3

3-1 PL-BMS-004, Rev. 0, *Building 124 Soil Characterization Plan for Bristol-Myers Squibb, New Brunswick, New Jersey*, February 2003.

3-2 *Radioisotope Production at Los Alamos National Laboratory*, a paper by Dennis R. Phillips presented at Specialization School on Health Physics Universita degli Studi di Milano, March 21, 2002.

4.0 RELEASE CRITERIA

The unrestricted release criteria given in 10 CFR 20 is a dose based standard where residual radioactivity, distinguishable from background radiation and resulting in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group will not exceed 25 mrem/y. Levels of residual radioactivity that correspond to the allowable radiation dose are calculated (derived) by analysis of various scenarios and pathways.

The release criteria used were the NRC Screening Values for Building Surface and Soil and DandD (Ref. 4-1) using default values equivalent to the 25 mrem/y. Reasonable efforts were made to remediate the facility below these levels.

The DCGLs for building surfaces and soils to be used were based on radionuclide specific screening values provided by the NRC in either the Federal Register (Ref. 4-2 and 4-3), or through calculations performed using the NRC's DandD Code, Version 2.1 (Ref. 4-1). The NRC screening values for ^{54}Mn, ^{57}Co, and ^{85}Sr were adjusted based on the NJDEP 15 mrem/year criteria, which is 60% of the 10CFR20 criteria. The DCGLs used for this survey are presented in Table 4-1 for building surfaces and Table 4-2 for soil.

For this project, a more conservative approach was taken that utilized the DCGL for the most restrictive radionuclide detected, ^{60}Co. The $DCGL_W$ for ^{60}Co was 7,100 dpm/100 cm2. The ^{60}Co $DCGL_W$ was utilized for all areas.

Table 4-1: BMS Screening Values for Building Surfaces

Radionuclide	Source	dpm/100 cm^2
^{3}H	Federal Register	120,000,000
^{14}C	Federal Register	2,900,000
^{22}Na	Federal Register	9,500
^{54}Mn	Federal Register	32,000
^{57}Co	Federal Register	210,000
^{60}Co	Federal Register	7,100
^{85}Sr	Federal Register	140,000
^{88}Zr	Estimated*	10,000
^{88}Y	Estimated*	10,000
^{99}Tc	Federal Register	1,000,000
^{137}Cs	Federal Register	28,000

Table 4-2: BMS Screening Values for Soil

Radionuclide	Source	Soil pCi/g
^{3}H	Federal Register	110
^{14}C	Federal Register	12
^{22}Na	Federal Register	4.3
^{54}Mn	60 % of Federal Register	9.0
^{57}Co	60 % of Federal Register	90
^{60}Co	Federal Register	3.8
^{85}Sr	60 % of Federal Register	16
^{88}Zr	Estimated*	4
^{88}Y	Estimated*	4
^{99}Tc	Federal Register	19
^{137}Cs	Federal Register	11

*Surface limit conservatively estimated based upon half life and inhalation ALI, soil limit estimated based upon half life and ingestion ALI.

REFERENCES FOR SECTION 4

4-1 NRC screening computer code *DandD* Version 2.1.0
4-2 NRC, 63 FR 64132, *Table 1-Acceptable License Termination Screening Values of Common Radionuclides for Building Surface Contamination*, Nov. 18, 1998.
4-3 NRC, 64 FR 68395, *Table 3-Interim Screening Values (pCi/g) of Common Radionuclides for Soil Surface Contamination Levels*, December 7, 1999

5.0 FINAL STATUS SURVEY DESIGN

The basis for the design of the final status survey is the MARSSIM. The specific elements of the MARSSIM survey process are discussed in subsequent sections of this plan. The overall goal of the FSS design was to ensure surveys were planned and conducted in such a manner that ensured the proper decisions were made as to whether or not to accept or reject the null hypothesis (Null hypothesis, H_0: residual radioactivity in the survey unit exceeds the release criterion). The COMPASS computer code (Ref. 5-1) was used as part of the survey planning process. Individual survey packages were prepared for each survey unit. Survey data obtained from FSS units were maintained with the survey packages. Some survey units received their final status survey prior to the completion of all D&D activities. Due to the extremely low source term at the facility, minimal access controls were required for areas surveyed prior to the completion of all D&D work. Also, some survey units had the final status survey performed prior to the approval of the FSS Plan. The FSS packages were reviewed after approval of this FSS plan to ensure all requirements were met.

The major inputs into the FSS planning process were the development of Data Quality Objectives (DQOs) (see section 5.4), the designation of survey area classifications and units within each survey area (see section 5.5), the review of contaminants and establishment of Derived Concentration Guideline Levels (DCGL) (see section 5.3), and the selection of appropriate survey instrumentation (see section 5.7).

The survey design identified relevant components of the FSS process and established the assumptions, methods, and performance criteria to be used. Areas ready for FSS were classified as Class 1, Class 2 or Class 3 and divided into survey units. Systematic scan and static measurements were prescribed according to a pattern and frequency established for each classification. Investigation levels were established which, if exceeded, initiated an investigation of the survey data. Measurements from a survey unit that exceeded the investigation level were marked and investigated and the level of the residual radioactivity present was determined. Such survey units were remediated, re-surveyed and on one occasion re-classified. The survey design is summarized in Table 5-1.

The application of survey design criteria to structures and land areas varied based on the type of survey media and the relative potential for elevated residual radioactivity.

The NRC's COMPASS computer code was used in the survey design process. The data input used for COMPASS was maintained in each survey package.

In order to support the final status surveys, the facility was cleared of all loose equipment and materials to the maximum extent practicable. Surveys were then performed as described in the following sections.

Table 5-1: Survey Design Summary

Specification	Class 1		Class 2		Class 3	
	Structures	Land Areas	Structures	Land Areas	Structures	Land Areas
SURVEY UNITS						
Size Range=>	10 to 100 m^2	100 to 2,000 m^2	10 to 1,000 m^2	100 to 10,000 m^2	No Limit	No Limit
Reference Coordinate Grid=>	1 to 2 m	10 to 20 m	1 to 2 m	10 to 20 m	5 to 10 m	20 to 50 m
SCAN MEASUREMENTS						
Scan Coverage=>	100%		10 to 100[a]%		0 to 10 %	
Scan Area Selection=>	Accessible surface areas		Judgmental; systematic along transects or of randomly selected grids		Judgmental; random	

STATIC MEASUREMENTS						
Number of Measurements	Calculated using the MARSSIM methodology and COMPASS computer code.					
Location Selection=>	Random starting point, systematic spacing				Random	
Spacing (L)=>	$L = (A/(0.866*N))^{1/2}$ $L = (A/N)^{1/2}$ for square grid A = total survey unit area; N = # of measurements				N/A	
Type of Survey[b]=>	SC	SO	SC	SO	SC	SO

5.1 Use of COMPASS

The COMPASS computer program (Ref. 5-1) is a program developed by the Oak Ridge Institute for Science and Education (ORISE) to assist in the development of MARSSIM survey packages and the assessment of final status survey data. This section generally describes the use of the COMPASS program and provides information as to the expected sources of inputs to COMPASS and the documentation to be included in survey packages describing these inputs. It assumes the Site Wizard function has already been run. The Site Wizard establishes the list of potential contaminants and their screening DCGLs for surface soil and building surfaces. A unique name was given to the site in COMPASS and once established, it could not be edited or revised. When a revision was necessary, the Site Wizard was run again and a new name assigned to the site.

The COMPASS program has four basic routines. The first two routines address survey package development for surface soil and building surfaces. The second two address survey data assessment for surface soil and building assessment.

5.1.1 Develop Data Quality Objectives for Surface Soil Assessment

(a) The Bristol-Myers Squibb site was selected.

(b) On the Survey Unit Details entry form, a unique name for the survey unit was entered in the Survey Unit Description entry form. The name assigned was the same as assigned to the survey package.
NOTE: If it was necessary to revise any of the information entered for a survey unit after the COMPASS run has been completed, a new name was designated that contained the original name with a sequential revision number assigned.

(c) On the next entry form the survey unit area in square meters and the Survey Class were entered.

(d) In the third entry form, labeled Comments, a brief description of the survey unit was entered such as, B-124 Outside Areas, Soil Samples.

(e) The next entry form provided a list of the potential contaminants for the site and their screening DCGLs. ^{137}Cs was selected (^{54}Mn was detected in a small percentage of characterization samples and could also have been selected. These were the only two non-naturally occurring isotopes detected during the characterization survey in the soil samples taken in the area around Building 124 and the Building 83 tanks).

(f) The next entry form lists the contaminants listed above. ^{137}Cs and ^{54}Mn were then designated as being measured directly.

(g) The next entry form requests estimated mean specific activity and standard deviation for each of the contaminants in the survey area and the reference area. No data entries were made in the sections for the reference area. The estimated mean specific activity and standard deviation of each contaminant in the survey area were calculated from characterization survey data and entered on this form.

(h) The next entry form requests the Lower Boundary of the Gray Region (LBGR) acceptable Alpha (type I) and Beta (type II) error rate. Per MARSSIM, section 8.3.3, if the estimated standard deviation, σ, is much smaller than the $DCGL_W$, the lower bound of the gray region (LBGR) should be set so that the relative shift, Δ/σ, is about 3. For other survey units the LBGR was set to be about 50% of the $DCGL_W$. The Alpha and Beta errors were both entered as 0.05.

(j) COMPASS then calculated the sample size and generated a power curve. The COMPASS results, which includes input values, were printed and included in the survey package.

5.1.2 Develop Data Quality Objectives for Building Surface Assessment

(a) On the first data entry form the Bristol-Myers Squibb site was selected.

(b) On the second entry form ^{60}Co was selected from the potential contaminants list for the site (see section 5.3.1).

(c) On the next entry form the Sign Test was then selected as the statistical test to be utilized.

(d) On the Survey Unit Details entry form, a unique name for the survey unit was entered in the Survey Unit Description entry form including a brief description of the survey unit such as "B-124 Room 146 Walls and Ceilings". Next the survey unit area in square meters and the Survey Class were entered.
NOTE: If it was necessary to revise any of the information entered for a survey unit after the COMPASS run has been completed, a new name was designated that contained the original name with a sequential revision number assigned.

(e) The material to be surveyed was also selected on this data entry form. If the material to be surveyed was not present in the list, it was entered in the New Material field. The material information was then selected and moved to the Background Material field from the list of previous entries.

(e) On the next data entry form the survey instrument to be used was selected from the list of instruments. If the instrument to be used was not on the list it was entered using the "Add Type" button entering the data for the new instrument. The 2π instrument efficiency was entered on this form. This can be assumed to be twice the efficiency posted on the instrument (as it is normally the 4π efficiency that is posted on the instrument). The value entered was in the range of 0.4-0.5 for beta detection using the Ludlum Model 2350 with a 43-68 probe.

(f) The Surface Efficiency was also entered on this entry form and the save button pressed. Typically for floors and other smooth surfaces, this value is 0.5. For concrete and other rough uneven surfaces, this value is 0.25. Clicking the ISO-7503 button gives some guidance on the use of surface efficiency values.

(g) On the next form the Count Time was entered, this was one minute for beta detection using the Ludlum Model 2350 with a 43-68 probe. Then a background material is selected from the material list entered earlier. If the background material selected earlier was one of the previous entries, then the average background count rate, standard deviation, and minimum detectable concentration (MDC) is displayed. If a new material was entered earlier, background count rate information will have to be entered. Normally, background count rate information obtained on that material or a similar material during the characterization survey is entered. As each new background count rate for a material is entered, the display above it showing the average background count rate, standard deviation, and minimum detectable concentration (MDC) is updated.

(h) The Gross Survey Unit Mean activity in cpm with standard deviation are entered on this same form. These values were calculated using characterization survey data from the same area. COMPASS calculates the Sign Test Sigma value.

(i) The LBGR, acceptable Alpha (type I) and Beta (type II) error rate are entered on the next form. For the LBGR, a value approximately three standard deviations less than the anticipated mean specific activity is entered. For both the Alpha and Beta errors, 0.05 is entered.

(j) COMPASS will then calculate the sample size and generate a power curve. The COMPASS results were printed and included in the survey package.

(k) For Class 1 Areas additional calculations must be performed to determine if additional samples must be taken for Elevated measurements Comparisons (EMC). The remaining steps in this section are for EMC. On Tab 1 of the EMC form, the efficiency for scanning beta detection using the Ludlum Model 2350 with a 43-68 probe was entered.

(l) On Tab 2 of the EMC form, a true positive error rate of 95% was selected, a false positive error rate of 25% to 40% was selected, a 2-second observation interval was entered and the default surveyor efficiency of 0.5 was utilized. By selecting the third Tab of the EMC form, MARSSIM calculated if additional sampling would be required. No additional samples were required from any of the Class 1 areas.

5.1.3 Data Assessment for surface soil and building surfaces

The second two MARSSIM modules were not utilized because the measured results were all less than the $DCGL_W$. *If every measurement in the survey unit is below the $DCGL_W$, the survey unit clearly meets the release criterion* (MARSSIM section 8.2.2.1).

5.2 Identity of Contaminants

The radionuclides of concern identified at the facility were identified based on review of process history, interviews with current and former BMS personnel and previous survey data, including sample analyses. This process is documented in the HSA portion of the Characterization Report. The radionuclides used were primarily short-lived radionuclides but traces of longer-lived radionuclides present as trace impurities and the production of ^{137}Cs and ^{60}Co reference standards indicated that some longer-lived nuclides were potentially present. The radionuclides with long enough half-lives to be of concern are ^{3}H, ^{14}C, ^{22}Na ^{54}Mn, ^{57}Co, ^{60}Co, ^{75}Se, ^{85}Sr, ^{99}Tc, ^{129}I, ^{134}Cs and ^{137}Cs. The anticipated radionuclides along with approximate decay information are provided in Table 5-2 below.

Table 5-2: Radionuclide with Decay Information

		Major Radiations Energies (MeV) and intensities (%)				
Nuclide	**Half-life**	**Gamma (Mev)**	**Gamma (Mev)**	**Gamma (Mev)**	**Avg. Beta (Mev)**	**Max. Beta (Mev)**
^{3}H	12.28 yr	-	-	-	0.0057	0.0186
^{14}C	5730 yr	-	-	-	0.049	0.0156
^{22}Na	2.602 yr	0.511 (180%)	1.275 (100%)		0.215*	0.545*
^{54}Mn	312.7 d	0.835 (100%)	-	-	none	none
^{57}Co	270.9 d	0.014 (10%)	0.122 (86%)	0.136 (11%)	none	none
^{60}Co	5.271 yr	1.173 (100%)	1.332 (100%)	-	0.096	0.318
^{85}Sr	64.84 d	0.514 (100%)	-	-	None	none
^{99}Tc	$2.13x10^{5}$ yr	-	-	-	0.0846	0.293
^{137}Cs	30.17 yr	0.662 (89%)	-	-	0.174	1.173

*Na-22 decays by positron (β+) decay.

During the characterization survey, alpha activity was detected, almost always in the 20-40 dpm/100 cm^2 range. However, no alpha emitters were ever used at BMS or identified as impurities. Also, gamma isotopic analyses of building materials, soil, and other debris samples showed readily identifiable naturally occurring radioactive materials (NORM). In addition, as discussed below, a 10CFR61 analysis of valve pit sediment did not identify any alpha emitters. For these reasons it has been concluded that the alpha activity identified during the characterization survey is all from NORM and no surveys for alpha activity were conducted for the final status survey except for the tanks pits that were released using NRC Regulatory Guide 1.86 criteria.

Radionuclides identified during characterization from samples analyzed by onsite gamma spectrum analysis were ^{22}Na, ^{54}Mn, ^{57}Co, ^{60}Co, ^{85}Sr, ^{99}Tc, ^{134}Cs and ^{137}Cs. This does not include the background radionuclides detected (^{40}K, ^{208}Tl, ^{212}Pb, ^{214}Pb, ^{212}Bi, ^{214}Bi, ^{226}Ra, ^{228}Ac and ^{230}Th). These radionuclides were not all present in a single sample location. For example ^{57}Co, ^{60}Co and ^{137}Cs were present in sediment from inside the Building 124 valve pit; ^{60}Co, ^{134}Cs and ^{137}Cs were present in the sediment sample from the Room 172 Cave track, ^{57}Co, ^{85}Sr and ^{137}Cs were present in the sediment sample taken from the process sewer manhole; ^{22}Na and ^{137}Cs were present in a smear sample taken from the bottom of a MINITEC Cave decay tank. ^{22}Na was only found in this one sample.

A sediment sample from the valve pit for the Building 124 decay tanks was sent off site for 10 CFR Part 61 radionuclide analyses. The sample analysis results indicated the presence of ^{14}C, ^{60}Co, ^{137}Cs, and ^{99}Tc with the other radionuclides being less than the minimum detectable concentration (MDC). The complete results are presented in Table 5-3: BMS 10 CFR 61 Analysis Results.

Table 5-3: BMS 10 CFR 61 Analysis Results

Radionuclide	Type of Analysis	MDC (pCi/g)	Result (pCi/g)
^{3}H	Liquid Scintillation	8.72	< MDC
^{14}C	Liquid Scintillation	1.43	3.88
^{60}Co	Gamma Spectroscopy	0.14	6.23
^{63}Ni	Liquid Scintillation	2.37	< MDC
^{90}Sr	Beta Proportional Counting	0.86	< MDC
^{99}Tc	Liquid Scintillation	0.31	4.49
^{129}I	Gamma Low Energy Photon Spectroscopy	0.66	< MDC
^{137}Cs	Gamma Spectroscopy	0.15	14
^{238}Pu	Alpha Spec	0.23	< MDC
$^{239/240}$Pu	Alpha Spec	0.16	< MDC
^{241}Pu	Alpha Spec	1.37	< MDC
^{242}Pu	Alpha Spec	0.08	< MDC
^{241}Am	Alpha Spec	0.22	< MDC
^{242}Cm	Alpha Spec	0.23	< MDC
$^{243/244}$Cm	Alpha Spec	0.20	< MDC

5.3 DCGL Establishment

The DCGLs for building surfaces and soils to be used are based on radionuclide specific screening values provided by the NRC in either the Federal Register (Ref. 5-2 and 5-3), or through calculations performed using the NRC's DandD Code, Version 2.1 (Ref. 5-1). The NRC screening values for ^{54}Mn, ^{57}Co, and ^{85}Sr were adjusted based on the NJDEP 15 mrem/year criteria, which is 60% of the 10CFR20 criteria. The DCGLs to be used for this survey are presented in Table 5-4 for building surfaces and Table 5-5 for soil.

5.3.1 Building Surface DCGLs

For building surfaces, the final status surveys used to demonstrate compliance with the criteria for release for unrestricted use were performed with gas flow proportional counters calibrated using a National Institute of Standards and Technology (NIST) traceable source. Such surveys included scans as well as fixed point measurements.

For this project, a conservative approach was taken that utilized the DCGL for the most restrictive radionuclide detected, ^{60}Co. The $DCGL_W$ for ^{60}Co is 7,100 dpm/100 cm^2.

The gross activity DCGL enables field measurements of gross activity rather than the determination of individual radionuclide activity. The gross activity DCGL can be calculated using a fraction of the total activity contributed by the radionuclides. For this FSS, all of the gross activity was conservatively assumed to be ^{60}Co.

Table 5-4: BMS Screening Values for Building Surfaces

Radionuclide	Source	dpm/100 cm^2
^{3}H	Federal Register	120,000,000
^{14}C	Federal Register	2,900,000
^{22}Na	Federal Register	9,500
^{54}Mn	Federal Register	32,000
^{57}Co	Federal Register	210,000
^{60}Co	Federal Register	7,100
^{85}Sr	Federal Register	140,000
^{99}Tc	Federal Register	1,000,000
^{137}Cs	Federal Register	28,000

Table 5-5: BMS Screening Values for Soil

Radionuclide	Source	Soil pCi/g
^{3}H	Federal Register	110
^{14}C	Federal Register	12
^{22}Na	Federal Register	4.3
^{54}Mn	60% of Federal Register	9.0
^{57}Co	60% of Federal Register	90
^{60}Co	Federal Register	3.8
^{85}Sr	60% of Federal Register	16
^{99}Tc	Federal Register	19
^{137}Cs	Federal Register	11

5.3.2 Criteria for Open Land Unrestricted Release

In open land areas the final status survey will include samples collected for gamma spectral analysis. If only one radionuclide were present, then the site specific DCGL is the appropriate screening value from Table 5-5.

For open land areas, where more than one radionuclide is present as at this BMS facility, the "sum of the fraction rule" applies and is calculated as follows:

$$\sum \frac{Conc_i}{GL_i} \leq 1$$

Where:

$Conc_i$ = Activity concentration of radionuclide i, pCi/g.

GL_i = The radionuclide specific guideline value (NRC screening values) for radionuclide i, pCi/g.

At BMS the activity concentrations will be known for each radionuclide that may be present in the mix so the above equation may be evaluated directly.

As required by New Jersey Department of Environmental Protection (NJDEP) regulations, all radiological analyses that are performed on soil samples where the results are used to support the unconditional release of the open area shall be performed by a laboratory that is properly certified by the NJDEP in accordance with NJAC 7:28.

5.4 Survey Data Quality Objectives

To ensure the proper release of the facility, the objectives of this survey plan were to:

- Ensure the proper selection of appropriate instrumentation to adequately detect the radionuclides of concern.
- Establish proper count times and measurement techniques to ensure Minimum Detectable Concentrations (MDCs) are <50% of the $DCGL_W$ and that scan MDCs are less than the $DCGL_{EMC}$.
- Ensure surveys are planned and conducted in a manner that enables the null hypothesis to be either accepted or rejected for each survey unit.
- Ensure DCGLs are established such that the total effective dose equivalent (TEDE) to an average member of the critical group from residual contamination will not exceed 25 mrem/year for NRC regulated radionuclides and 15 mrem/year for New Jersey Department of Environmental Protection (NJDEP) regulated radionuclides.
- Ensure that a statistically significant number of measurements are taken for each survey unit in accordance with the guidance provided in the MARSSIM manual.
- Ensure the final status survey is planned, conducted and documented in a manner consistent with the applicable federal and State of New Jersey regulations.

5.5 Area Classification

In accordance with the guidance presented in the MARSSIM, all areas at a licensed site are classified as either impacted (potentially having residual contamination as a result of previous operations) or non-impacted (no potential for residual contamination as a result of previous operations). All of Building 124, the fenced area outside of B-124 and the area immediately surrounding and under the B-83 waste tanks were designated as impacted. All other areas of the BMS New Brunswick site were designated as non-impacted and beyond the scope of this FSS. These designations were identical to those assigned prior to the characterization survey. Prior to the performance of the characterization survey and based partly on the HSA, the impacted areas, or those areas to be unconditionally released, were divided into one of three classes of areas based on their known or potential for radioactive contamination. The criteria for each class are given below:

Class 1 - Areas which have, or had prior to remediation, a potential for radioactive contamination based on site operating history or known contamination above the $DCGL_W$ (DCGL for average concentrations over a wide area).
Class 2 – Areas which have, or had prior to remediation, a potential for radioactive contamination or known contamination which is not expected to exceed the $DCGL_W$.
Class 3 - Areas that are not expected to contain any residual radioactivity or are expected to contain levels of residual activity at a small fraction of the $DCGL_W$.

For the final status survey, the classification designations from the characterization survey were reviewed against the results of the characterization survey. Several classifications were changed for the final status survey based on this review. The majority of the changes were made due to the walls and ceilings of several of the laboratory rooms being changed from class 1 to class 2. The floors in these rooms remain a class 1.

A list of the survey units is provided in Attachment 2 and the survey units are generally described in the following sections. Included in Attachment 2 is the classification for each survey unit, and a listing of any elevated measurements in that survey unit from the characterization survey.

Individual survey units were established based on several criteria. First, the entire survey unit had to be within the same classification. Second, the area of the survey unit had to meet the total area guidelines established in section 4.6 of MARSSIM.

Also, where possible, physical boundaries such as walls were used to establish survey units.

5.5.1 Class 1 Areas

These were areas that were known to be radioactively contaminated based upon the characterization survey operations conducted in the area. These areas had the greatest potential for contamination and therefore received the highest degree of survey effort.

The objective of surveys in Class 1 areas was to demonstrate that remediation activities have removed licensed radioactive materials and that the remediated areas now meet regulatory requirements for unrestricted release of these areas. Class 1 areas are shown in Figure 5-1.
The class 1 areas include the following:

(a) Building 124 Caves

The equipment in these caves was removed along with the shield doors, shield door tracks and door operators.

The under-slab process ventilation ducts and process drain lines were removed exposing surface soils under the floor slab.

(b) Class 1 Lab Area Floors

The floors of lab rooms 146 through 153 were Class 1 areas along with the floors of cave production support rooms 142, 171, 176, 177, 178, 180, 181 and 190. Prior to the characterization survey, all surfaces of these rooms were considered class 1, however, after review of the characterization survey results, only the floors remained as class 1.

(c) Building 122, Room 222 Floor

The floor at the south end of this room was Class 1. This was the area where the radwaste compactor was located and was used as a temporary storage area for radwaste generated during the D&D phase.

5.5.2 Class 2 and 3 Areas

These were areas which the characterization indicated that remediation was not required but radioactive material may be present in low concentrations. The objective of surveys in Class 2 and 3 areas was to confirm with 95 percent confidence the presence or absence of radioactive material in excess of the DCGL's. The number of fixed survey points was sufficient to confirm the absence of radioactive material requiring remediation by comparisons to DCGLs. Class 2 and 3 areas are shown in Figure 5-2 through Figure 5-5.

The class 2 and 3 areas included the following:

(a) Laboratory (except for floors), Office, and Production areas inside Buildings 122 and 124
(b) Exterior of Building 122 and 124
(c) Building Exterior Open Land Areas (Buildings 122, 124, and Building 83)
(d) Soils below Building 124 Tank areas and below Building 83 Tank area.

5.5.3 Non-Impacted Areas

These are areas in which the presence of radioactive material was not expected. These areas comprised those portions of the BMS property not falling within the two preceding categories.

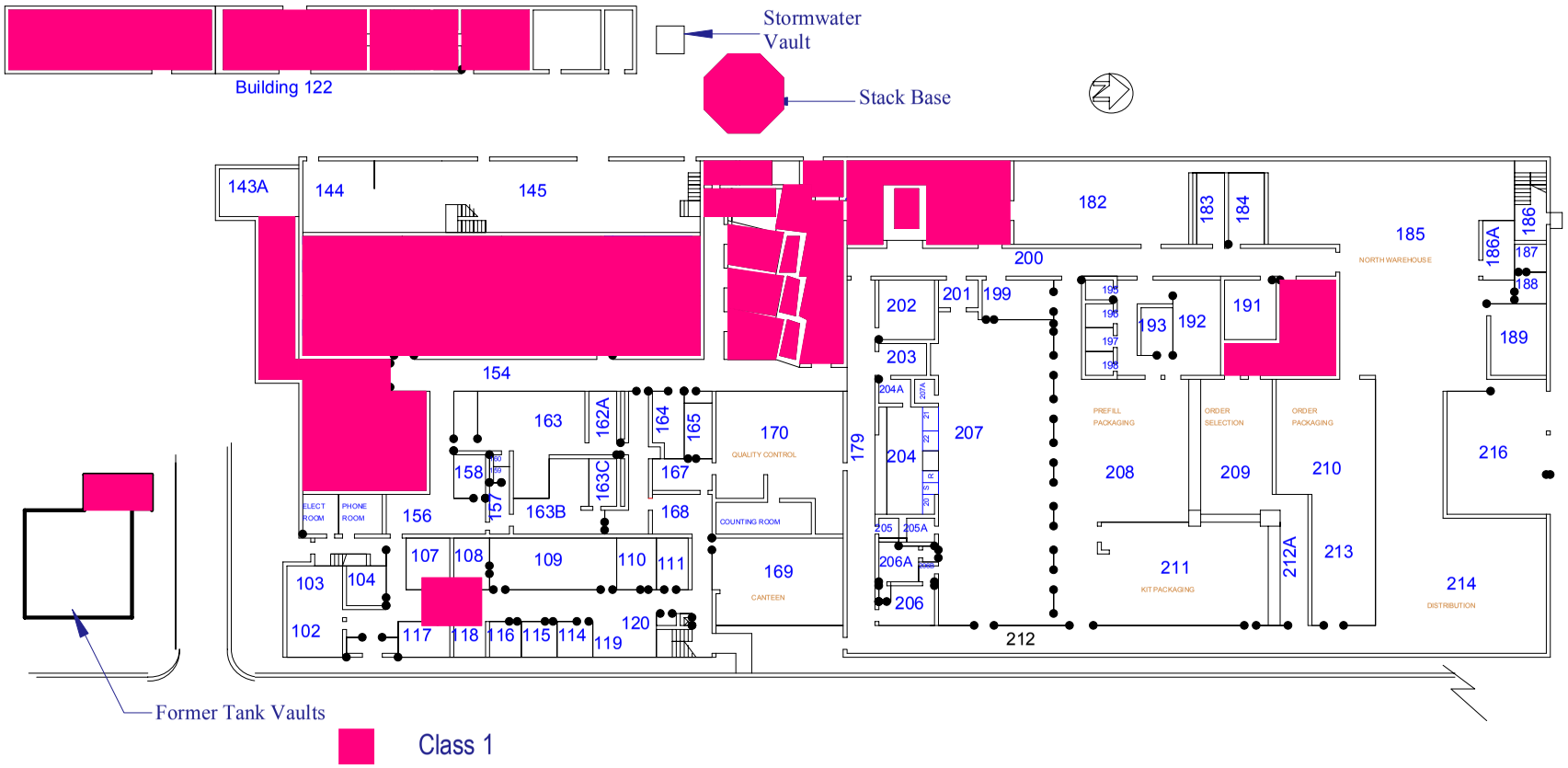


Figure 5-1: BMS Building 122 and 124 First Floor Class 1 Areas

(This is a multi-colored diagram)

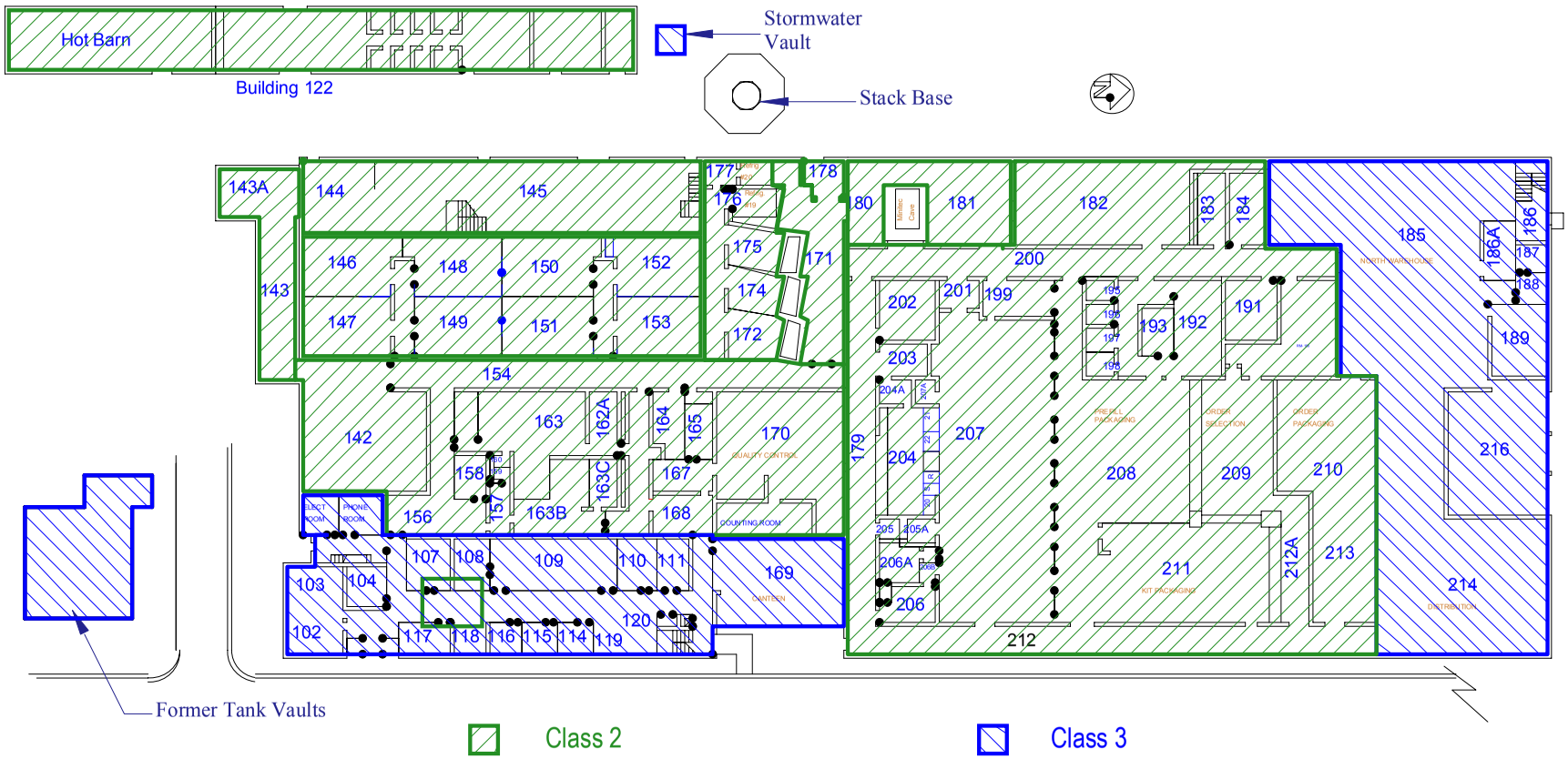


Figure 5-2: BMS Building 124 First Floor Structure Class 2 and Class 3 Areas

(Note: This is a multi-colored diagram.)

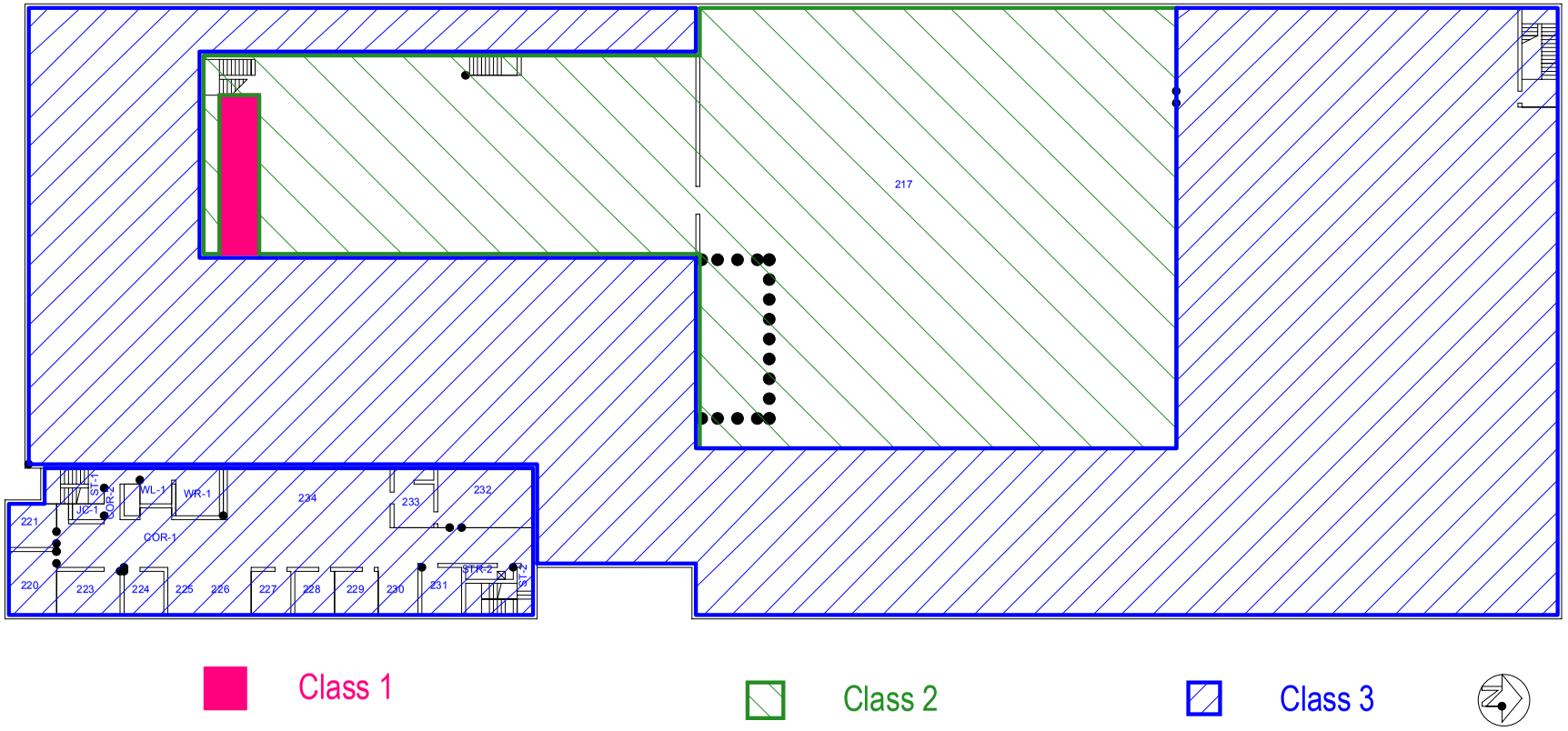


Figure 5-3: BMS Building 124 Second Floor Structure Class 1, Class 2 and Class 3 Areas

(Note: This is a multi-colored diagram.)

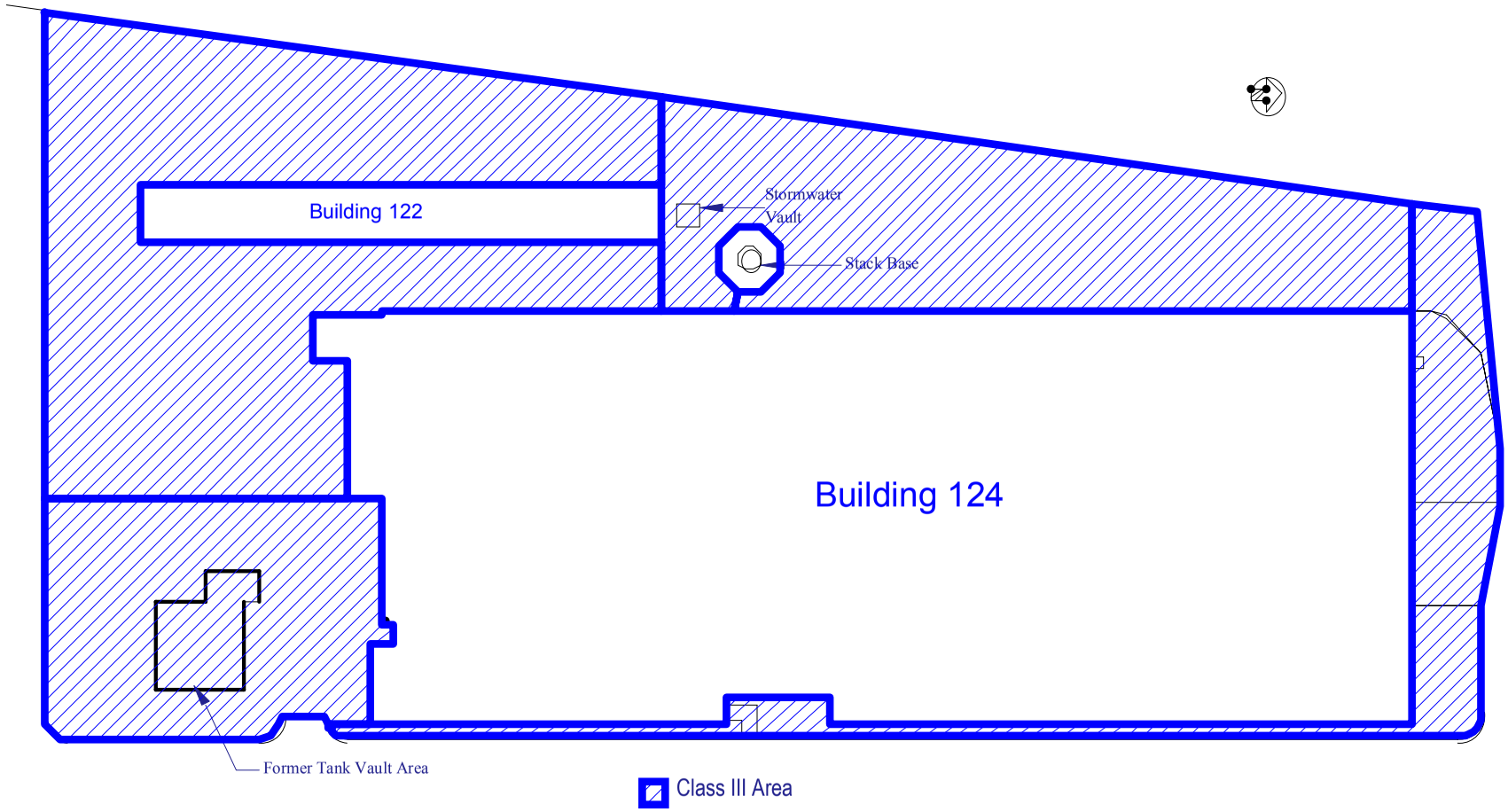


Figure 5-4: BMS Building 124 Outdoor Class 3 Areas

(Note: This is a multi-colored diagram.)

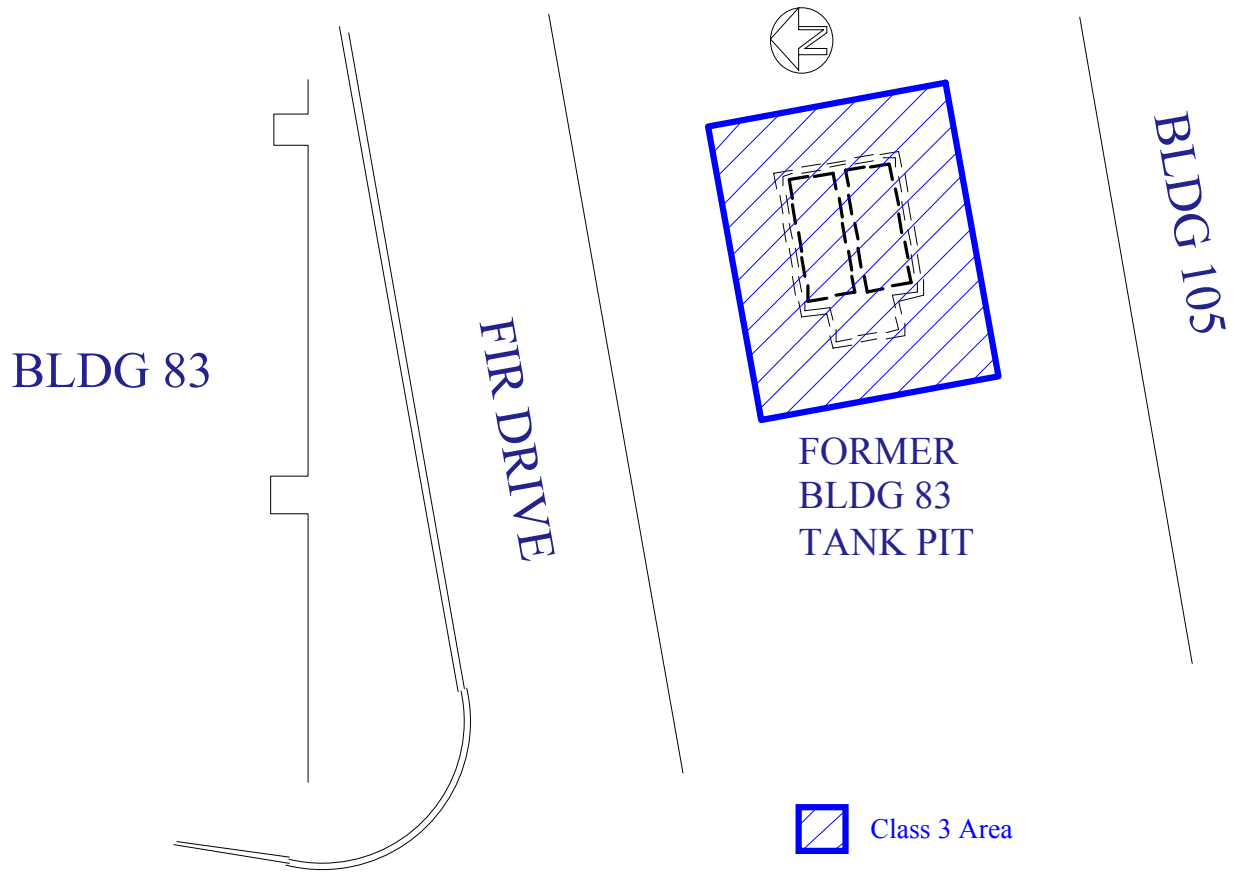


Figure 5-5: BMS Tank 83 Outdoor Class 2 and Class 3 Areas

(Note: This is a multi-colored diagram.)

5.6 Survey Units

For each survey area/unit, the project team developed a package, or portfolio, by performing a walk-down and preparing a worksheet/tracking sheet outlining the general survey instructions, location codes, and any specific survey instructions for any abnormal conditions within the survey area. Completion and review signature blocks were used to track the progress of the surveys.

The survey package included the following items as a minimum:

- A Survey package Worksheet that includes the Survey Package Identification Number, the Survey Location, the Area Classification, a description of the survey area, historical information about the survey area, general survey instructions, special survey instructions, a table that lists the survey requirements with block to initial when each item is complete, a package review and signature area and an area for comments if the survey was modified during the performance of the survey.
- A sheet indicating the survey locations and the factors used in calculating the survey locations.
- A map showing the survey locations.
- The results of the COMPASS run that was used to determine the number of measurements required.
- The characterization data input into COMPASS.

5.6.1 Scan Measurements

Scan measurements were performed to locate elevated areas of residual radioactivity that required further investigation. They were performed according to a preset pattern established for each classification. The level of scanning effort was proportional to the potential for finding elevated measurement results.

Scan measurements of Class 1 survey units were performed over 100 percent of the accessible surface area. Scan surveys were designed to detect small areas of elevated radioactivity that would not be detected by static measurements using a systematic measurement pattern. The sensitivity of the scanning method was sufficient to detect levels of residual radioactivity below the $DCGL_W$, so the number of static measurements did not need to be adjusted.

Scan measurements of Class 2 survey units were performed over 10 to 20 percent of the surface area. Class 2 survey units have a lower probability of elevated residual radioactivity than Class 1 survey units. Those areas with the highest potential for elevated residual radioactivity were included in the survey based on professional judgment. A 10 percent scanning coverage was used for those where it was unlikely that any area would exceed the DCGL.

Scan measurements of Class 3 survey units were performed over approximately 10 percent of the surface area. Class 3 survey units have the lowest probability of containing elevated residual radioactivity. Those areas with the highest potential for elevated residual radioactivity, based on professional judgment were selected for scanning in the Class 3 areas.

5.6.2 Static Measurements

Static measurements provided a quantitative measure of the radioactivity present at the locations measured. Static measurements were performed at a frequency and location throughout each survey unit, such that a statistically sound conclusion was developed.

5.7 Selection of Instruments

The purpose of the final status survey was to collect sufficient survey data to support release for unrestricted use the former BMS radiopharmaceutical manufacturing operations facility and associated grounds and structures at New Brunswick, NJ. The project team performed surveys according to project specific Duratek procedures and the Final Status Survey (FSS) Plan. Implementation of the FSS Plan included the following:

1) Survey instrumentation was set up and source checked to ensure proper operation.
2) The Project Manager/Supervisor performed preliminary inspections of the areas to identify additional specific survey requirements.
3) The Project Manager/Supervisor developed survey packages for the survey areas.
4) The project team marked the fixed-point survey locations as applicable.
5) The project team took survey measurements and collected samples as required using appropriate calibrated instruments and performed daily source and background checks before and after each day's work.
6) Direct survey data collected during the project was downloaded from the survey instrument into a database for storage and processing.
7) The Project Manager reviewed the completed survey packages to ensure that all required surveys had been performed.
8) The Project Manager reviewed the survey results to identify any areas exceeding the specified release criteria.

5.7.1 Instrumentation and Selection

Selection and use of instruments was appropriate to ensure sensitivities were sufficient to detect the identified primary radionuclides at the minimum detection requirements. Table 5-6 provides a list of the instruments, types of radiation detected and calibration sources used or available for use during the project. The hard-to-detect radionuclides that include low energy beta emitters cannot be measured using these field instruments. These radioisotopes were quantified through off-site laboratory analysis during the site characterization. Scaling factors were not needed to account for these nuclides during field surveys because a more conservative approach was taken that utilized the DCGL for the most restrictive radionuclide detected, ^{60}Co (see Section 4.0).

Duratek used the Ludlum Model 2350-1 Data Logger with a variety of detectors for direct measurements of total beta surface activity as well as exposure rate measurements. The Data Logger is a portable microprocessor-based counting instrument capable of operation with NaI(Tl) gamma scintillation, gas-flow proportional, GM and ZnS scintillation detectors. The Data Logger is capable of retaining in memory the survey results and instrument/detector parameters for up to 1000 measurements. This data was then downloaded to a personal computer for subsequent reporting.

Detector selection was dependant on the survey being performed, surface contour and survey area size. All of the final status survey scan and fixed point readings were taken using a 126 cm^2 gas-flow proportional detector (Ludlum model no. 43-68) for direct beta measurements.

Removable contamination surveys were performed using standard smear survey techniques and the smears counted on a Ludlum model no. 43-10-1 phoswich detector.

In addition to the standard detector systems described above, a 1" x 1" Sodium Iodide (NaI) gamma scintillation detector was used for in situ measurements at all soil sample locations. This detector is used with the Ludlum 2350-1 data logger. These measurements were used for informational purposes.

Soil samples received an onsite screening using a high purity germanium (HPGe) gamma spectroscopy system. Soil samples were then sent offsite to a NJDEP certified laboratory for official analysis.

Table 5-6: Survey Instrumentation

Instrument/Detector	Detector Type	Radiation Detected	Calibration Source	Use
Ludlum Model 2350-/43-68	Gas-flow proportional (126 cm^2)	Alpha or beta	^{99}Tc (β) ^{230}Th (α)	Direct measurements and smear counting
Ludlum Model 2350-1/43-37	Gas-flow proportional (550 cm^2)	Alpha or beta	^{99}Tc (β) ^{230}Th (α)	Direct measurements
Ludlum Model 2350-1/43-94 or Model 2350/43-98	Gas-flow proportional Pipe Detector	Alpha or beta	^{99}Tc (β) ^{230}Th (α)	Direct measurements
Ludlum Model 2350-1/ SP-113-3m or SP-175-3m	GM Pipe Detector	Beta	^{99}Tc (β)	Direct Beta measurements
Ludlum Model 2350-1/44-2	1" x 1" NaI scintillator	Gamma	^{137}Cs (γ)	Gamma exposure rate
Ludlum Model 2350-1/44-40	Shielded GM (15.5 cm²)	Beta	^{99}Tc (β)	Direct Beta measurements
Ludlum Model 2929/43-10-1	Phoswich	Alpha & Beta	^{99}Tc (β) ^{230}Th (α)	Alpha and Beta smear counting
Canberra Gamma Spectroscopy System	High Purity Germanium	Gamma	Mixed Gamma	Nuclide identification and quantification

5.7.2 Detection Sensitivity

The data logger/gas-flow proportional counter has a scan MDC of ~620 dpm/100 cm^2 and fixed point MDC of ~250 dpm/100 cm^2 for measurements made on a flat even surface such as floors. Each of the MDCs are a factor of 2 higher when making measurements on uneven surfaces such as concrete walls. These MDCs are significantly lower than the investigation levels (see section 5.14). The detection sensitivity of the Ludlum 2350-1 Data Logger with the 43-68 detector that was routinely used for surface contamination measurements was estimated and the results summarized in Table 5-7. Count times were selected to ensure that the measurements were sufficiently sensitive with respect to the $DCGL_W$.

Table 5-7: Typical Detection Sensitivities

Instrument & Detector	Radiation	BKGND Count Time (min)	BKGND (cpm)	Instrument Efficiency[a] (cpm/dpm)	Count time (min)	MDC (dpm/100 cm^2)	Scan[a] MDC dpm/100 cm^2
Model 43-68	Beta-Gamma	1	250	0.24	1	250	620

[a] MDC_{scan} is calculated by assuming a scan rate of 5 cm/sec (unless otherwise marked), which is equivalent to a count time of 0.03 min, assuming an 8.9 cm detector width.

5.8 Instrument Calibration

Duratek calibrates the data loggers and associated detectors on a semi-annual basis using NIST traceable sources and calibration equipment. The calibration includes:

- high voltage calibration,
- discriminator/threshold calibration,
- window calibration,
- alarm operation verification, and
- scaler calibration verification.

The detector calibration includes:

- operating voltage determination,
- calibration constant determination, and
- dead time correction determination.

Calibration labels showing the instrument identification number, calibration date and calibration due date are attached to all portable field instruments. The user checks the instrument calibration label before each use. Procedures for calibration, maintenance, accountability, operation and quality control of radiation detection instruments are listed in Attachment 1.

5.9 Calibration Sources and Instrument Response Testing

All sources used for calibration or efficiency determinations for the survey were representative of the instrument's response to the identified nuclides and are traceable to NIST.

Health Physics Survey Specialists controlled radioactive sources used for instrument response checks and efficiency determination. Sources were stored securely and an inventory maintained onsite.

5.10 Survey Procedures

All instrumentation used for survey measurements were operated according to approved instrument operating procedures. The procedures used for the Final Status Survey work are provided in Attachment 1.

5.11 Minimum Detectable Concentration

Minimum Detectable Concentration (MDC) is the smallest amount or concentration of radioactive material that will yield a net positive count with a 5% probability of falsely interpreting background responses as true activity. The MDC is dependent upon the counting time, geometry, sample size, detector efficiency and background count rate. As a Data Quality Objective, the MDCs were less than 50% of the applicable Derived Concentration Guideline Level. There are two different MDCs that were utilized, one for direct beta surface activity measurements and one for field scanning.

These are calculated differently as follows. The equation used for calculating the MDC for direct field instrumentation is:

$$MDC = \frac{\frac{2.71}{t_s} + 3.29\sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{E\left(\frac{A}{100}\right)}$$

Where:

MDC	=	Minimum Detectable Concentration (dpm/100 cm^2)
R_b	=	Background Count Rate (cpm)
t_b	=	Background Count Time (min)
t_s	=	Sample Count Time (min)
A	=	Detector Area (cm^2)
E	=	Detector Efficiency (c/d)

The equation for the scanning MDC is:

$$MDC = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{E_i * E_s * \sqrt{p} * \frac{A}{100}}$$

Where:

MDC	=	Minimum Detectable Concentration (dpm/100 cm^2)
d’	=	Decision error taken from Table 6-5 of MARSSIM
i	=	Observation counting interval (scan speed divided by the detector width)
b_i	=	Background count per observation interval
E_i	=	Detector Efficiency (c/d)
E_s	=	Surface Efficiency (typically around 50% for beta contamination on concrete)
p	=	Surveyor Efficiency (typically 50%)
A	=	Detector Area (cm^2)

The MDC for the offsite gamma spectral analysis of soil was sufficient to detect at 50% or less of the $DCGL_W$ for ^{60}Co.

5.12 Sample Size and Location Instructions

The MARSSIM guidelines coupled with professional judgment were used to divide facilities and areas into appropriately sized survey units. Survey unit sizing was sufficient to assure that the total number of data points, based on the measurement frequency, allowed statistical evaluation of the data. Considerations for establishing survey units were physical characteristics, concentration levels, and previous remediation efforts, as well as spatial and logistical considerations.

Survey units were sized to ensure data points were relatively uniformly distributed among areas of similar potential for residual contamination. Small survey units were developed to ensure a conservatively established coverage of an area.

Survey units size ranges were given in Table 5-1.

5.12.1 Number of Measurements/Samples

The number of measurement/samples for each survey unit were determined in accordance with section 5.20 of this report. A relative shift of between 1 and 3 was used, providing a minimum of 13 samples/measurements per survey unit, depending upon the measurement distribution and the size of the area.

For class 1 and 2 survey units, measurements were taken using randomly generated coordinates for the starting point with systematic spacing between survey points as described in 5.12.2 and 5.12.3 below. For class 3 survey units, the survey points were all randomly generated.

5.12.2 Sample/Measurement Grid Spacing

The grid spacing for the measurement and samples was estimated in two ways depending upon the shape of the grid (either triangular or rectangular grid). When a triangular grid was used, the grid spacing was estimated as follows:

$$L = \sqrt{\frac{A}{0.866N}}$$

Where:

L = Distance between measurement locations
A = Survey unit Area
N = Number of measurements

When a square grid was used, the spacing was estimated as follows:

$$L = \sqrt{\frac{A}{N}}$$

5.12.3 Starting Location

Once the number of measurements and the grid spacing were determined, a starting point for the survey was established for each class 1 and 2 survey unit. This was performed by selecting a reference point for the survey unit, such as the corner of the room, and using a random number generator to provide a random location based on the size of the area to be surveyed for the initial offset from the reference point in both the x and y coordinates.

Upon establishing the first grid location, the calculated grid spacing was used to establish a grid system throughout the survey unit. When the survey unit included the floor, walls and ceiling, the grid extended to all surfaces from the initial point.

Once the grid locations were established, a check was made to ensure that the number of grid locations satisfied the calculated number of measurements to be performed. The calculated number of measurements was frequently increased in order to ensure the minimum number of measurements/samples were obtained.

5.12.4 Soil Sampling

A surface soil sample (0-15 cm deep) was obtained at each grid node for the facility grounds immediately around buildings and at other survey unit/area determined to be necessary. A sample volume of approximately 1 quart of soil was collected, dried, homogenized and sieved to minus 1/4-inch mesh. All Final Status Survey soil samples were sent offsite to an independent laboratory approved by the NJDEP.

5.13 Survey Instructions

A survey package was prepared for each survey unit prior to the performance of the final status survey for that unit. A typical survey package included a survey package worksheet, a copy of the COMPASS computer code data quality objective printout (DQO Wizard), a map of the survey unit showing the fixed survey points, and additional documentation as necessary that provided the inputs used for the COMPASS computer code. The survey package worksheet lists the package ID number, survey unit location and description, unit classification, historical information, and survey instructions. After the survey of the unit is completed, a copy of the survey results was added to the package in the form of the Ludlum 2350-1 printout.

5.14 Data Investigations

The data collection, investigation and evaluation process was designed to provide a high degree of confidence that all data requirements have been met.

5.14.1 Investigation Levels

Examples of typical investigation levels are shown in Table 5-8, taken from the MARSSIM manual (Table 5.8 of NUREG-1575). Investigation levels are radioactivity levels that are based on the release criteria, which if exceeded, initiate an investigation of the survey data. Investigation levels were established for each class of survey unit.

Table 5-8: Typical Investigation Levels (from MARSSIM)

Survey Unit Classification	Flag Direct Measurements or Sample Result When:	Flag Scan Measurements When:
Class 1	>$DCGL_{EMC}$ or >$DCGL_W$ and > a statistical parameter based value	>$DCGL_{EMC}$
Class 2	>$DCGL_W$	>$DCGL_W$ or > MDC
Class 3	>fraction of >$DCGL_W$	>$DCGL_W$ or > MDC

The principal purpose of an investigation level is to guard against the possible misclassification of the survey unit. They also serve as a QC check during the final survey process. A survey measurement that exceeds an investigation level may indicate that the survey unit has been improperly classified. It may also indicate a failing survey instrument or a localized area of elevated residual radioactivity where there was a failure in the remediation process. Large variations in background exposure rates may also result in investigative surveys.

Depending upon the results of the investigation, survey units may require no action, may be remediated, or may be reclassified, and /or re-surveyed. Initial administrative action or investigation level guidelines are be found in Table 5-9. For a Class 1 survey unit, while measurements above the DCGL are not necessarily unexpected, any measurement exceeding the DCGL is investigated. The release criteria allows individual measurements representing small areas of residual radioactivity to exceed the DCGL. However, any measurement that exceeds the DCGL is subject to the EMC. For a Class 2 survey unit, any measurement above the DCGL is unexpected and is investigated. As there is a low expectation for residual radioactivity in a Class 3 survey unit, any above background static measurement, exceeding a small fraction of a DCGL is investigated. If the scanning MDC exceeds the DCGL, any indication of residual radioactivity during the scan is also investigated. No FSS measurements at this site exceeded the DCGL.

Table 5-9: Summary of Investigation/Action Levels

	SURVEY AREA TYPE		
	CLASS 1 AREA	**CLASS 2 AREA**	**CLASS 3 AREA**
Investigation or Action Level	Flag any measurement > $DCGL_W$.	Flag any measurement >50% of $DCGL_W$.	Flag any measurement >25% of $DCGL_W$.
Reclassification Level	N/A	If any measurement are ≥ $DCGL_W$, area should be reclassified as Class 1.	If any measurement ≥ $DCGL_W$, area should be reclassified as Class 1. If any measurement exceeds 50% of the $DCGL_W$, but are < the $DCGL_W$, area should be reclassified as Class 2 area.
Remediation Indication When:	Consider remediation when residual activity exceeds the $DCGL_W$ for any scan or discrete measurement averaged over 100 cm^2.	Not indicated for Class 2 or Class 3 survey areas unless above limits specified for Class 1 survey area. Reclassify and resurvey as necessary.	Not indicated for Class 2 or Class 3 survey areas unless above limits specified for Class 1 survey area. Reclassify and resurvey as necessary.

5.14.2 Investigation

Locations identified by scan or static measurements with residual radioactivity, which exceed an investigation level are marked and investigated. The elevated measurement is then confirmed to exceed the investigation level. The area around the elevated measurement is investigated to determine the extent of the elevated residual radioactivity and to provide reasonable assurance that other undiscovered areas of elevated radioactivity do not exist. Scan coverage of the area being investigated is increased to 100 percent (if not already at that level). Static measurements are also taken if scan measurements are not capable of providing sufficient data to characterize the elevated area. Depending on the results of the investigation, the survey unit may require remediation, reclassification, and/or resurvey. Possible outcomes of the data investigation process are shown in Table 5-10.

Static measurements above the investigation level that should have been, but were not identified by scan measurements may indicate that the scanning method is inadequate. In that case, the scanning method is evaluated and appropriate corrective actions are taken. Corrective actions may include re-scanning affected survey units using other survey protocol or survey instrumentation.

Table 5-10: Possible Actions Resulting from Data Analysis

No.	Data Results	Class 1	Class 2	Class 3
1	One or more data points > $DCGL_W$	Remediate and resurvey as necessary	Reclassify & resurvey	Reclassify & resurvey
2	All data points ≤ $DCGL_W$	Survey Unit Passes	Determine if reclassification is required.	Determine if reclassification is required.
3	One or more points > 50% of $DCGL_W$ but ≤ $DCGL_W$	Survey Unit Passes	Increase survey coverage or review & reclassify & resurvey as necessary	Reclassify & resurvey
4	One or more points > 25% of $DCGL_W$ but ≤ 50% $DCGL_W$	Survey Unit Passes	Survey Unit Passes	Reclassify & resurvey
5	All data points ≤ 25% DCGL	Survey Unit Passes	Survey Unit Passes	Survey Unit Passes

5.14.3 Remediation

Areas of elevated residual radioactivity above the $DCGL_W$ should be considered for remediation. Based on the survey data, it may be necessary to remediate all or a portion of a survey unit.

5.14.4 Reclassification

If survey measurements in a Class 2 or Class 3-survey unit exceed the DCGL, the survey unit is reclassified as a Class 1-survey unit. A Class 2 or Class 3-survey unit that is remediated is reclassified as a Class 1 survey unit. If survey measurements in a Class 3-survey unit exceed 25% of the DCGL, the survey unit is reclassified as a Class 2 survey unit. If a Class 2 survey unit exhibits measurements exceeding 50% of the DCGL it may be further investigated or reclassified as a Class 1 survey unit.

5.14.5 Resurvey

If a survey unit is reclassified or if remediation activities are performed, then a re-survey using the methods and frequency applicable to the new survey unit classification is performed. Where only a small fraction (<10%) of the area of a Class 1 survey unit is remediated, replacement measurements are collected within the remediated area. Their locations are determined using the random selection process.

5.15 Decision Error

There are two types of decision errors applied to analytical results: Type I (α) and Type II (β) errors. A Type I error, or false positive, is the probability that null hypothesis is rejected when it should be accepted. A Type II error, or false negative, is the probability of determining that null hypothesis is accepted when it should be rejected. The probability of making decision errors can be controlled by adopting an approach called hypothesis testing. The null hypothesis (H_0) is treated like a baseline condition and is defined by MARSSIM as:

H_0 = residual radioactivity in the survey unit exceeds the release criterion.

This means that the site or survey area is assumed contaminated until proven otherwise. For the purpose of this final survey, Type I or α error will be set at 0.05 or 5 percent and Type II or β error will be set at 0.05 or 5 percent.

5.16 Background Reference Areas

For the BMS site, the decision has been made based on evaluation of the characterization data that the contaminants of concern are assumed to be not present in the environment, or in the case of ^{137}Cs, to be

present at such an insignificant level that it can be considered not present. Therefore, background reference areas are not required and the survey planning process and survey data assessment process will utilize the Sign test to determine if any residual contamination in a survey unit exceeds the DCGL.

5.17 Building Material Backgrounds

Material-specific background count rate information for input into the survey planning process was obtained from the characterization survey report. The standard deviation in the background count rate was calculated based on the data obtained. In the routine survey planning process, material-specific background information from the characterization report was input into COMPASS where it is stored. COMPASS automatically calculates the standard deviation. The material-specific background information was stored as part of the general site information and not on a survey unit specific basis.

5.18 Anticipated Survey Unit Contamination Level

The anticipated contamination level for each survey unit for input into the survey planning process was obtained from the characterization report. This same data was used to calculate the standard deviation of the anticipated contamination level. These two manually calculated values were input into COMPASS when prompted for "Gross Survey Unit Mean (cpm)" and the standard deviation.

5.19 Relative Shift

The relative shift is defined as Δ/σ where Δ is the DCGL - LBGR and σ is the standard deviation of the contaminant distribution. In order to calculate the relative shift, the DCGL must be determined and two assumptions must be made to estimate the LBGR and the standard deviation of the measurement distribution. Per MARSSIM, section 8.3.3, if the estimated standard deviation, σ, is much smaller than the $DCGL_W$, the LBGR should be set so that the relative shift, Δ/σ, is about 3. For other survey units the LBGR was set to be about 50% of the $DCGL_W$. The standard deviation may be calculated from preliminary survey data, prior surveys of similar areas and materials or the standard deviation of a reference background area.

It should be noted that σ represents the standard deviation prior to release after all area decontamination is thought to be complete. If no reference data is available to make a reasonable estimate of the background standard deviation, MARSSIM suggests using 30% of the mean survey unit background. For the BMS facility, data from the facility characterization or from post-remediation surveys was used to calculate the standard deviation value for each survey unit. The value for LBGR is input into COMPASS. The relative shift is automatically calculated and reported by COMPASS.

5.20 Number of Samples/Measurements

Once the relative shift is determined the calculated value, Δ/σ, can be used to obtain the minimum number of measurements or samples necessary to reject the null hypothesis based upon the initial assumptions and justify that the survey unit meets the requirements for release for unrestricted use. MARSSIM Table 5-3 contains the number of samples or measurements necessary for the given decision errors, α and β, and the calculated relative shift, Δ/σ, when dealing with non-radionuclide specific measurements or when the radionuclide is present in the background. The value N/2 from MARSSIM Table 5-3 represents the number of samples or measurements to be collected in each survey unit and reference background area. MARSSIM Table 5-5 provides the number of measurements of samples for the case in which the radionuclide is not in the background.

5.21 Sample/Measurement Number Reasonableness

Once the number of samples/measurements is determined, it must be assessed whether or not that number is reasonable for the survey unit and the survey unit size. It is possible, even if MARSSIM guidance is strictly followed, that there are not enough samples to produce the desired level of "comfort" or the number becomes excessive. The number of samples is determined on a case-by-case basis and if the number of samples/measurements is not reasonable, then the data quality objectives or initial assumptions should be re-evaluated.

REFERENCES FOR SECTION 5

5-1 *COMPASS Code* Version 1.0.0 was developed under the sponsorship of the U.S. Nuclear Regulatory Commission for implementation of MARSSIM in support of the decommissioning license termination rule (10 CFR Part 20, Subpart E).

5-2 NRC, 63 FR 64132. Table 1 – *Acceptable License Termination Screening Values of Common Radionuclides for Building Surface Contamination*, November 18, 1998.

5-3 NRC, 64 FR 68395. Table 3 – Interim *Screening Values (pCi/g) of Common Radionuclides for Soil Surface Contamination Levels*, December 7, 1999.

6.0 SURVEY RESULTS

The Final Status Surveys were completed as planned. Survey packages were the primary method of controlling and tracking the hard copy records of survey results. Records of surveys were documented and maintained in the survey package for each area. Each survey measurement was identified by the date, technician, instrument type and serial number, detector type and serial number, location code, type of measurement, mode of instrument operation, and QC sample number, as applicable. The minimum data collection requirements determined for each survey package were met or exceeded. A chain-of-custody record to track each sample accompanied all soil samples shipped off site for analysis. There were no sample measurements that exceeded the release guidelines for surfaces or soils. In addition, the average results were less than 50% of the DCGL and therefore less than the NJDEP 15 mrem/year criteria.

According to the findings of this final status survey, the release criteria have been met and the facilities covered by the scope of the survey are suitable for unconditional release.

6.1 Data Reduction and Evaluation

All data collected was documented, reviewed and evaluated as indicated in the sections that follow.

6.1.1 Data Review

The completed survey package and survey data from each survey unit be reviewed by the Project Manager/Supervisor to verify all documentation is complete and accurate.

Duratek personnel verified the following for each survey package, as a minimum:

- The Survey Technician initialed and dated the survey package instructions.
- The Survey Technician collected the number of measurements and samples specified in the survey package in the appropriate locations.
- The sensitivity of the measurements met designated criteria (i.e., count times, background, and detection efficiency were appropriate to meet MDAs).
- Properly calibrated/response checked instruments were used to perform measurements/analysis.
- Quality control checks were performed as designated in the survey package.
- Chain of custody forms, data download reports, and laboratory analysis results were complete and in the survey package.
- Any outlying data in the survey/sample results that differed significantly from those expected were evaluated to determine the need for follow-up samples/measurements.

The Characterization Supervisor reviewed on-site and offsite laboratory analysis results for accuracy and signed the Survey Package Cover Sheet signifying survey package completion.

6.1.2 Survey Data Reports

Survey data was downloaded to a database maintained at a computer download station that generates the survey data reports. The database compiles data from survey units or survey packages, and generates a statistical summary report for each survey area or unit (structure, system or open land area).

The compilation of statistical summaries, area-specific historical information, applicable maps and drawings, and conclusions constitutes the characterization survey report for each survey package. Survey data reports are contained in APPENDIX A: BMS Final Status Survey Packages and Results by Survey Area. The content of these FSS data reports is summarized in Table 6-1: BMS Survey Area Report contents that follows.

Table 6-1: BMS Survey Area Report contents

Form Title	Contents
Summary	• General historical information on the survey area, including equipment operating history, construction and coating materials, and past contamination incidents • Summary and results of survey activities • References (e.g., documents, interviews)
Summary of Survey Units	• Package description (e.g., building and elevation) • List of units within each survey area (i.e., area, room, or equipment identification), and surfaces (i.e., ceiling, equipment, floor, walls) within each unit, if applicable • List of materials in each survey area (e.g., concrete, metal) and the assigned beta levels for each taken from the background survey results
Survey Map or Drawing	• Representative diagram of the survey area and units • Location of survey measurements.
Statistical Summary and Graph	Statistics and a graph of results for each type of measurement (direct measurements for total beta activity, removable alpha and beta activity, and gamma exposure rate at 1 meter) performed for the survey area. Statistics typically include mean, maximum, minimum, standard deviation, minimum detectable activity, samples reported, and samples prescribed.
Results Listing Report	Corrected data and location information for each applicable measurement type.
Download File & Survey Instrumentation Calibration Summary	A summary of survey date, file number (Download #- Station #), detector model number, instrument and detector serial numbers and calibration due date(s), detector efficiency and Survey Technician's ID number for each instrument and detector combination used to collect data.

6.1.3 Data Analysis Equations

The following sections describe the equations used for characterization data analysis in the report.

- Direct Measurements for Total Surface Activity

  Direct measurements for total alpha and beta surface activity per unit area were calculated for counts from the Ludlum Model 2350-1 Data Logger by the equation that follows.

$$A = \frac{C \times \left(\frac{1}{t_s}\right) - \left[R_b + \left(A_m \times E \times \frac{a}{100}\right)\right]}{E \times \left(\frac{a}{100}\right)}$$

Where:
- A = net surface activity (dpm/100 cm^2),
- C = integrated gross counts (counts),
- t_s = sample count time (min),
- R_b = background count rate (cpm),
- A_m = naturally-occurring material-specific surface activity (dpm/100 cm^2),
- E = efficiency of the survey instrument (cpd), and
- a = detector area (cm^2).

- Measurements for Removable Surface Contamination

  For the measurements of removable alpha and beta surface contamination, Survey Technicians analyzed smear samples taken from an approximate 100-cm^2 area. The following equation was used to convert gross counts into net activity per unit area.

$$A = \frac{C \times \left(\frac{1}{t_s}\right) - R_b}{E \times \left(\frac{a}{100}\right)}$$

Where:
- A = net removable activity (dpm/100 cm^2),
- C = integrated gross counts (counts),
- t_s = sample count time (min),
- R_b = background count rate (cpm),
- E = efficiency of the survey instrument (cpd), and
- a = area of the sample (cm^2).

- Mean and Standard Deviation

  The following equations were used to calculate the mean and standard deviation of characterization measurements in a survey package data set:

$$\bar{x} = \frac{1}{n}\sum x_i$$

Where:
- $\bar{x}$ = the mean of the measurements
- x_i = the individual measurement
- n = the number of sample measurements

$$S = \sqrt{\frac{\sum\left(\bar{x} - x_i\right)^2}{n-1}}$$

Where:
- s = the standard deviation of the population
- $\bar{x}$ = the mean of the measurements
- x_i = the individual measurement
- n = the number of sample measurements

6.2 Deviations from FSS Plans or Procedures

There were no significant deviations from project plans and procedures. However, during the performance of the surveys there were occasionally interferences that prevented a survey being completed as planned. Such instances were documented in survey packages, which were then reviewed and approved. For example a survey location may have been designated which falls in an opening on a wall. In this case the survey point would most likely have been offset to the nearest location which could be surveyed and the offset noted in the survey package.

6.3 Results Summary

The results for each survey area indicated that there was no activity detected in excess of the $DCGL_W$ demonstrating that each survey unit met the release criteria.

The results for beta scan surveys are summarized in Table 6-2 below. Note as discussed previously these results **do not** include the subtraction of background activity. The average background activity was about 250 cpm/100cm^2 or about 1,000 dpm/100 cm^2.

Table 6-2: BMS Beta Survey Results Summary

Package	Number of Measurements	Mean dpm/100 cm^2	Standard Deviation dpm/100 cm^2	Median dpm/100 cm^2	Maximum dpm/100 cm^2
A0100	16	1,163	86	1,164	1,323
A0200	18	1,193	150	1,171	1,733
A0310	16	1,108	61	1,106	1,227
A0400	18	1,121	69	1,132	1,216
A0500	17	1,095	96	1,085	1,234
A0600	22	2,258	245	2,296	2,740
A0700	23	997	102	968	1,192
A0800	23	727	203	658	1,239
A0810	20	935	349	813	2,106
A0900	34	1,045	82	1,043	1,214
A1000	16	1,013	156	985	1,268
A1100	50	856	405	746	2,395
A1200	39	1,188	88	1,192	1,398
A1300	28	1,250	83	1,263	1,392
A1400	13	1,359	119	1,323	1,572
A1500	23	962	60	978	1,076
A1600	22	1,462	432	1,276	2,367
A1610	21	1,363	145	1,335	1,767
A1620	21	1,472	235	1,408	2,136
A1700*	22	440	393	507	1,051
A1910	15	807	176	762	1,159
B0100	24	1,378	133	1,415	1,651
B0200	28	1,141	154	1,169	1,427
B0300	31	1,177	234	1,129	2,049
B0310	24	1,074	116	1,071	1,248
B0400	25	1,166	264	1,165	1,989
B0600	30	1,135	122	1,152	1,320
B0700	46	1,271	434	1,148	2,894
B0800	20	1,128	167	1,141	1,353
B0900	31	1,007	168	987	1,370
B0910	23	1,206	136	1,228	1,475
B1000	43	1,040	164	1,039	1,315
B1100	39	1,110	283	1,046	2,564

Package	Number of Measurements	Mean dpm/100 cm^2	Standard Deviation dpm/100 cm^2	Median dpm/100 cm^2	Maximum dpm/100 cm^2
B1200	26	1,088	137	1,103	1,277
B1300	26	1,101	162	1,086	1,418
B1400	30	928	107	917	1,142
B1500	16	1,044	197	1,058	1,386
B1600	18	983	107	978	1,170
B1700	16	1,032	178	975	1,494
B1800	20	995	172	961	1,347
B1900	30	926	638	811	4,247
B2000	28	800	125	821	1,016
B2100	27	678	132	658	982
B2200	33	791	175	768	1,299
B2300	25	701	83	680	866
B2400	20	1,206	100	1,210	1,319
B2500	17	1,085	179	1,103	1,507
C0100	24	1,071	121	1,102	1,283
C0200	20	981	212	956	1,629
C0300	33	969	233	925	1,939
C0310	30	1,113	291	1,075	2,477
C0400	20	1,179	376	1,123	2,614
C0500	29	1,848	419	1,812	2,632
C0600	28	1,742	376	1,624	2,632
C0700	16	961	70	968	1,072

***** This was a RG 1.86 survey and the pit was removed, characterization survey data reported for information only.

The mean of all results was 1,114 dpm/100 cm^2. This corresponds to a projected annual dose of about 4 mrem/year as compared to the NJDEP 15 mrem/year criteria (note: the average background of about 1,000 dpm/100 cm^2 was not subtracted to arrive at the projected 4 mrem/yr annual dose.

The results for soil surveys are summarized in Table 6-3 below.

Table 6-3: BMS Soil Survey Results Summary

Package*	Measurements	Radionuclide	Mean (pCi/g)	Standard Deviation (pCi/g)	Median (pCi/g)	Maximum (pCi/g)
A0300	17	Co-60	0.23	0.43	0.014	1.44
		Cs-137	0.59	1.09	0.073	3.74
B2600	16	Ac/Th-228 pCi/g	0.49	0.20	0.47	0.89
		Co-60 pCi/g	-0.0005	0.010	-0.0025	0.030
		Cs-137pCi/g	0.041	0.087	0.018	0.363
		K-40 pCi/g	10.15	3.14	10.57	13.68
B2700	16	Ac/Th-228 pCi/g	0.32	0.09	0.30	0.53
		Co-60 pCi/g	-0.0008	0.009	-0.0020	0.019
		Cs-137pCi/g	0.021	0.063	0.004	0.254
		K-40 pCi/g	7.25	4.93	5.83	17.22
D0100	5	Co-60 pCi/g	0.002	0.004	0.002	0.008
		Cs-137pCi/g	-0.001	0.006	-0.002	0.008
D0100 Characterization	19	Co-57 pCi/g	0.023	0.099	0.0000	0.430
		Co-60 pCi/g	0.000	0.000	0.0000	0.000
		Cs-134pCi/g	0.012	0.033	0.0000	0.114
		Cs-137pCi/g	0.012	0.021	0.0000	0.053
		Mn-54 pCi/g	0.004	0.015	0.0000	0.067
E0100	16	Co-60 pCi/g	0.006	0.008	0.0057	0.016
		Cs-137pCi/g	0.214	0.143	0.2195	0.429
E0200	3	Co-60 pCi/g	-0.003	0.006	-0.003	0.004
		Cs-137pCi/g	-0.012	0.008	-0.009	-0.006
E0200 Characterization	33	Co-60 pCi/g	0.000	0.000	0.0000	0.000
		Cs-134pCi/g	0.002	0.009	0.0000	0.045
		Cs-137pCi/g	0.014	0.028	0.0000	0.114
		Mn-54 pCi/g	0.001	0.004	0.0000	0.023

* Results were from the Framatome ANP Environmental Laboratory (an NJDEP certified laboratory), Westborough, MA except for the characterization results. Characterization results for Packages D0100 Characterization and E0200 Characterization were from the Duratek, Inc on-site laboratory that provided the characterization results in 2001.

6.3.1 Investigations Resulting from Survey Action Level Triggers

There was only one area where final status survey activities triggered an investigation based on a survey action trigger. This trigger occurred while surveying a large HEPA housing on the south end of the second floor of Building 124. The activities noted were near the $DCGL_W$ limit. An investigation resulted in removal of some ducting attached to this HEPA housing and some minor portions of the HEPA housing itself. A new Class 1 survey package, A1910, was established for the HEPA housing interior and it was surveyed and released.

6.3.2 Data Quality Objective Attainment

The instrumentation used during the final status survey was adequate to detect the radionuclides of concern at this facility. Count times and measurement techniques utilized ensured MDCs were <50% of the $DCGL_W$ and that scan MDCs were less than the $DCGL_{EMC}$. The COMPASS program (Ref. 5-1) was used in developing the data survey requirements. The results for each survey area indicated that there was no activity detected in excess of the $DCGL_W$ demonstrating that each survey unit met the release criteria.

The DCGLs were established such that the TEDE to an average member of the critical group from residual contamination did not exceed either 25 mrem/year for NRC regulated radionuclides or 15 mrem/year for NJDEP regulated radionuclides.

The number of measurements taken for each survey unit met or exceeded the number established using COMPASS and the guidance provided in the MARSSIM manual.

6.3.3 Survey Overview

The project team performed 1,642 alpha, beta and exposure rate survey measurements and collected 125, soil samples for analysis as defined in the survey packages to complete the BMS facility and site characterization. The totals exclude measurements taken during the site characterization except for the soils around the tank vaults. Measurements were performed using appropriate calibrated instruments and with daily instrument quality control (QC) checks performed before and after each day's work. Table 6-4 summarizes the number types of measurements and samples performed or collected for the survey for each survey classification

Table 6-4Table 6-4: Total Number of Survey Measurements Performed

Survey Measurement Type	**Number of Measurements and Samples**			
	Class 1 Survey Unit	**Class 2 Survey Unit**	**Class 3 Survey Unit**	**Total**
Direct Beta	439	696	200	**1,335**
Direct Alpha	5	8	0	**13**
Exposure Data	11	158	107	**276**
Removable H-3	15	0	0	**15**
Soil Samples	17	32	76	**125**
Total	**487**	**894**	**1,381**	**1,767**

The project team marked the survey measurement or sample points at the location and on drawings depicting the survey area or survey unit as applicable. Survey data collected during the project was downloaded from survey instruments into a database for storage, analysis, and reporting. Supervisory personnel reviewed the completed survey packages to ensure that all required surveys were performed and that the completed survey packages contained all necessary information.

6.4 Results by Survey Unit

Results include the following:

- Survey Unit Location Map;
- Measured sample concentrations including mean, median, standard deviation;
- Plots of data;
- A discussion of anomalous data, including any areas of elevated direct radiation detected during scanning that exceeded the investigation level or measurement locations in excess of $DCGL_W$;
- The results of statistical tests (WRS or Sign) and any elevated measurement comparisons;
- A discussion of any survey units that fail the statistical test must be clearly identified as well as the actions taken to ultimately pass the survey unit. These actions may include remediation and resurvey, resurvey alone, or supplementing the initial sample size with additional samples;
- A statement that a given survey unit satisfied the $DCGL_W$ and the elevated measurement comparison if any sample points exceeded the $DCGL_W$;
- Detailed results in appendices that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, smear results and laboratory analysis data.

6.4.1 Package A0100: B-124 Room 146 and 147 Floors

The areas included in this survey package were the floors in Rooms 146 and 147 of Building 124 as shown on the Figure 6-1 location drawing. This was a 90 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 13 fixed beta measurements required by the survey design and 16 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0100	Mean	Standard Deviation	Median	Maximum	Measurements
(cpm/100 cm2)	276	20	276	313	16
(dpm/100 cm2)	1,163	86	1,164	1,323	

Survey unit A0100 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$. Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

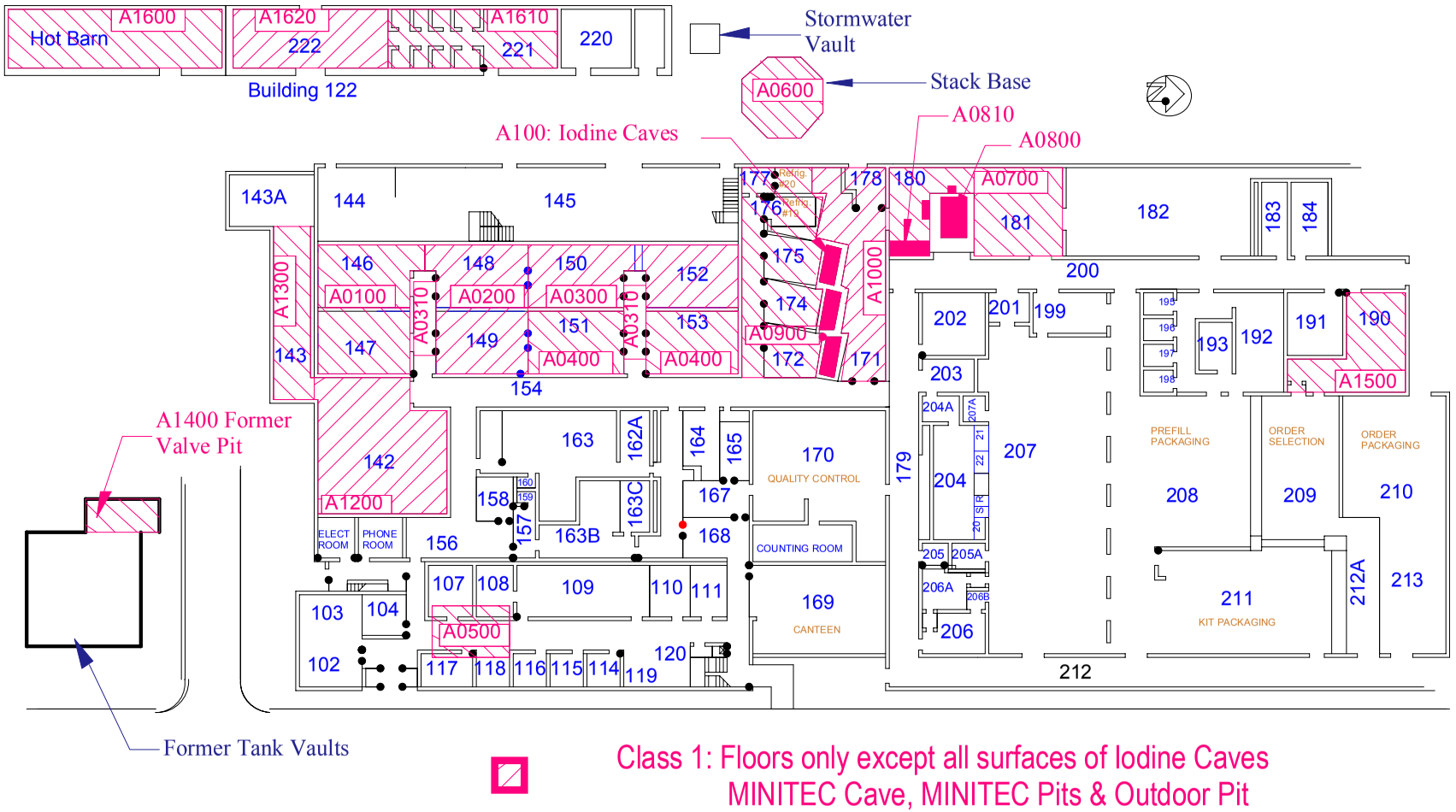


Figure 6-1: BMS B-124 First Floor Class 1 Areas

(Note: This is a multi-colored diagram.)

6.4.2 Package A0200: B-124 Room 148 and 149 Floors

The areas included in this survey package were the floors in Rooms 148 and 149 of Building 124 as shown on the Figure 6-1 location drawing. This was an 87 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 18 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0100	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	267	34	262	388	18
dpm/100 cm^2	1,193	150	1,171	1,733	

Survey unit A0200 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.3 A0300: B-124 Room 150 and 152 Soil

The areas included in this survey package were the soils in Rooms 150 and 152 of Building 124 as shown on the Figure 6-1 location drawing. This was a 94 m^2 Class 1 Area and the soils were exposed after the concrete floor slab was removed and contaminated soil was removed.

There were 13 soil samples required by the survey design and 17 soil samples were obtained. There were no readings in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package A0300	Mean (pCi/g)	Standard Deviation (pCi/g)	Median (pCi/g)	Maximum (pCi/g)	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60	0.23	0.43	0.014	1.44	17	3.80	6.1%
Cs-137	0.59	1.09	0.073	3.74		11.00	5.4%

The soil surface was 100% scanned for gamma activity. In addition there were two fixed-point gamma measurements taken at each sample location. The first point was taken at the soil surface and the second at one meter above the sample point. A summary of these results is presented below.

Package A0300	Mean	Standard Deviation	Median	Maximum	Measurements
Micro R/hr	10.8	3.8	9.9	32	125

Survey unit A0300 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, and download data.

6.4.4 A0310: B-124 Corridor 146C and 150C Floors

The areas included in this survey package were the floors in Corridors 146C and 150C of Building 124 as shown on the Figure 6-1 location drawing. This was a 32 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 16 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0310	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	254	14	253	281	16
dpm/100 cm^2	1,108	61	1,106	1,227	

Survey unit A0310 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.5 A0400: B-124 Room 151 and 153 Floors

The areas included in this survey package were the floors in Rooms 151 and 153 of Building 124 as shown on the Figure 6-1 location drawing. This was a 94 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 18 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0400	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	257	16	259	279	18
dpm/100 cm^2	1,121	69	1,132	1,216	

Survey unit A0400 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.6 A0500: B-124 Former Tank Area Floors

The areas included in this survey package were the floors over the Former Tank Area of Building 124 as shown on the Figure 6-1 location drawing. This was a 100 m^2 Class 1 Area and the floors were concrete or thin carpet over concrete.

The floors were 100% scanned for beta activity with no activity detected in excess of the DCGLW.

There were 14 fixed beta measurements required by the survey design and 17 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0500	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	251	22	248	283	17
dpm/100 cm^2	1,095	96	1,085	1,234	

Survey unit A0500 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.7 A0600: B-124 Stack Base

The area included in this survey package was the Building 124 Stack Base as shown on the Figure 6-1 location drawing. This was a 37 m2 Class 1 Area and the surface was concrete.

The surface was 100% scanned for beta activity with no activity detected in excess of the DCGLW.

There were 14 fixed beta measurements required by the survey design and 22 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0600	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	503	55	512	611	22
dpm/100 cm^2	2,258	245	2,296	2,740	

Survey unit A0600 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.8 A0700: B-124 Room 180 and 181 Floors

The areas included in this survey package were the floors in Rooms 180 and 181 of Building 124 as shown on the Figure 6-1 location drawing. This was an 87 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 13 fixed beta measurements required by the survey design and 23 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0700	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	240	25	233	287	23
dpm/100 cm^2	997	102	968	1,192	

Survey unit A0700 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.9 A0800: B-124 MINITEC Cave Floor, Walls & Ceiling

The areas included in this survey package were the floors, walls and ceiling in the MINITEC Cave of Building 124 as shown on the Figure 6-1 location drawing. This was a 46 m^2 Class 1 Area and all surfaces were concrete with the wall and ceiling surfaces covered with an epoxy type paint. The floor and lower wall surfaces in the former cave basement area were rough concrete.

The cave was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 15 fixed beta measurements required by the survey design and 23 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0800	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	166	46	150	283	23
dpm/100 cm^2	727	203	658	1,239	

Survey unit A0800 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.10 A0810: B-124 Floors & Walls of MINITEC Pits

The areas included in this survey package were the floors and walls in the three (3) MINITEC Pits of Building 124 as shown on the Figure 6-1 location drawing. This was a 26 m^2 Class 1 Area and all surfaces were bare concrete with rough concrete on the floor and wall surfaces in the Tank Pit as these areas had been scabbled.

The pits were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 15 fixed beta measurements required by the survey design and 20 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0810	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	213	79	185	480	20
dpm/100 cm^2	935	349	813	2,106	

The floor of the MINITEC Tank Pit was wet from below grade water in leakage so beta readings on the floor would not have been meaningful. Instead, gamma readings were taken from the scabbled concrete floor surface. A summary of these results is presented below.

Package A0810	Mean	Standard Deviation	Median	Maximum	Measurements
Micro R/hr	7.4	0.2	7.5	8	6

Survey unit A0810 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.11 A0900: B-124 Rooms 172, 174, 175, 176 an d 177 Floors

The areas included in this survey package were the floors in Rooms 172, 174, 175, 176 an d 177 of Building 124 as shown on the Figure 6-1 location drawing. This was an 82 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 34 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A0900	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	244	19	244	284	34
dpm/100 cm^2	1,045	82	1,043	1,214	

Survey unit A0900 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.12 A1000: B-124 Rooms 171 and 178 Floors

The areas included in this survey package were the floors in Rooms 171 and 178 of Building 124 as shown on the Figure 6-1 location drawing. This was a 74 m^2 Class 1 Area and the floors were linoleum tiles over a concrete slab.

The floors were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 16 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1000	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	237	36	231	297	16
dpm/100 cm^2	1,013	156	985	1,268	

Survey unit A1000 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.13 A1100: B-124 Iodine Caves Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceiling in the Iodine Caves of Building 124 as shown on the Figure 6-1 location drawing. This was a 78 m^2 Class 1 Area and all surfaces were concrete. The floor and some lower wall surfaces were rough concrete as some of these areas had been scabbled.

The cave was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 19 fixed beta measurements required by the survey design and 50 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1100	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	201	96	175	560	50
dpm/100 cm^2	856	405	746	2,395	

Survey unit A1100 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.14 A1200: B-124 Room 142 Floor

The area included in this survey package was the floor in Room 142 of Building 124 as shown on the Figure 6-1 location drawing. This was a 99 m2 Class 1 Area and the floor surface was a sealed concrete.

The floor was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 18 fixed beta measurements required by the survey design and 39 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1200	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	279	21	280	329	39
dpm/100 cm^2	1,188	88	1,192	1,398	

Survey unit A1200 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.15 A1300: B-124 Rooms 143 Floor

The area included in this survey package was the floor in Room 143 of Building 124 as shown on the Figure 6-1 location drawing. This was a 52 m2 Class 1 Area and the floor surface was a sealed concrete.

The floor was 100% scanned for beta activity with no activity detected in excess of the DCGLW.

There were 18 fixed beta measurements required by the survey design and 28 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1300	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	280	19	283	312	28
dpm/100 cm^2	1,250	83	1,263	1,392	

Survey unit A1300 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.16 A1400: B-124 Outside Valve Pit

The area included in this survey package was the Valve Pit south of Building 124 as shown on the Figure 6-1 location drawing. This was a 52 m^2 Class 1 Area and the floor surface was a sealed concrete. The NRC Reg. Guide 1.86 release criteria were used for this concrete pit. The Reg. Guide 1.86 beta-gamma limits were 5,000 dpm/100 cm^2 average, 15,000 dpm/100 cm^2 maximum and 1,000 dpm/100 cm^2 removable. The Reg. Guide 1.86 alpha limits were 100 dpm/100 cm^2 average, 300 dpm/100 cm^2 maximum and 20 dpm/100 cm^2 removable.

The floor was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 13 fixed beta measurements required by the survey design and 13 measurements were obtained. There were no readings in excess of 3,000 dpm/100 cm^2. A summary of these results is presented below.

Package A1400	Mean	Standard Deviation	Median	Maximum	Measurements
Beta cpm/100 cm^2	311	27	303	360	13
Beta dpm/100 cm^2	1,359	119	1,323	1,572	

There were 5 fixed alpha measurements taken on the valve pit prior to the removal of the pit concrete. A summary of these results is presented below.

Package A1400	Mean	Standard Deviation	Median	Maximum	Measurements
Alpha cpm/100 cm^2	3.5	1.5	3.5	5.5	5
Alpha dpm/100 cm^2	18.4	7.7	18.4	28.9	

A summary of the micro-R measurements taken is presented below.

Package A1400	Mean	Standard Deviation	Median	Maximum	Measurements
Gamma μ R/hr	4.4	0.1	4.4	4.6	5

Survey unit A1400 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

A smear sample was taken at each of the measurement locations and they were analyzed for alpha and beta activity. All the smear survey results were less than the Beta MDA of 108 dpm/100 cm^2 and the Alpha MDA of 14 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.17 A1500: B-124 Rooms 190 Floor

The area included in this survey package was the floor in Room 190 of Building 124 as shown on the Figure 6-1 location drawing. This was a 52 m^2 Class 1 Area and the floor surface was linoleum tiles over a concrete slab.

The floor was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 23 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1500	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	219	14	221	245	23
dpm/100 cm^2	962	60	978	1,076	

Survey unit A1500 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.18 A1600: B-122 Hot Barn Floor

The area included in this survey package was the floor in Hot Barn of Building 124 as shown on the Figure 6-1 location drawing. This was an 88 m2 Class 1 Area and the floor surface was a sealed concrete slab.

The floor was 100% scanned for beta activity with no activity detected in excess of the DCGLW.

There were 14 fixed beta measurements required by the survey design and 22 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1600	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	333	98	291	540	22
dpm/100 cm^2	1,462	432	1,276	2,367	

In addition there were 15 liquid scintillation smears taken for tritium on these floors. A summary of these results is presented below. The DCGL for tritium is 120,000,000 dpm/100 cm^2.

Package A1600	Mean	Standard Deviation	Median	Maximum	Measurements
H-3 dpm/100cm^2	-24	30	-27	36	15

Survey unit A1600 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.19 A1610: B-122 Room 221 Floor

The area included in this survey package was the floor in Room 221 of Building 122 as shown on the Figure 6-1 location drawing. This was a 71 m^2 Class 1 Area and the floor surface was a sealed concrete slab.

The floor was 100% scanned for beta activity with no activity detected in excess of the DCGLW.

There were 14 fixed beta measurements required by the survey design and 21 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1610	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	314	33	307	406	21
dpm/100 cm^2	1,363	145	1,335	1,767	

Survey unit A1610 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.20 A1620: B-122 Rooms 222 Floor

The area included in this survey package was the floor in Room 222 of Building 122 as shown on the Figure 6-1 location drawing. This was a 63 m^2 Class 1 Area and the floor surface was a sealed concrete slab.

The floor was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 21 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1620	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	338	55	324	491	21
dpm/100 cm^2	1,472	235	1,408	2,136	

Survey unit A1620 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.21 A1700: B-83 Outdoor Tank Vault

The area included in this survey package was the Tank Vault south of Building 83 as shown on the Figure 6-2 location drawing. The small vault on the end of the buried tanks associated with Building 83 was surveyed and released using the Reg. Guide 1.86 guidelines. The Reg. Guide 1.86 beta-gamma limits were 5,000 dpm/100 cm^2 average, 15,000 dpm/100 cm^2 maximum and 1,000 dpm/100 cm^2 removable. The Reg. Guide 1.86 alpha limits were 100 dpm/100 cm^2 average, 300 dpm/100 cm^2 maximum and 20 dpm/100 cm^2 removable. The vault was removed and disposed of off site as clean concrete. This area was included with the Class 1 Area survey results because of one elevated survey reading on a piece of equipment. The equipment was removed and disposed of separately.

Note, a separate survey package, E0200, was generated for the soils under the tank and tank vault area for use after the tanks and vault were removed.

The concrete surfaces were 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed the Reg. Guide 1.86 limits. All the smear survey results were less than the Beta MDA of 108 dpm/100 cm^2 and the Alpha MDA of 14 dpm/100 cm^2.

Survey unit A1700 met Reg. Guide 1.86 release guidelines with no readings exceeding the release limits.

Detailed results are in Appendix A that include the above plus the survey packages and smear results.

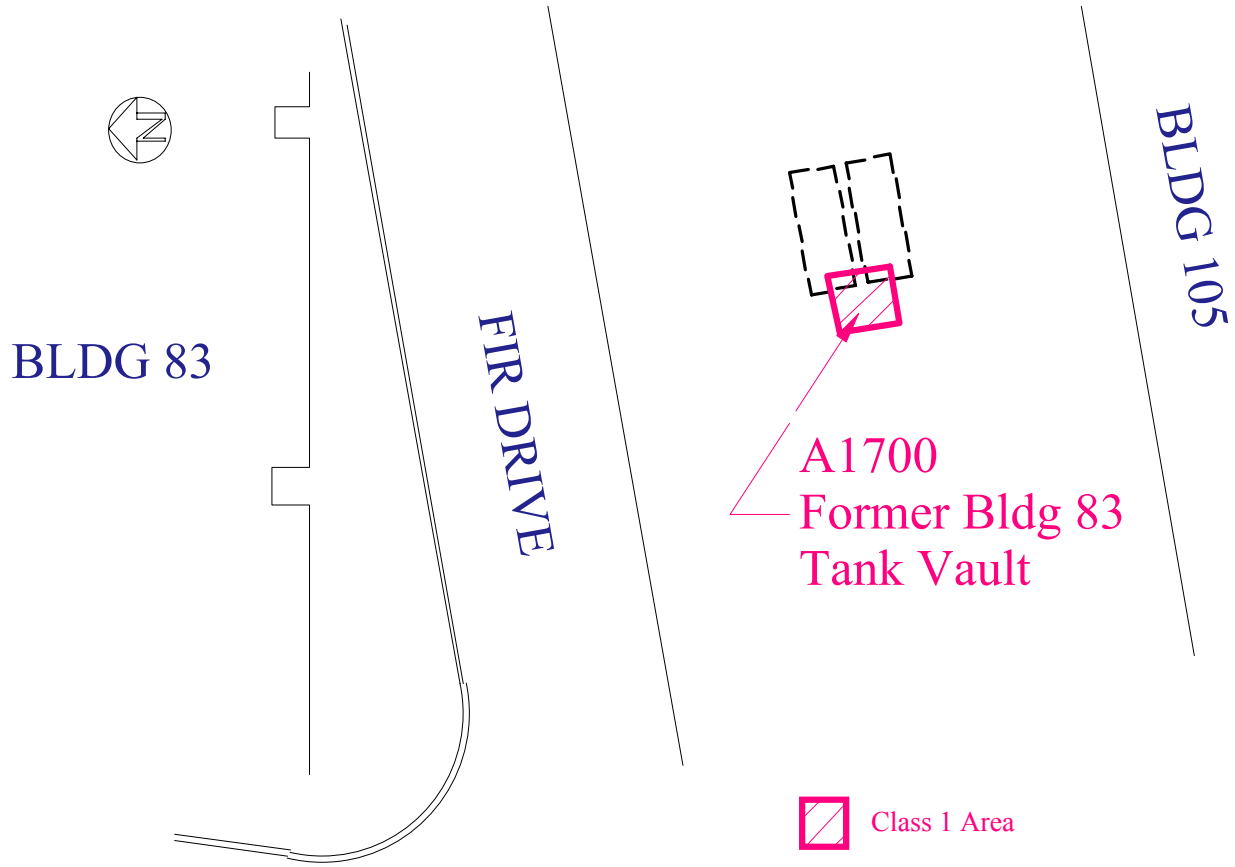


Figure 6-2: BMS B-83 Tank Vault Class 1 Area

(Note: This is a multi-colored diagram.)

6.4.22 A1910: B-124 HEPA Housing

This package was generated after a large HEPA housing that was left in place on the second floor of Building 124 was found to be contaminated. The unit was decontaminated and portions of the unit were removed. The survey area includes the interior surfaces of the HEPA housing as shown on the Figure 6-3 location drawing. This was an 18 m^2 Class 1 Area and the interior surfaces were steel.

The interior was 100% scanned for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 15 measurements were obtained. There were no readings in excess of the $DCGL_W$ (7,100 dpm/100 cm^2 or ~ 1,775 cpm/100cm^2). A summary of these results is presented below.

Package A1910	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	182	40	172	262	15
dpm/100 cm^2	807	176	762	1,159	

Survey unit A1910 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 107 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

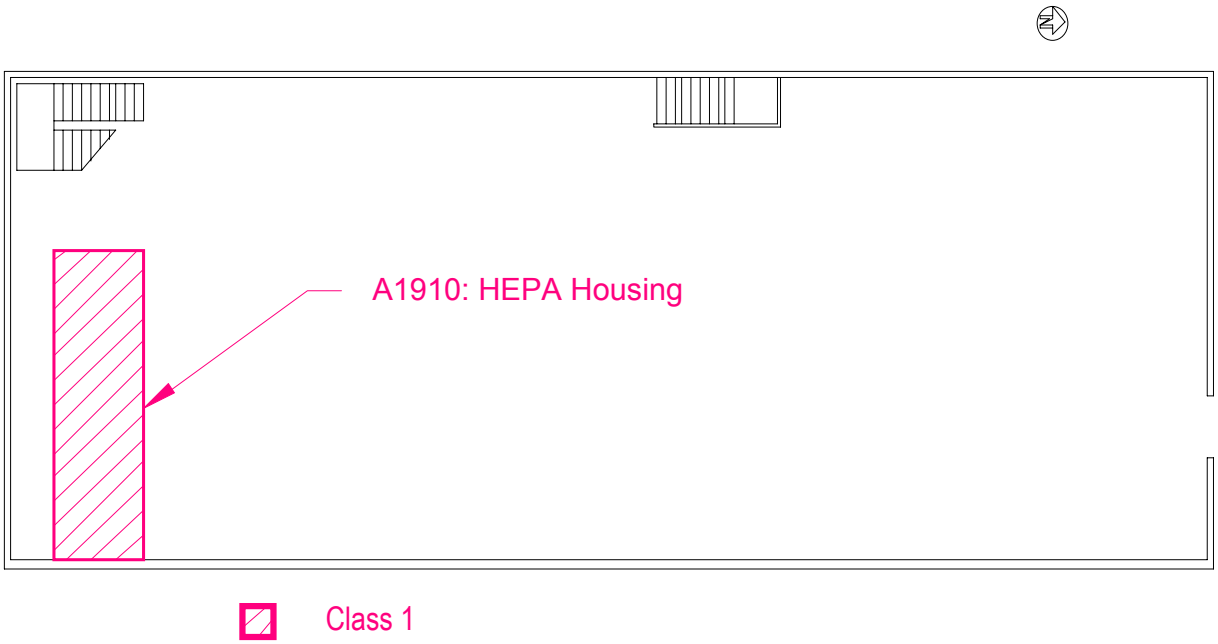


Figure 6-3: BMS B-124 Old Section Second Floor Class 1 Area

(Note: This is a multi-colored diagram.)

6.4.23 B0100: B-124 Outdoor Tank Vault

The areas included in this survey package were the concrete tank vaults to the south of Building.124 as shown on the Figure 6-4 location drawing. The vaults were surveyed and removed. The soils around the vaults were sampled previously and reported in the characterization report. In addition there were 24 samples taken after the vaults were removed as shown on the map in the survey package. This was a 582 m^2 Class 2 Area. All surfaces were concrete.

Package B0100	Mean	Standard Deviation	Median	Maximum	Measurements
Beta cpm/100 cm^2	315	30	324	378	24
Beta dpm/100 cm^2	1,378	133	1,415	1,651	

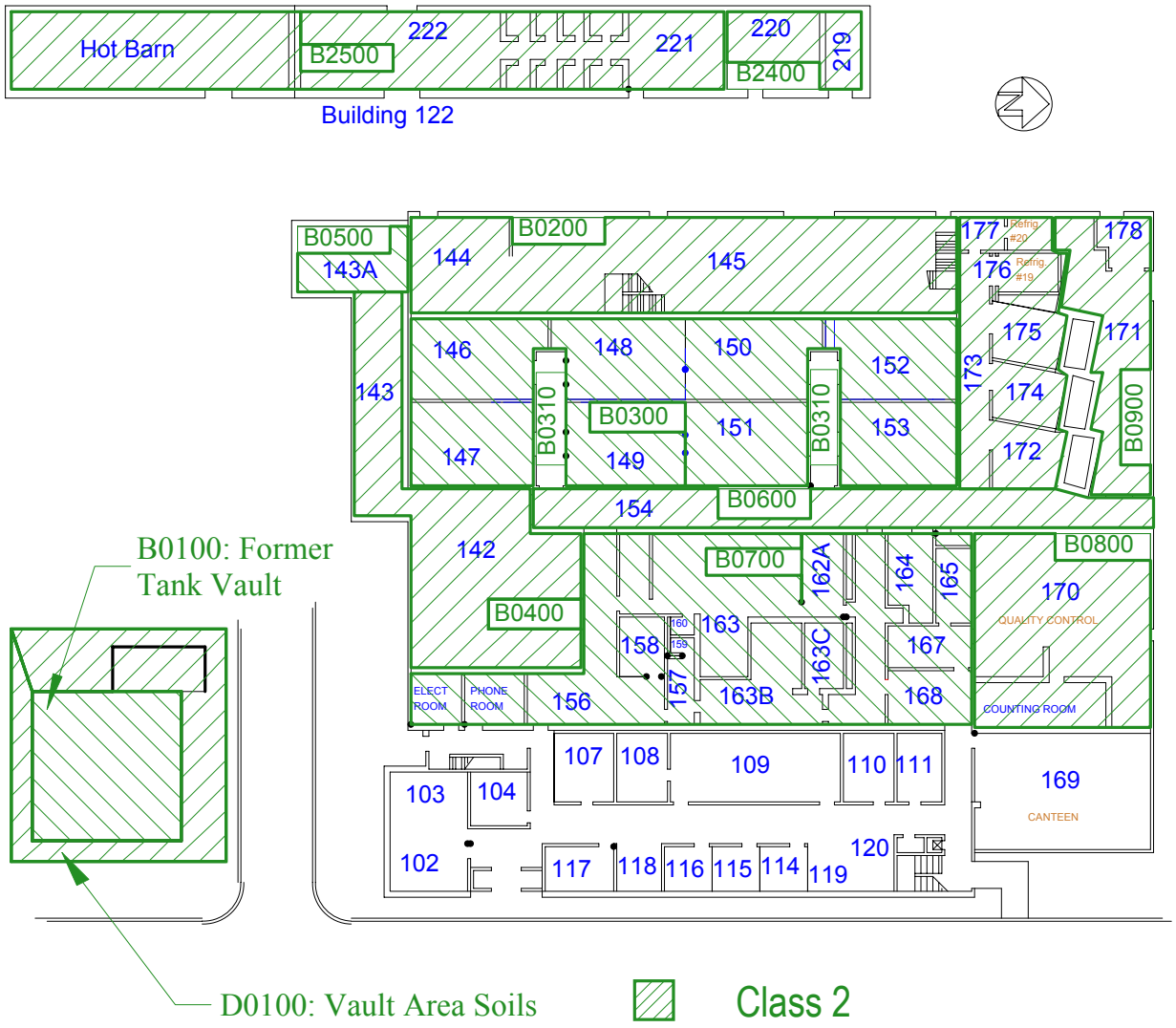


Figure 6-4: BMS B-124 Old Section First Floor Class 2 Areas

(Note: This is a multi-colored diagram.)

6.4.24 B0200: B-124 Rooms 144 and 145 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 144 and 145 in Building 124 as shown on the Figure 6-4 location drawing. This was a 71 m^2 Class 2 Area. The floor surfaces were sealed concrete, the walls were sealed concrete and sealed block and the ceilings were sealed concrete.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 28 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0200	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	254	34	261	318	28
dpm/100 cm^2	1,141	154	1,169	1,427	

Survey unit B0200 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.25 B0300: B-124 Rooms 146 to 153 Walls & Ceilings

The areas included in this survey package were the walls and ceilings (no floors) in Rooms 146 to 153 in Building.124 as shown on the Figure 6-4 location drawing. This was a 990 m^2 Class 2 Area. The walls and ceilings were painted drywall.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 31 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0300	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	275	55	264	479	31
dpm/100 cm^2	1,177	234	1,129	2,049	

Survey unit B0300 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.26 B0310: B-124 Corridors 146C and 150C Walls & Ceilings

The areas included in this survey package were the walls and ceilings (no floors) in Corridors 146C and 150C in Building.124 as shown on the Figure 6-4 location drawing. This was a 148 m^2 Class 2 Area. The walls and ceilings were painted drywall.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 24 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0310	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	246	26	245	286	24
dpm/100 cm^2	1,074	116	1,071	1,248	

Survey unit B0310 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.27 B0400: B-124 Rooms 142 and 143 Walls & Ceilings

The areas included in this survey package were the walls and ceilings (no floors) in Rooms 142 & 143 in Building.124 as shown on the Figure 6-4 location drawing. This was a 402 m^2 Class 2 Area. The 142 walls were painted concrete blocks and concrete and the ceiling was painted concrete. The 143 walls were concrete block and wood; the ceiling was plastic film over insulation.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 25 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0400	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	272	61	271	463	25
dpm/100 cm^2	1,166	264	1,165	1,989	

Survey unit B0400 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.28 B0500: B-124 Room 143A Floor, Walls & Ceiling

The areas included in this survey package were the floors walls and ceilings in Room 143A in Building.124 as shown on the Figure 6-4 location drawing. This was a 190 m^2 Class 2 Area. The floor was bare concrete and the walls and ceilings were painted metal.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 26 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0500	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	274	97	234	551	26
dpm/100 cm^2	1,223	434	1,045	2,459	

Survey unit B0500 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.29 B0600: B-124 Hallway 154 Floor, Walls & Ceiling

The areas included in this survey package were the floor walls and ceiling in Hallway 154 in Building.124 as shown on the Figure 6-4 location drawing. This was a 442 m^2 Class 2 Area. The floors were linoleum covered concrete, the walls were painted drywall and the ceilings were acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 30 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0600	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	260	28	264	302	30
dpm/100 cm^2	1,135	122	1,152	1,320	

Survey unit B0600 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.30 B0700: B-124 Rooms 155 to 168 Floors, Walls & Ceilings

The areas included in this survey package were the floors walls and ceilings in Rooms 155 to 168, phone room and electrical room in Building.124 as shown on the Figure 6-4 location drawing. This was a 908 m^2 Class 2 Area. The floors were linoleum covered concrete; the walls were painted drywall and the ceilings were acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 46 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0700	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	299	102	270	680	46
dpm/100 cm^2	1,271	434	1,148	2,894	

Survey unit B0700 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.31 B0800: B-124 Room 170 to 168 Floor, Walls & Ceiling

The areas included in this survey package were the floor walls and ceiling in Room 170 in Building.124 as shown on the Figure 6-4 location drawing. This was a 345 m^2 Class 2 Area. The floor was linoleum covered concrete, the walls were painted drywall and the ceiling was suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 20 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0800	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	253	37	256	303	20
dpm/100 cm^2	1,128	167	1,141	1,353	

Survey unit B0800 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.32 B0900: B-124 Rooms 171 to 178 Walls & Ceilings

The areas included in this survey package were the walls and ceilings in rooms 171 to 178 in Building 124 as shown on the Figure 6-4 location drawing. This was a 654 m^2 Class 2 Area. The walls were painted drywall and the ceilings were suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 31 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0900	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	236	39	231	321	31
dpm/100 cm^2	1,007	168	987	1,370	

Survey unit B0900 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.33 B0910: B-124 Rooms 180 to 181 Walls & Ceilings

The areas included in this survey package were the walls and ceilings in rooms 180 and 181 in Building.124 as shown on the Figure 6-5 location drawing. This was a 357 m^2 Class 2 Area. The walls were painted concrete and the ceilings were a combination of painted concrete and suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 23 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B0910	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	291	33	296	356	23
dpm/100 cm^2	1,206	136	1,228	1,475	

Survey unit B0910 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

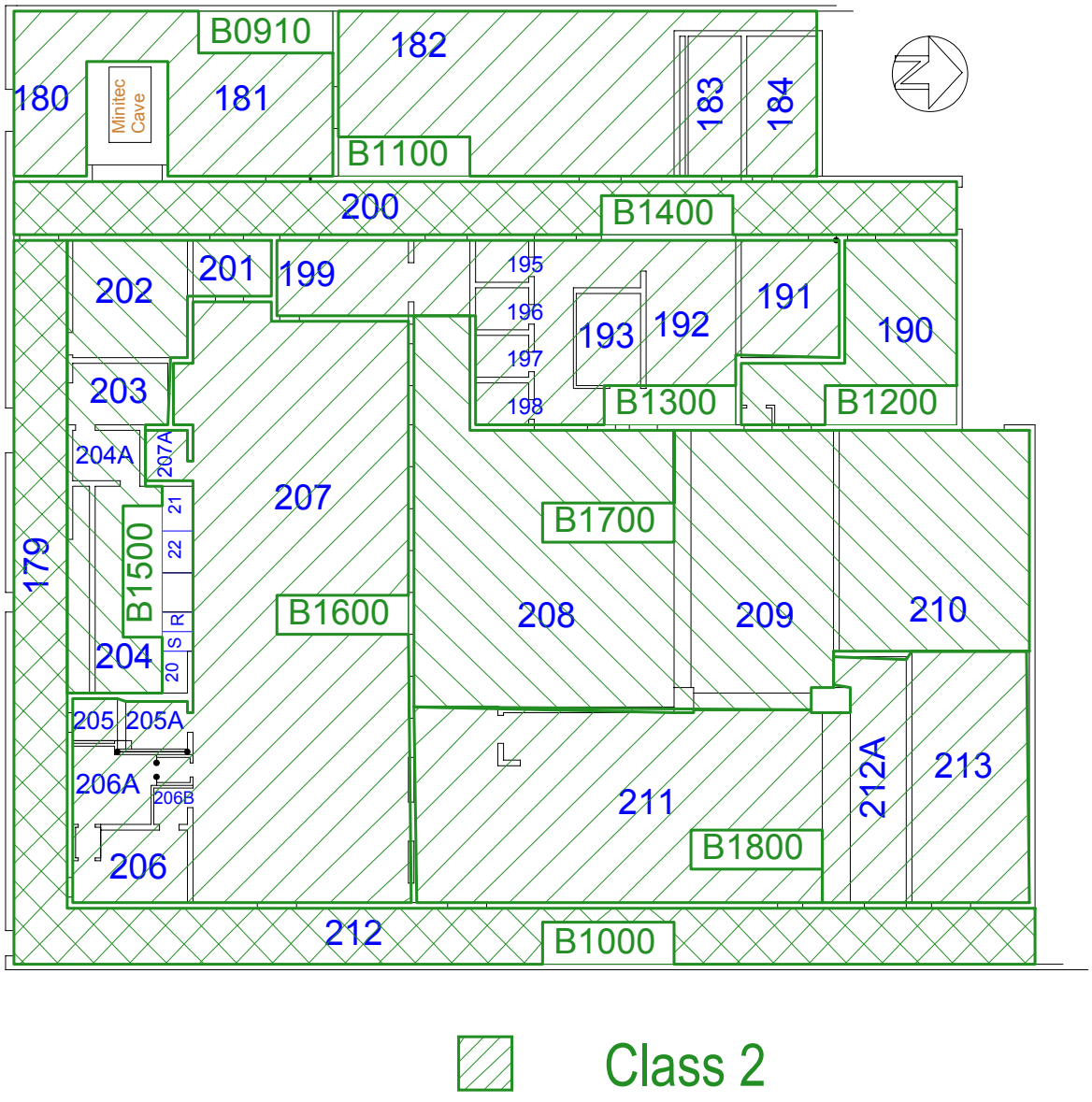


Figure 6-5: BMS B-124 New Section First Floor Class 2 Areas

(Note: This is a multi-colored diagram.)

6.4.34 B1000: B-124 Hallways 179 and 212 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Hallways 179 and 212 in the new section of Building.124 as shown on the Figure 6-5 location drawing. This was a 859 m^2 Class 2 Area. The floors were linoleum tiles over concrete, the walls were painted concrete and the ceilings were suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 43 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1000	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	239	38	239	302	43
dpm/100 cm^2	1,040	164	1,039	1,315	

Survey unit B1000 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.35 B1100: B-124 Rooms 182 to 184 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 182 to 184 in the new section of Building.124 as shown on the Figure 6-5 location drawing. This was a 543 m^2 Class 2 Area. The floors were linoleum tiles over concrete, the walls were painted concrete and the ceilings were suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 28 fixed beta measurements required by the survey design and 39 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1100	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	255	65	238	590	39
dpm/100 cm^2	1,110	283	1,046	2,564	

Survey unit B1100 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.36 B1200: B-124 Room 190 Walls & Ceiling

The areas included in this survey package were the walls and ceiling in Room 190 in the new section of Building 124 as shown on the Figure 6-5 location drawing. This was a 132 m^2 Class 2 Area. The walls were painted concrete and painted wallboard and the ceiling was suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 13 fixed beta measurements required by the survey design and 26 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1200	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	248	31	252	291	26
dpm/100 cm^2	1,088	137	1,103	1,277	

Survey unit B1200 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.37 B1300: B-124 Rooms 191 to 199 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 191 to 199 in the new section of Building 124 as shown on the Figure 6-5 location drawing. This was a 570 m^2 Class 2 Area. The floors were linoleum tiles over concrete, the walls were painted concrete and painted wallboard and the ceiling was suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 26 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1300	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	248	36	244	319	26
dpm/100 cm^2	1,101	162	1,086	1,418	

Survey unit B1300 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.38 B1400: B-124 Hallway 200 Floor, Walls & Ceiling

The areas included in this survey package were the floor, walls and ceiling in Hallway 200 in the new section of Building 124 as shown on the Figure 6-5 location drawing. This was a 433 m^2 Class 2 Area. The floors were linoleum tiles over concrete, the walls were painted concrete and painted wallboard and the ceiling was suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 30 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1400	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	212	24	209	260	30
dpm/100 cm^2	928	107	917	1,142	

Survey unit B1400 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.39 B1500: B-124 Rooms 201, 202, 203, 204 & 204A Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 201, 202, 203, 204 & 204A in the new section of Building 124 as shown on the Figure 6-5 location drawing. This was a 422 m^2 Class 2 Area. The floors were linoleum tiles over concrete, the walls were painted concrete and painted wallboard and the ceiling was suspended acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 16 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1500	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	235	44	238	312	16
dpm/100 cm^2	1,044	197	1,058	1,386	

Survey unit B1500 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.40 B1600: B-124 Rooms 205 to 207 Floors

The areas included in this survey package were the floors in Rooms 205 to 207 in Building 124 as shown on the Figure 6-5 location drawing. This was a 734 m^2 Class 2 Area. The floors were sealed concrete.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 18 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1600	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	224	24	223	267	18
dpm/100 cm^2	983	107	978	1,170	

Survey unit B1600 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.41 B1700: B-124 Rooms 208 to 210 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 208 to 210 in the new section of Building 124 as shown on the Figure 6-5 location drawing. This was a 1,000 m^2 Class 2 Area. The floors were linoleum tiles over concrete and the walls and the ceiling were painted wallboard.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 16 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1700	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	237	41	224	344	16
dpm/100 cm^2	1,032	178	975	1,494	

Survey unit B1700 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.42 B1800: B-124 Rooms 211, 212A and 213 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 211, 212A and 213 in the new section of Building 124 as shown on the Figure 6-5 location drawing. This was a 608 m^2 Class 2 Area. The floors were linoleum tiles over concrete and the walls and the ceiling were painted wallboard.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 20 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B1800	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	224	39	216	303	20
dpm/100 cm^2	995	172	961	1,347	

Survey unit B1800 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.43 B1900: B-124 Second Floor, Old Section, South End, Former Ventilation System Area

The areas included in this survey package were the floors, walls and ceilings in the former ventilation system area on the second floor, south end, of the old section Building 124 as shown on the Figure 6-6 location drawing. This was a 690 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the DCGLW.

There were 14 fixed beta measurements required by the survey design and 30 measurements were obtained. There was one reading, point #34, in excess of 50% of the $DCGL_W$ or greater than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. All other readings were less than 50% of the $DCGL_W$. Point #34 was added to the original survey plan to include a point inside a ventilation duct that had been remediated. The survey duct was 100% scanned and no other readings in excess of 50% of the $DCGL_W$ were detected. A summary of these results is presented below.

Package B1900	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	211	145	185	968	30
dpm/100 cm^2	926	638	811	4,247	

Survey unit B1900 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 107 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.44 B2000: B-124 Second Floor, Old Section, North End, Former Ventilation System Area

The areas included in this survey package were the floors, walls and ceilings in the former ventilation system area on the second floor, north end, of the old section Building 124 as shown on the Figure 6-6 location drawing. This was a 690 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 28 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B2000	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	182	28	187	232	28
dpm/100 cm^2	800	125	821	1,016	

Survey unit B2000 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 107 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

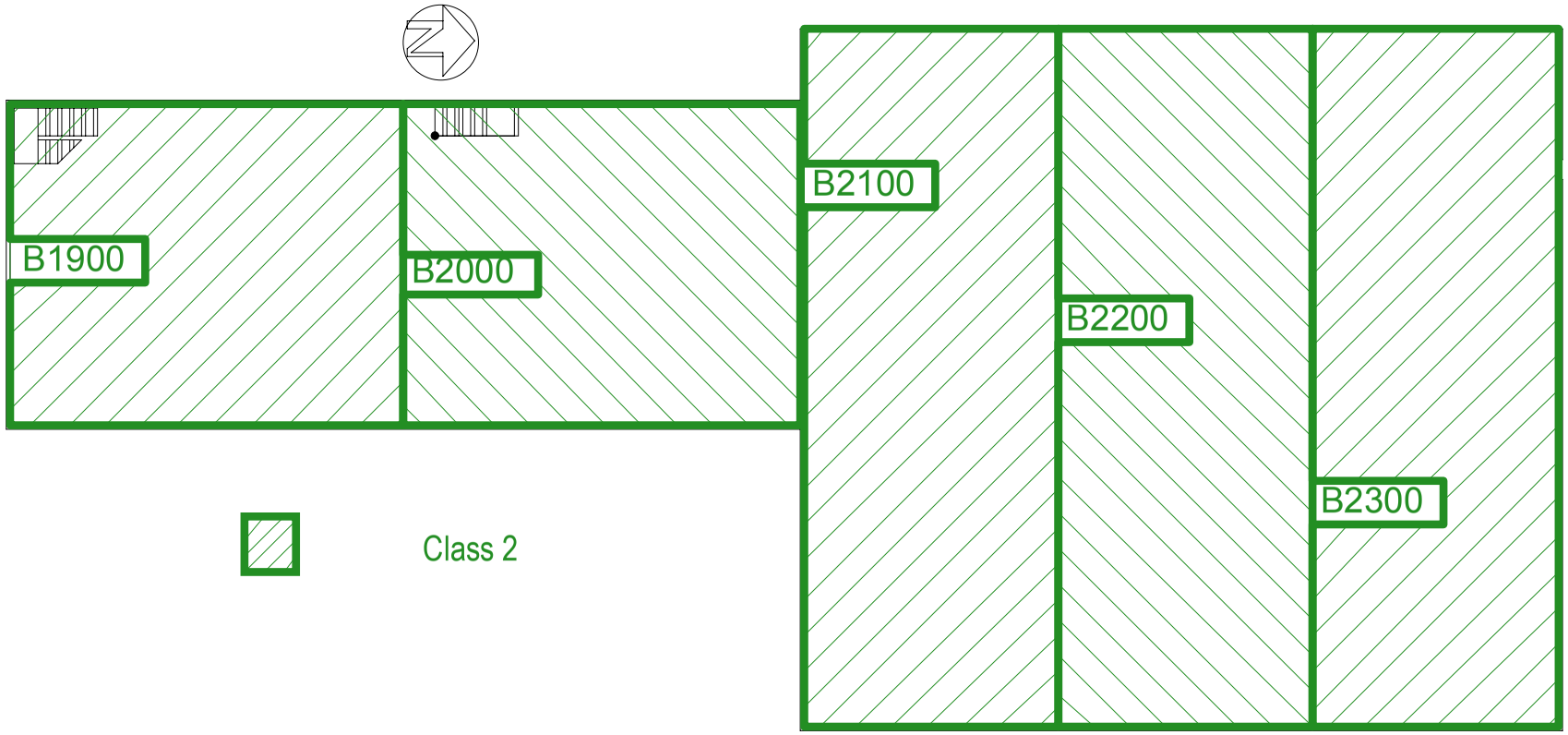


Figure 6-6: BMS B-124 Second Floor Class 2 Areas

(Note: This is a multi-colored diagram.)

6.4.45 B2100: B-124 Second Floor, New Section, South End, Former Ventilation System Area

The areas included in this survey package were the floors, walls and ceilings in the former ventilation system area on the second floor, south end, of the new section Building 124 as shown on the Figure 6-6 location drawing. This was an 875 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 27 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B2100	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	155	30	150	224	27
dpm/100 cm^2	678	132	658	982	

Survey unit B2100 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 107 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.46 B2200: B-124 Second Floor, New Section, Center Area, Former Ventilation System Area

The areas included in this survey package were the floors, walls and ceilings in the former ventilation system area on the second floor, center area, of the new section Building 124 as shown on the Figure 6-6 location drawing. This was an 875 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 33 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B2200	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	191	40	187	294	33
dpm/100 cm^2	791	175	768	1,299	

Survey unit B2200 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 107 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.47 B2300: B-124 Second Floor, New Section, North End, Former Ventilation System Area

The areas included in this survey package were the floors, walls and ceilings in the former ventilation system area on the second floor, north end, of the new section Building 124 as shown on the Figure 6-6 location drawing. This was an 875 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 25 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B2300	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	162	19	157	200	25
dpm/100 cm^2	701	83	680	866	

Survey unit B2300 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 107 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.48 B2400: B-122 Rooms 219 and 220 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 219 and 220 of Building 122 as shown on the Figure 6-4 location drawing. This was a 231 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 20 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B2400	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	271	23	272	297	20
dpm/100 cm^2	1,206	100	1,210	1,319	

Survey unit B2400 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.49 B2500: B-122 Hot Barn and Rooms 221 and 222 Walls & Ceilings

The areas included in this survey package were the walls and ceilings in the Hot Barn and Rooms 221 and 222 of Building 122 as shown on the Figure 6-4 location drawing. This was a 686 m^2 Class 2 Area. The floors were sealed concrete, the walls and ceiling were painted steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the DCGLW.

There were 14 fixed beta measurements required by the survey design and 17 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package B2500	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	247	41	252	344	17
dpm/100 cm^2	1,085	179	1,103	1,507	

Survey unit B2500 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.50 B2600: B-124 Pipe Trenches in Old Section of Building

The areas included in this survey package were the soils in exposed after removal of drain piping in all rooms except for 150 and 152 in the old section of Building 124 as shown on the Figure 6-7 location drawing. This was a 340 m long Class 2 Area and the soils were exposed after the concrete floor slab and piping were removed.

There were 14 soil samples required by the survey design and 17 soil samples were obtained. There were no readings in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package B2600	Mean (pCi/g)	Standard Deviation (pCi/g)	Median (pCi/g)	Maximum (pCi/g)	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60	-0.0005	0.010	-0.0025	0.030	17	3.80	-0.01%
Cs-137	0.041	0.087	0.018	0.363		11.00	0.37%

The soil surface was 100% scanned for gamma activity. In addition there were two fixed-point gamma measurements taken at each sample location. The first point was taken at the soil surface and the second at one meter above the sample point. A summary of these results is presented below.

Package B2600	Mean	Standard Deviation	Median	Maximum	Measurements
Micro R/hr	8.5	1.6	8.4	11.9	118

Survey unit B2600 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Detailed results are in Appendix A that includes the above plus the survey packages, COMPASS runs, sample location spreadsheets, and download data.

6.4.51 B2700: B-124 Pipe Trenches in New Section of Building

The areas included in this survey package were the soils exposed after removal of drain piping in all rooms in the new section of Building 124 as shown on the Figure 6-8 location drawing. This was a 166 m long Class 2 Area and the soils were exposed after the concrete floor slab and piping were removed.

There were 14 soil samples required by the survey design and 16 soil samples were obtained. There were no readings in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package B2700	Mean (pCi/g)	Standard Deviation (pCi/g)	Median (pCi/g)	Maximum (pCi/g)	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60	-0.0008	0.009	-0.0020	0.019	16	3.8	-0.02%
Cs-137	0.021	0.063	0.004	0.254		11.0	0.19%

The soil surface was 100% scanned for gamma activity. In addition there were two fixed-point gamma measurements taken at each sample location. The first point was taken at the soil surface and the second at one meter above the sample point. A summary of these results is presented below.

Package B2700	Mean	Standard Deviation	Median	Maximum	Measurements
Micro R/hr	6.1	0.9	6.0	8.9	32

Survey unit B2700 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Detailed results are in Appendix A that includes the above plus the survey packages, COMPASS runs, sample location spreadsheets, and download data.

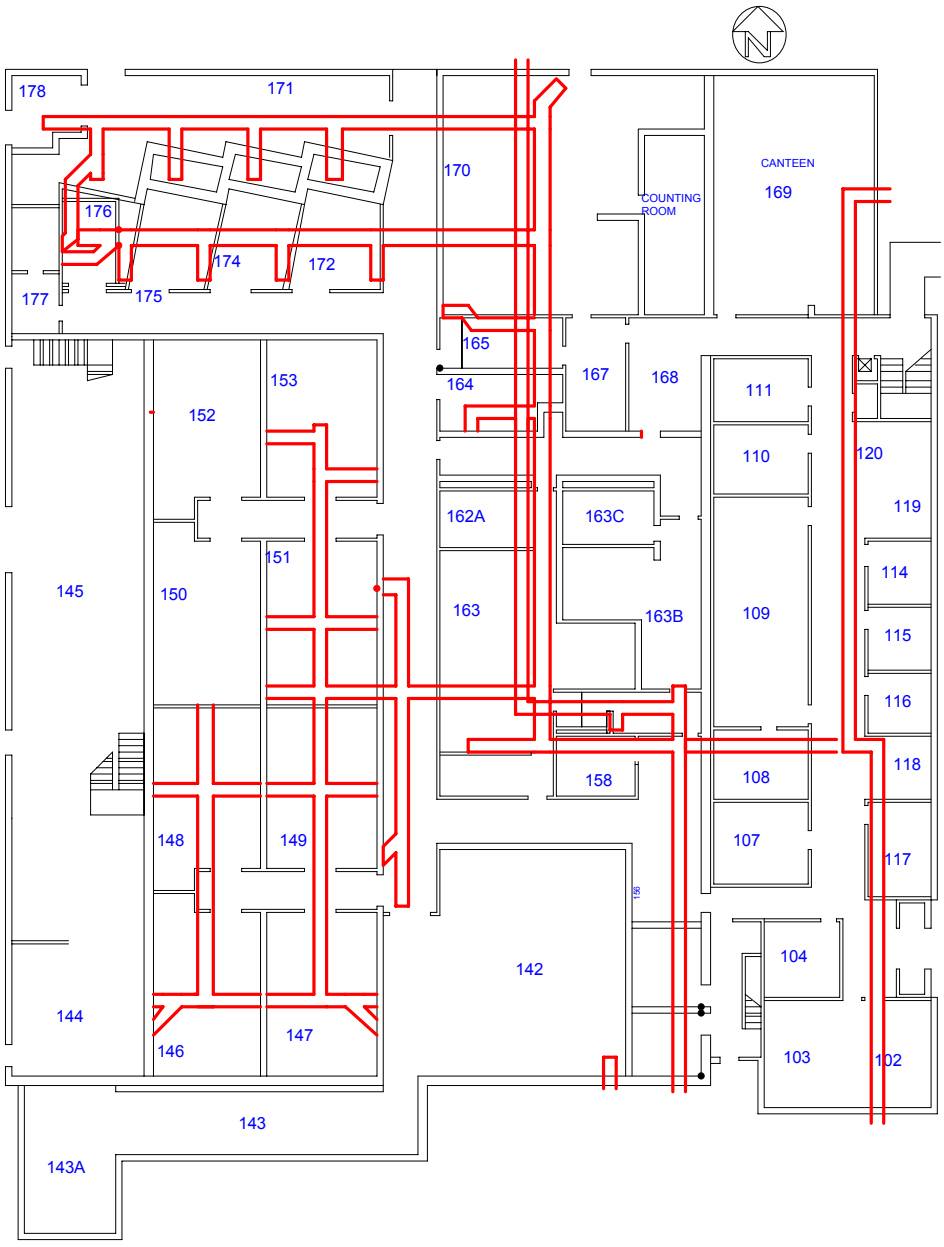


Figure 6-7: BMS B-124 Old Section Class 2 Area Pipe Trenches

(Note: This is a multi-colored diagram.)

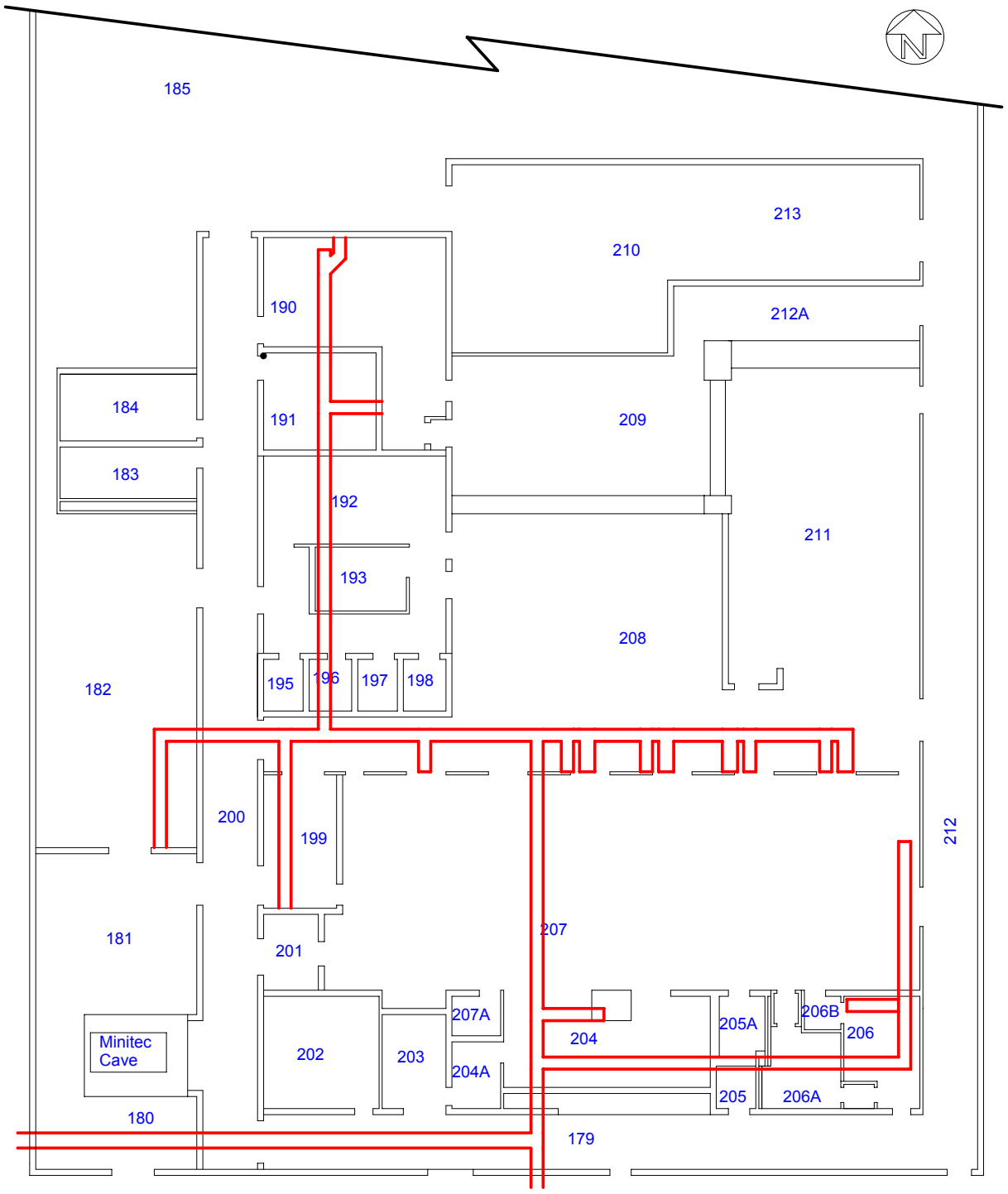


Figure 6-8: BMS B-124 New Section Class 2 Area Pipe Trenches

(Note: This is a multi-colored diagram.)

6.4.52 C0100: B-124 Old Section Duct Space Bottom, Walls & Ceiling

The areas included in this survey package were the bottom surface, walls and ceiling in the duct space (above first floor false ceiling and below floor slab for second floor as shown on the Figure 6-9 location drawing. This was a 3,561 m^2 Class 3 Area. The bottom surface was ceiling tile or plaster, the walls were concrete block or steel and the ceiling was concrete slab or steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 24 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0100	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	254	29	261	304	24
dpm/100 cm^2	1,071	121	1,102	1,283	

Survey unit C0100 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 106 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

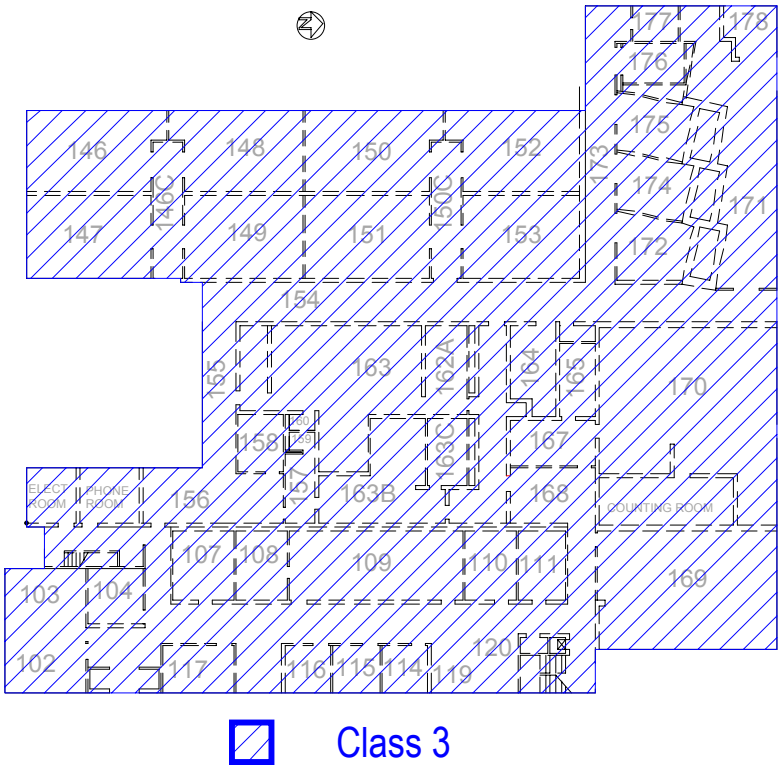


Figure 6-9: BMS B-124 Old Section Class 3 Area Above False Ceilings

(Note: This is a multi-colored diagram.)

6.4.53 C0200: B-124 New Section Duct Space Bottom, Walls & Ceiling

The areas included in this survey package were the bottom surface, walls and ceiling in the duct space (above first floor false ceiling and below floor slab for second floor as shown on the Figure 6-10 location drawing. This was a 3,819 m^2 Class 3 Area. The bottom surface was ceiling tile or plaster, the walls were concrete block or steel and the ceiling was concrete slab or steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 13 fixed beta measurements required by the survey design and 20 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0200	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	226	49	220	375	20
dpm/100 cm^2	981	212	956	1,629	

Survey unit C0200 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

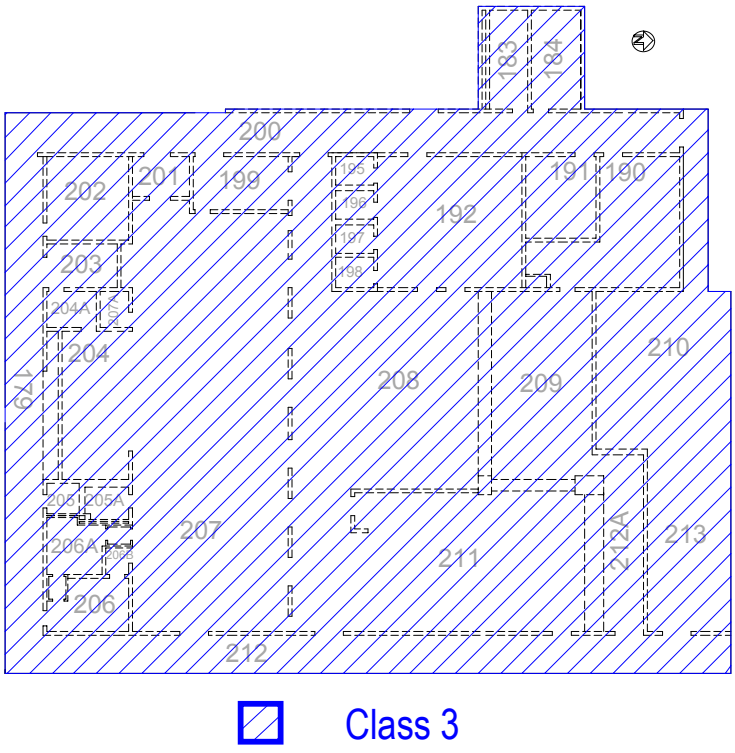


Figure 6-10: BMS B-124 New Section Class 3 Area Above False Ceilings

(Note: This is a multi-colored diagram.)

6.4.54 C0300: B-124 1st Floor Offices, Canteen, etc., Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in the 1st Floor Offices, Canteen, etc. as shown on the Figure 6-11 location drawing. This was a 1,787 m^2 Class 3 Area. The bottom surface was linoleum tile over concrete or carpet over concrete, the walls were painted wallboard and the ceiling was acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 33 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0300	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	228	55	217	456	33
dpm/100 cm^2	969	233	925	1,939	

Survey unit C0300 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 108 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.55 C0310: B-124 2nd Floor Offices, Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in the 2nd Floor Offices, Canteen, etc. as shown on the Figure 6-11 location drawing. This was a 1,559 m^2 Class 3 Area. The bottom surface was linoleum tile over concrete or carpet over concrete, the walls were painted wallboard and the ceiling was acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 30 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0310	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	249	65	241	555	30
dpm/100 cm^2	1,113	291	1,075	2,477	

Survey unit C0310 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 105 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

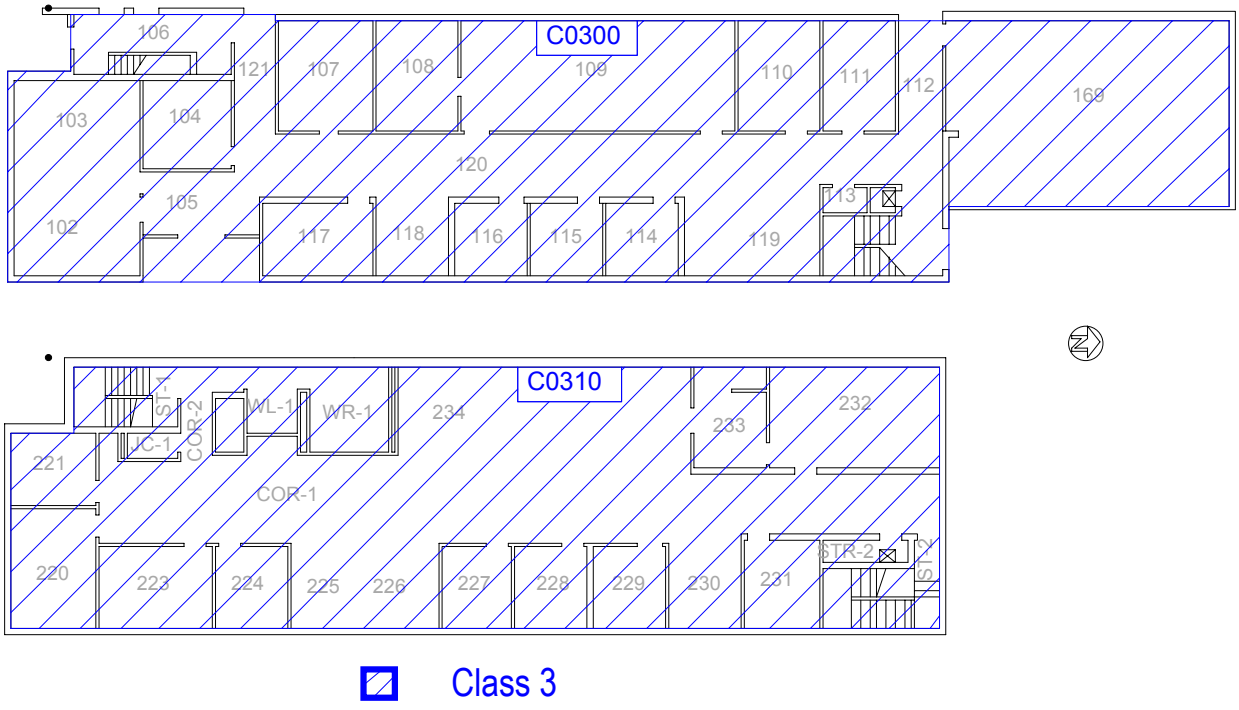


Figure 6-11: BMS B-124 New Section Class 3 Area Above False Ceilings

(Note: This is a multi-colored diagram.)

6.4.56 C0400: B-124 Rooms 185-189, 214 and 216 Floors, Walls & Ceilings

The areas included in this survey package were the floors, walls and ceilings in Rooms 185-189, 214 and 216 of Building 124 as shown on the Figure 6-12 location drawing. This was a 2,245 m^2 Class 3 Area. The floors were sealed concrete, the walls were painted wallboard, painted block or steel and the ceilings were concrete, steel or acoustic tile.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 13 fixed beta measurements required by the survey design and 20 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0400	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	268	86	256	596	20
dpm/100 cm^2	1,179	376	1,123	2,614	

Survey unit C0400 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 110 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

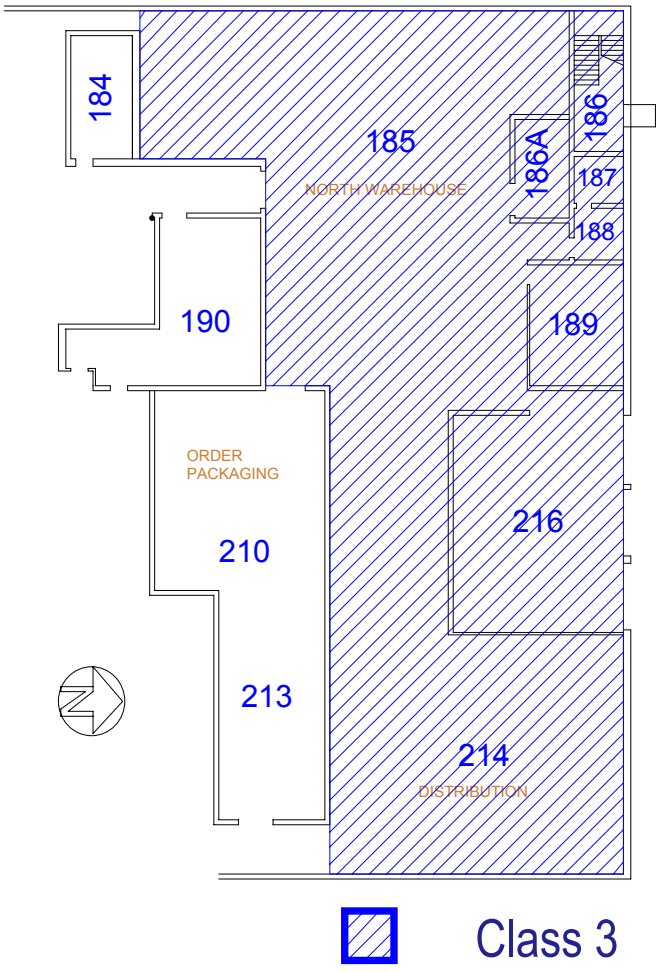


Figure 6-12: BMS B-124 North Warehouse Class 3 Area

(Note: This is a multi-colored diagram.)

6.4.57 C0500: B-122 and B-124 Exteriors

The areas included in this survey package were the exterior walls and roofs on Buildings 122 and 124 as shown on the Figure 6-13 location drawing. This was a 7,373 m^2 Class 3 Area. The roofs were a rubber type membrane and the walls were brick and steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 29 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0500	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	438	99	429	624	29
dpm/100 cm^2	1,848	419	1,812	2,632	

Survey unit C0500 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 106 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.58 C0600: B-122 and B-124 Exterior Paved Areas

The areas included in this survey package were the exterior paved areas around Buildings 122 and 124 as shown on the Figure 6-13 location drawing. This was a 3,174 m^2 Class 3 Area. The roofs were a rubber type membrane and the walls were brick and steel.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 28 measurements were obtained. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0600	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	413	89	385	624	28
dpm/100 cm^2	1,742	376	1,624	2,632	

Survey unit C0600 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 106 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.59 C0700: B-124 Storm Water Vault

The areas included in this survey package were the interior concrete surfaces of the Building 124 storm water vault as shown on the Figure 6-13 location drawing. This was a 43 m^2 Class 3 Area. All interior surfaces were bare concrete, however the floor was covered with mud.

All surfaces were scanned a minimum of 10% for beta activity with no activity detected in excess of the $DCGL_W$.

There were 14 fixed beta measurements required by the survey design and 16 measurements were obtained. Beta measurements could not be obtained from the floor because it was wet, covered with mud and water was running through the vault. There were no readings in excess of 50% of the $DCGL_W$ or all readings were less than 3,550 dpm/100 cm^2 or ~ 888 cpm/100cm^2. A summary of these results is presented below.

Package C0700	Mean	Standard Deviation	Median	Maximum	Measurements
cpm/100 cm^2	228	17	229	254	16
dpm/100 cm^2	961	70	968	1,072	

Gamma measurements were taken from the vault floor. A summary of these results is presented below.

Package C0700	Mean	Standard Deviation	Median	Maximum	Measurements
Micro R/hr	4.3	0.3	4.4	4.9	15

Survey unit C0700 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Smear results were obtained to verify that the removable activity did not exceed 10% of the fixed beta readings obtained in this survey package. All the smear survey results were less than the MDA of 106 dpm/100 cm^2.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, download data, and smear results.

6.4.60 D0100: Soils below the B-124 Tank Vaults

The areas included in this survey package were the soils below the Building 124 tank vaults as shown on the Figure 6-13 location drawing. This was a 279 m^2 Class 3 Area. The vaults were removed when these samples were taken. It had been planned to bore through the concrete floor slabs in these vaults to obtain samples. This did not prove to be feasible. The vault floors were thicker than anticipated, over two feet thick, when bored through at one location water sprayed up out around the core bore due to local water table hydraulic pressure and there was about two feet of gravel under the slab. It became apparent that it was not reasonable to sample the soil at this time. After reviewing the situation with the NRC and the New Jersey DEP, it was decided to obtain a few grab soil samples as the concrete slabs were being removed. Three grab soil samples were obtained from under the tank vaults. In addition the characterization deep samples results from around the vaults would be also be utilized to demonstrate that the soils did not exceeded the $DCGL_W$.

There were 13 soil samples required by the survey design and 5 soil samples were obtained because of the sampling problem reported above. There were no readings in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package B2700	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	0.002	0.004	0.002	0.008	5	3.8	0.05%
Cs-137pCi/g	-0.001	0.006	-0.002	0.008		11.0	-0.01%

There were 19 prior characterization deep samples (0 to 20 feet below the surface) taken from around the vaults. There were no results in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package D0100 CHAR	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-57 pCi/g	0.023	0.099	0.000	0.430	19	54	0.04%
Co-60 pCi/g	0.000	0.000	0.000	0.000		3.8	0.00%
Cs-134pCi/g	0.012	0.033	0.000	0.114		3.4	0.36%
Cs-137pCi/g	0.012	0.021	0.000	0.053		11.0	0.11%
Mn-54 pCi/g	0.004	0.015	0.000	0.067		5.40	0.07%

Survey unit D0100 satisfied the DCGLW and no individual sample measurements exceeded the DCGLW.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, and sample data.

6.4.61 E0100: Undisturbed Soils around B-122 and B-124

The areas included in this survey package were the undisturbed soils around Building 122 and Building 124 as shown on the Figure 6-13 location drawing. Most of the area around the buildings is paved or is the disturbed soil where the tank vaults were removed. This was an 830 m^2 Class 3 Area.

There were 14 soil samples required by the survey design and 16 soil samples were obtained. There were no readings in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package E0100	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	0.006	0.008	0.0057	0.016	16	3.8	0.15%
Cs-137pCi/g	0.214	0.143	0.2195	0.429		11.0	1.95%

Survey unit E0100 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, and sample data.

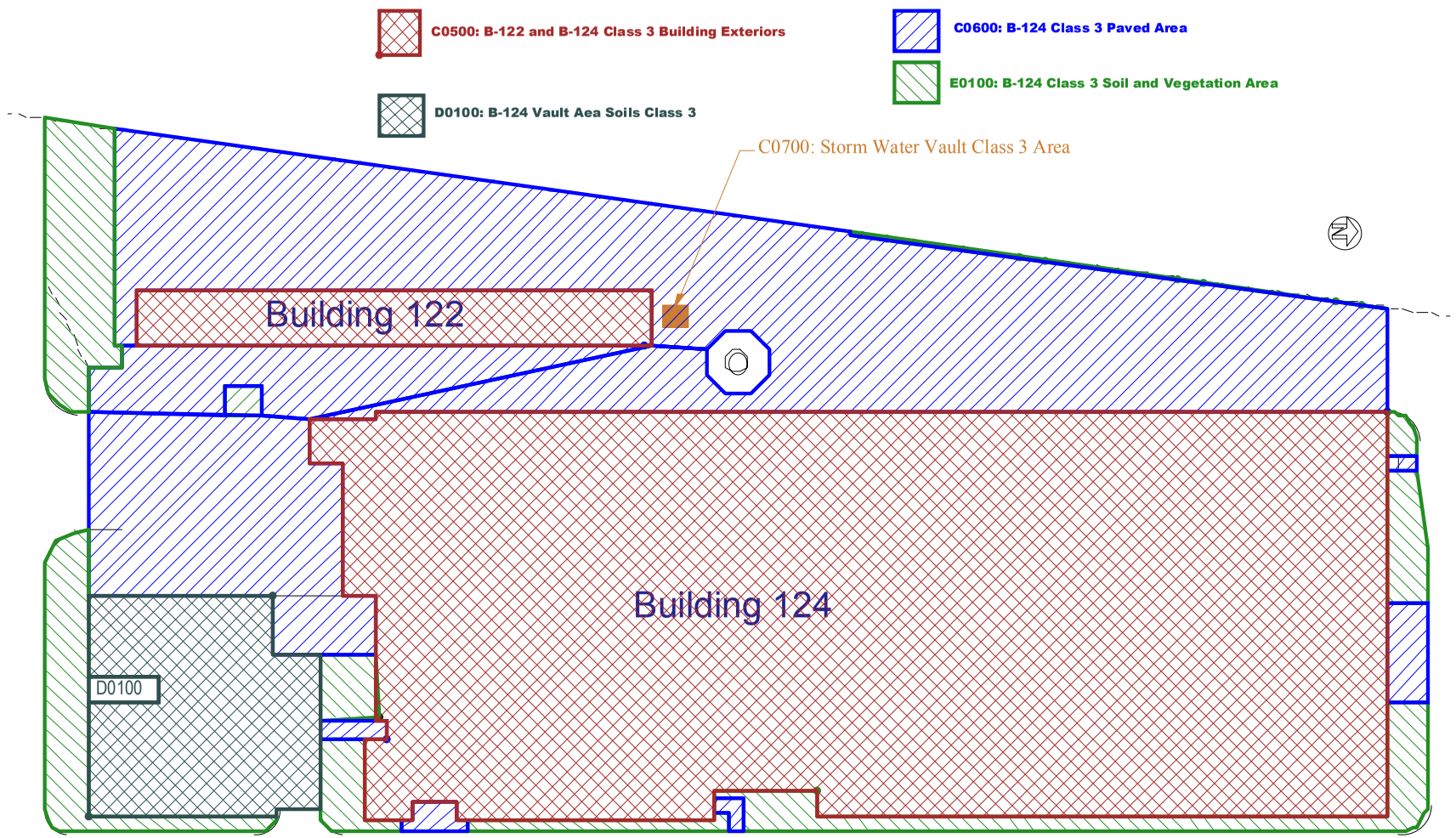


Figure 6-13: BMS Class 3 Outdoor Survey Areas Around B-122 & B-124

(Note: This is a multi-colored diagram.)

6.4.62 E0200: Undisturbed Soils around B-83 Tanks

The areas included in this survey package were the soils below the Building 83 tank vaults as shown on the Figure 6-14 location drawing. This was a 56 m^2 Class 3 Area. The vaults were removed when these samples were taken. It had been planned to remove the concrete floor slab and obtain the samples. This did not prove to be feasible. There was about two feet of gravel under the slab, the soils under the gravel were a hardpan and the water table had to be pumped down to keep it below the gravel layer. It became apparent that it was not reasonable to sample the soil at this time. After reviewing the situation with the NRC and the NJDEP, it was decided to obtain a few grab soil samples at locations where soil could be found. Three grab soil samples were obtained from under the tank vault slab. In addition the characterization deep samples results from around the vaults were also utilized to demonstrate that the soils did not exceeded the $DCGL_W$.

There were 13 soil samples required by the survey design and 3 soil samples were obtained because of the sampling problem reported above. There were no readings in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package E0200	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	-0.003	0.006	-0.003	0.004	3	3.8	-0.07%
Cs-137pCi/g	-0.012	0.008	-0.009	-0.006		11.0	-0.11%

There were 33 prior characterization deep samples (0 to 20 feet below the surface) taken from around the vaults. There were no results in excess of the DCGL sum-of-fractions. A summary of these results is presented below.

Package E0200 CHAR	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	0.000	0.000	0.0000	0.000	33	3.8	0.00%
Cs-134pCi/g	0.002	0.009	0.0000	0.045		3.4	0.07%
Cs-137pCi/g	0.014	0.028	0.0000	0.114		11.0	0.13%
Mn-54 pCi/g	0.001	0.004	0.0000	0.023		5.40	0.01%

Survey unit E0200 satisfied the $DCGL_W$ and no individual sample measurements exceeded the $DCGL_W$.

Detailed results are in Appendix A that include the above plus the survey packages, COMPASS runs, sample location spreadsheets, and sample data.

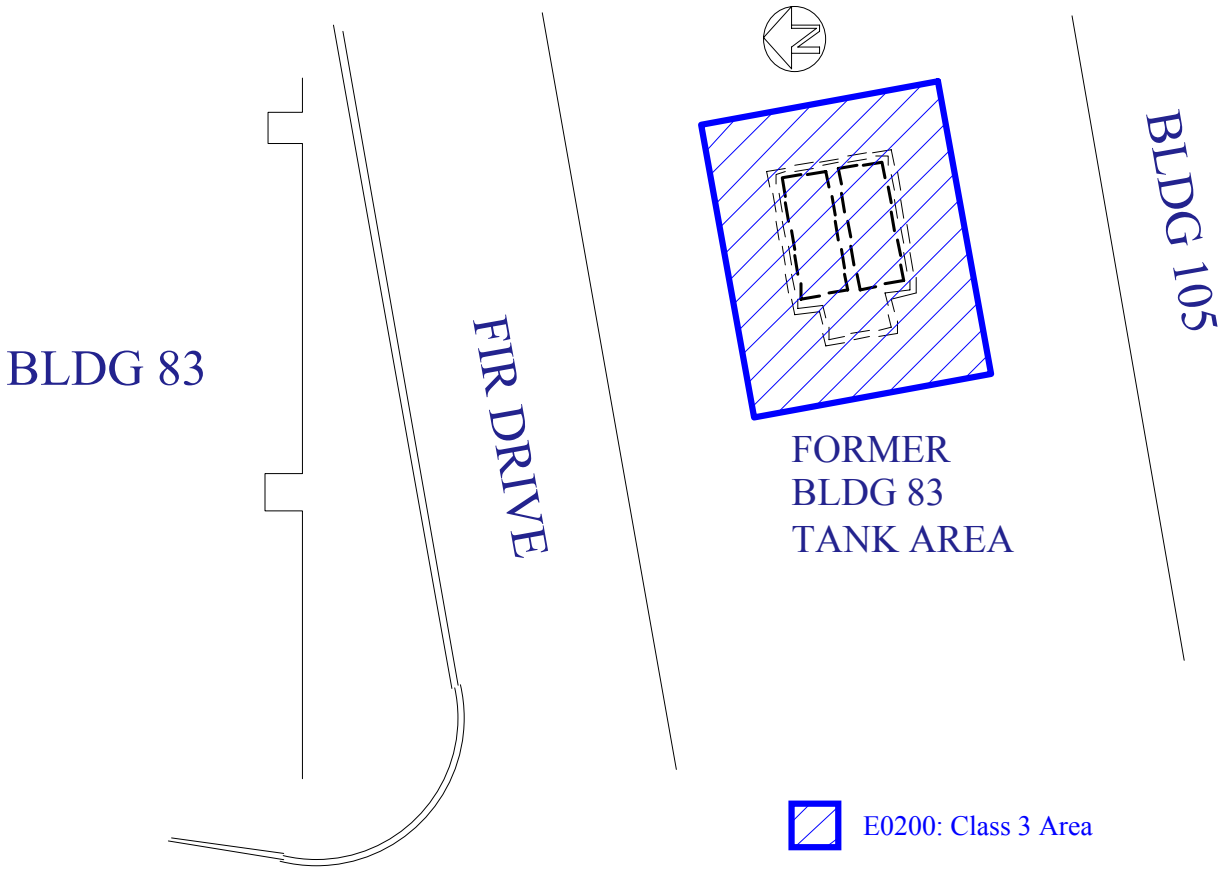


Figure 6-14: BMS Building 83 Tank Area Soils Class 3

(Note: This is a multi-colored diagram.)

7.0 ATTACHMENTS

Attachment 1: BMS Facility Characterization Procedures

Attachment 2: Gamma Spectral Analysis Results Summary

Attachment 1: BMS Facility Final Status Survey Procedures

	PROC. NO.	TITLE	REV.
1.	DTK-AD-002	Document Storage and Control	Rev. 2
2.	DTK -AD-005	First Notification Procedure	Rev. 2
3.	DTK -AD-029	Personnel Training Policy and Implementation Procedure	Rev. 1
4.	RFS-QA-001	Radioactive Field Solutions Quality Plan	Rev. 0
5.	DTK-SF-001	Office Safety	Rev. 1
6.	DTK-SF-002	Personal Protective Equipment Program	Rev. 1
7.	DTK-SF-003	Safety Harnesses, Lifelines/Lanyards General Fall Protection	Rev. 1
8.	DTK-SF-005	Equipment Lockout and Tagout	Rev. 1
9.	DTK-SF-006	Portable Electrical Equipment Inspection	Rev. 1
10.	DTK-SF-008	Ladder Inspection and Use	Rev. 1
11.	DTK-SF-009	Care and Use of Hand Tools and Portable Electric Power Tools	Rev. 1
12.	DTK-SF-012	Compressed Gas Storage and Use	Rev. 1
13.	DTK-SF-013	Flammable Liquid Storage and Handling	Rev. 1
14.	DTK-SF-016	Confined Space Entry Policy	Rev. 1
15.	DTK-SF-019	Mgmt, Reporting, & Record Keeping of Occupational Injuries & Illnesses	Rev. 1
16.	DTK-SF-020	Minimum Industrial Safety Standards for RFS	Rev. 1
17.	DTK-SF-023	Hearing Conservation Program	Rev. 1
18.	DTK-SF-024	Hazard Communication Program	Rev. 0
19.	REDS-ADM-102	Radiological Occurrence Reports	Rev. 1
20.	REDS-CHM-101	Sample Identification and Chain-Of-Custody	Rev. 2
21.	REDS-CHR-106	Surface Soil Sampling	Rev. 0
22.	REDS-CHR-107	Subsurface Soil Sampling	Rev. 0
23.	REDS-CSA-203	Ludlum Model 2350 Series Data Logger Download Operation	Rev. 0
24.	REDS-INST-100	Radiation Protection Instrumentation Program	Rev. 3
25.	REDS-INST-101	Issue, Control & Accountability of Rad Protection Instrumentation	Rev. 2
26.	REDS-INST-102	Quality Control of Counting Systems and Portable Counters	Rev. 2
27.	REDS-INST-104	Calibration & Test Requirements for Rad Protection Instrumentation	Rev. 3
27.	REDS-INST-201	Operation of the Ludlum Model 2350 Series Data Loggers	Rev. 4
28.	REDS-INST-206	Operation of the Ludlum Model 19 Micro-R Meter	Rev. 0
29.	REDS-INST-211	Operation of the Eberline BC-4 Portable Beta Counter	Rev. 0
30.	REDS-INST-247	Operation of EG&G Nomad with Gamma Vision-32 Software	Rev. 0
31.	REDS-INST-311	Calibration of the Eberline BC-4 Portable Beta Counter	Rev. 1
32.	REDS-INST-347	Calibration of EG&G Nomad with Gamma Vision-32 Software	Rev. 0
33.	REDS-OPS-202	Selection & Use of Protective Clothing	Rev. 2
34.	REDS-OPS-206	Personnel Survey & Decontamination	Rev. 2
35.	REDS-OPS-208	Radiation/Hazardous Work Permits	Rev. 4
36.	REDS-OPS-301	Performance of Surveys	Rev. 5
38.	REDS-RAM-103	Unconditional Release of Tools, Equipment & Waste Materials	Rev. 3
39.	REDS-RAM-104	Radioactive Source Inventory, Leak Testing and Control	Rev. 3
40.	REDS-RAM-106	Shipment of Radioactive Material	Rev. 5
41.	REDS-RAM-107	Packaging of Radioactive Material	Rev. 1

Attachment 2: Gamma Spectral Analysis Results Summary

SURVEY PACKAGE A0300 – Building 124, Rooms 150 & 152 Soil

Package A0300	Mean (pCi/g)	Standard Deviation (pCi/g)	Median (pCi/g)	Maximum (pCi/g)	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60	0.23	0.43	0.014	1.44	17	3.80	6.1%
Cs-137	0.59	1.09	0.073	3.74		11.00	5.4%

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-A0300-1	Room 150/152 Soil Sample #1	3/21/03	4/23/03	Ac/Th-228	0.58	5.80E-01	0.038	0.150
				Co-60	<MDA	7.20E-03	0.010	0.034
				Cs-137	<MDA	2.00E-03	0.011	0.037
				K-40	15.51	1.55E+01	0.430	0.330
BMS-A0300-2	Room 150/152 Soil Sample #2	3/21/03	4/23/03	Ac/Th-228	0.282	2.82E-01	0.002	0.083
				Co-60	<MDA	-6.70E-03	0.006	0.022
				Cs-137	<MDA	-2.50E-03	0.006	0.021
				K-40	11.39	1.14E+01	0.260	0.230
BMS-A0300-3	Room 150/152 Soil Sample #3	3/21/03	4/23/03	Ac/Th-228	0.423	4.23E-01	0.028	0.099
				Co-60	<MDA	6.90E-03	0.007	0.022
				Cs-137	<MDA	1.58E-02	0.006	0.020
				K-40	12.89	1.29E+01	0.290	0.250
BMS-A0300-4	Room 150/152 Soil Sample #4	3/21/03	4/23/03	Ac/Th-228	0.321	3.21E-01	0.024	0.083
				Co-60	<MDA	-4.80E-03	0.006	0.023
				Cs-137	<MDA	8.20E-03	0.006	0.021
				K-40	11.16	1.12E+01	0.250	0.210
BMS-A0300-5	Room 150/152 Soil Sample #5	3/21/03	5/2/03	Ac/Th-228	0.396	3.96E-01	0.014	0.051
				Co-60	0.0328	3.28E-02	0.004	0.015
				Cs-137	1.431	1.43E+00	0.015	0.015
				K-40	9.85	9.85E+00	0.140	0.140

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-A0300-6	Room 150/152 Soil Sample #6	3/21/03	4/23/03	Ac/Th-228	0.561	5.61E-01	0.027	0.086
				Co-60	0.172	1.72E-01	0.010	0.030
				Cs-137	0.368	3.68E-01	0.015	0.031
				K-40	11.64	1.16E+01	0.290	0.290
BMS-A0300-7	Room 150/152 Soil Sample #7	3/21/03	4/21/03	Ac/Th-228	0.708	7.08E-01	0.026	0.097
				Co-60	<MDA	9.90E-03	0.008	0.026
				Cs-137	0.387	3.87E-01	0.015	0.031
				K-40	14.7	1.47E+01	0.280	0.260
BMS-A0300-8	Room 150/152 Soil Sample #8	3/21/03	4/21/03	Ac/Th-228	0.303	3.03E-01	0.026	0.100
				Co-60	<MDA	4.90E-03	0.007	0.025
				Cs-137	<MDA	1.80E-02	0.008	0.027
				K-40	12.65	1.27E+01	0.300	0.260
BMS-A0300-9	Room 150/152 Soil Sample #9	3/21/03	4/23/03	Ac/Th-228	0.365	3.65E-01	0.020	0.079
				Co-60	0.0604	6.04E-02	0.006	0.018
				Cs-137	0.0727	7.27E-02	0.007	0.019
				K-40	11.08	1.11E+01	0.220	0.180
BMS-A0300-10	Room 150/152 Soil Sample #10	3/21/03	4/21/03	Ac/Th-228	0.34	3.40E-01	0.023	0.088
				Co-60	<MDA	3.30E-03	0.006	0.021
				Cs-137	<MDA	-9.00E-04	0.006	0.020
				K-40	10.12	1.01E+01	0.270	0.250
BMS-A0300-11	Room 150/152 Soil Sample #11	3/21/03	4/21/03	Ac/Th-228	0.58	5.80E-01	0.025	0.110
				Co-60	0.2278	2.28E-01	0.010	0.029
				Cs-137	0.103	1.03E-01	0.011	0.032
				K-40	13.94	1.39E+01	0.270	0.240
BMS-A0300-12	Room 150/152 Soil Sample #12	3/21/03	4/21/03	Ac/Th-228	0.385	3.85E-01	0.025	0.092
				Co-60	<MDA	1.44E-02	0.007	0.022
				Cs-137	<MDA	1.44E-02	0.007	0.024
				K-40	10.27	1.03E+01	0.250	0.250
BMS-A0300-13	Room 150/152 Soil Sample #13	3/21/03	5/2/03	Ac/Th-228	0.955	9.55E-01	0.021	0.073
				Co-60	0.2244	2.24E-01	0.007	0.019
				Cs-137	0.2122	2.12E-01	0.009	0.021
				K-40	12.54	1.25E+01	0.180	0.190

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-A0300-14	Room 150/152 Soil Sample #14	3/21/03	4/21/03	Ac/Th-228	0.977	9.77E-01	0.032	0.110
				Co-60	<MDA	-2.32E-02	0.008	0.028
				Cs-137	0.0418	4.18E-02	0.010	0.030
				K-40	15.52	1.55E+01	0.300	0.280
BMS-A0300-15	Room 150/152 Soil Sample #15	3/21/03	4/23/03	Ac/Th-228	0.679	6.79E-01	0.032	0.120
				Co-60	0.686	6.86E-01	0.014	0.027
				Cs-137	3.736	3.74E+00	0.038	0.033
				K-40	14.14	1.41E+01	0.270	0.260
BMS-A0300-16	Room 150/152 Soil Sample #16	3/21/03	4/23/03	Ac/Th-228	0.625	6.25E-01	0.032	0.120
				Co-60	1.44	1.44E+00	0.019	0.025
				Cs-137	0.817	8.17E-01	0.019	0.034
				K-40	11.89	1.19E+01	0.240	0.220
BMS-A0300-17	Room 150/152 Soil Sample #17	3/21/03	4/28/03	Ac/Th-228	0.695	6.95E-01	0.045	0.160
				Co-60	1.072	1.07E+00	0.023	0.037
				Cs-137	2.835	2.84E+00	0.044	0.047
				K-40	13.3	1.33E+01	0.340	0.320

SURVEY PACKAGE B2600 – Building 124 Old Section Pipe Trenches

Package B2600	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Ac/Th-228 pCi/g	0.49	0.20	0.47	0.89	16		
Co-60 pCi/g	-0.0005	0.010	-0.0025	0.030		3.8	-0.01%
Cs-137pCi/g	0.041	0.087	0.018	0.363		11.0	0.37%
K-40 pCi/g	10.15	3.14	10.57	13.68			

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-2600-018	Room 147 Sample Location #18	2/6/03	4/11/03	Ac/Th-228	0.274	2.74E-01	3.60E-02	1.30E-01
				Co-60	<MDA	-1.09E-02	9.40E-03	3.70E-02
				Cs-137	<MDA	2.66E-02	9.90E-03	3.10E-02
				K-40	9.7	9.70E+00	3.80E-01	3.30E-01
BMS-2600-024	Room 149 Sample Location #24	2/6/03	4/11/03	Ac/Th-228	0.712	7.12E-01	3.70E-02	1.30E-01
				Co-60	<MDA	8.60E-03	9.50E-03	3.20E-02
				Cs-137	<MDA	1.95E-02	9.90E-03	3.20E-02
				K-40	12.93	1.29E+01	3.40E-01	2.90E-01
BMS-2600-034	Room 151 Sample Location #34	2/6/03	4/11/03	Ac/Th-228	0.496	4.96E-01	3.10E-02	1.10E-01
				Co-60	<MDA	-9.60E-03	8.10E-03	3.10E-02
				Cs-137	<MDA	2.20E-02	1.00E-02	3.30E-02
				K-40	12.43	1.24E+01	3.30E-01	2.40E-01
BMS-2600-035	Room 151 Sample Location #35	2/6/03	4/11/03	Ac/Th-228	0.359	3.59E-01	1.60E-02	5.40E-02
				Co-60	<MDA	1.00E-03	4.60E-03	1.60E-02
				Cs-137	<MDA	1.55E-02	5.90E-03	1.90E-02
				K-40	9.87	9.87E+00	1.80E-01	1.60E-01
BMS-2600-040	Room 153 Sample Location #40	2/6/03	4/11/03	Ac/Th-228	0.395	3.95E-01	3.90E-02	1.40E-01
				Co-60	<MDA	-4.30E-03	8.60E-03	3.40E-02
				Cs-137	<MDA	1.60E-02	1.00E-02	3.40E-02
				K-40	9.07	9.07E+00	3.80E-01	3.40E-01
BMS-2600-067	Room 162A Sample Location #67	2/7/03	4/14/03	Ac/Th-228	0.414	4.14E-01	2.50E-02	1.00E-01
				Co-60	<MDA	2.00E-04	7.10E-03	2.50E-02
				Cs-137	<MDA	8.90E-03	7.50E-03	2.50E-02
				K-40	10.74	1.07E+01	2.70E-01	2.40E-01
BMS-2600-069	Room 162A Sample Location #69	2/7/03	4/11/03	Ac/Th-228	0.472	4.72E-01	3.10E-02	9.90E-02
				Co-60	<MDA	-7.40E-03	7.00E-03	2.60E-02
				Cs-137	<MDA	5.40E-03	8.10E-03	2.80E-02
				K-40	10.56	1.06E+01	2.80E-01	2.50E-01

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-2600-095	Room 163 Sample Location #95	2/6/03	4/11/03	Ac/Th-228	0.509	5.09E-01	3.20E-02	1.10E-01
				Co-60	<MDA	-1.17E-02	7.30E-03	2.80E-02
				Cs-137	<MDA	1.35E-02	7.60E-03	2.50E-02
				K-40	11.3	1.13E+01	3.00E-01	3.00E-01
BMS-2600-099	Room 162A Sample Location #99	2/6/03	4/11/03	Ac/Th-228	0.307	3.07E-01	3.00E-02	1.10E-01
				Co-60	<MDA	-9.00E-03	7.30E-03	2.80E-02
				Cs-137	<MDA	1.00E-04	7.80E-03	2.70E-02
				K-40	13.68	1.37E+01	3.30E-01	2.50E-01
BMS-2600-107	Room 165 Sample Location #107	2/6/03	4/11/03	Ac/Th-228	0.633	6.33E-01	1.90E-02	8.90E-02
				Co-60	<MDA	8.00E-04	5.00E-03	1.70E-02
				Cs-137	0.0244	2.44E-02	6.10E-03	2.00E-02
				K-40	11.83	1.18E+01	1.60E-01	2.70E-01
BMS-2600-164	Hallway 120 Sample Location #164	2/7/03	4/11/03	Ac/Th-228	0.631	6.31E-01	3.20E-03	1.20E-01
				Co-60	<MDA	-2.40E-03	7.80E-03	2.80E-02
				Cs-137	<MDA	7.40E-03	8.70E-03	2.90E-02
				K-40	10.58	1.06E+01	3.00E-01	2.80E-01
BMS-2600-170	Hallway 120 Sample Location #170	2/10/03	4/11/03	Ac/Th-228	0.89	8.90E-01	3.70E-02	1.30E-01
				Co-60	<MDA	-2.50E-03	8.80E-03	3.20E-02
				Cs-137	0.04	4.00E-02	1.10E-02	3.50E-02
				K-40	13.24	1.32E+01	3.40E-01	3.20E-01
BMS-2600-241	Hallway 154 Sample Location #241	2/13/03	4/11/03	Ac/Th-228	0.469	4.69E-01	2.00E-02	7.50E-02
				Co-60	0.0301	3.01E-02	4.70E-02	1.70E-02
				Cs-137	0.0677	6.77E-02	7.40E-03	2.10E-02
				K-40	10.25	1.03E+01	2.00E-01	1.70E-01
BMS-2600-259	Room 153 Sample Location #259	2/6/03	4/11/03	Ac/Th-228	0.183	1.83E-01	2.90E-02	1.20E-01
				Co-60	<MDA	-3.50E-03	8.10E-03	3.00E-02
				Cs-137	<MDA	2.35E-02	7.90E-03	2.40E-02
				K-40	10.41	1.04E+01	3.40E-01	2.70E-01
BMS-2600-278	Hallway 120 Sample Location #278	2/13/03	4/11/03	Ac/Th-228	0.277	2.77E-01	4.50E-02	1.40E-01
				Co-60	<MDA	1.13E-02	9.30E-03	3.20E-02
				Cs-137	0.363	3.63E-01	2.30E-02	4.00E-02
				K-40	3.06	3.06E+00	2.50E-01	4.00E-01

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-2600-338	Room 170 Sample Location #338	2/5/03	4/11/03	Ac/Th-228	0.785	7.85E-01	1.50E-02	5.30E-02
				Co-60	<MDA	2.00E-03	4.00E-03	1.30E-02
				Cs-137	<MDA	1.00E-04	6.00E-03	2.00E-02
				K-40	2.676	2.68E+00	8.80E-02	2.00E-01

SURVEY PACKAGE B2700 – Building 124 New Section Pipe Trenches

Package B2700	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Ac/Th-228 pCi/g	0.32	0.09	0.30	0.53	16		
Co-60 pCi/g	-0.0008	0.009	-0.0020	0.019		3.8	-0.02%
Cs-137pCi/g	0.021	0.063	0.004	0.254		11.0	0.19%
K-40 pCi/g	7.25	4.93	5.83	17.22			

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-2700-003	Hallway 179 Sample Location #03	1/28/03	4/8/03	Ac/Th-228	0.421	4.21E-01	4.00E-02	1.30E-01
				Co-60	<MDA	0.00E+00	9.10E-03	3.40E-02
				Cs-137	<MDA	-9.00E-03	1.00E-02	3.80E-02
				K-40	10.27	1.03E+01	4.00E-01	3.80E-01
BMS-2700-005	Room 204 Sample Location #05	1/28/03	4/8/03	Ac/Th-228	0.368	3.68E-01	4.30E-02	1.50E-01
				Co-60	<MDA	1.85E-02	8.50E-03	2.50E-02
				Cs-137	<MDA	0.00E+00	8.90E-03	3.30E-02
				K-40	4.77	4.77E+00	3.20E-01	3.50E-01
BMS-2700-009	Room 207 Sample Location #09	1/28/03	4/8/03	Ac/Th-228	0.234	2.34E-01	2.40E-02	9.10E-03
				Co-60	<MDA	1.24E-02	7.70E-03	2.50E-02
				Cs-137	<MDA	4.80E-03	6.80E-03	2.30E-02
				K-40	17.22	1.72E+01	3.50E-01	2.30E-01

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-2700-013	Room 207 Sample Location #13	1/28/03	4/8/03	Ac/Th-228	0.232	2.32E-01	3.40E-02	1.10E-01
				Co-60	<MDA	-4.50E-03	6.70E-03	2.80E-02
				Cs-137	<MDA	6.50E-03	8.40E-03	2.90E-02
				K-40	2.13	2.13E+00	2.10E-01	3.60E-01
BMS-2700-038	Room 190 Sample Location #38	1/28/03	4/8/03	Ac/Th-228	0.335	3.35E-01	4.00E-02	1.20E-01
				Co-60	<MDA	5.10E-03	8.20E-03	3.00E-02
				Cs-137	<MDA	2.30E-03	8.90E-03	3.20E-02
				K-40	1.69	1.69E+00	1.90E-01	3.70E-01
BMS-2700-040	Room 190 Sample Location #40	1/28/03	4/8/03	Ac/Th-228	0.273	2.73E-01	3.80E-02	8.40E-02
				Co-60	<MDA	-5.70E-03	7.40E-03	3.20E-02
				Cs-137	<MDA	-4.10E-03	8.40E-03	3.20E-02
				K-40	1.41	1.41E+00	1.90E-01	4.10E-01
BMS-2700-058	Room 182 Sample Location #58	1/28/03	4/8/03	Ac/Th-228	0.298	2.98E-01	3.90E-02	1.20E-01
				Co-60	<MDA	-9.50E-03	7.70E-03	3.30E-02
				Cs-137	<MDA	-1.14E-02	9.40E-03	3.60E-02
				K-40	5.88	5.88E+00	3.20E-01	3.70E-01
BMS-2700-060	Room 199 Sample Location #60	1/28/03	4/8/03	Ac/Th-228	0.194	1.94E-01	3.00E-02	1.20E-01
				Co-60	<MDA	1.26E-02	7.80E-03	2.60E-02
				Cs-137	<MDA	1.51E-02	8.10E-03	2.60E-02
				K-40	5.78	5.78E+00	2.70E-01	2.90E-01
BMS-2700-090	Room 180 Sample Location #90	2/25/03	4/8/03	Ac/Th-228	0.26	2.60E-01	3.10E-02	1.20E-01
				Co-60	<MDA	-4.00E-03	7.70E-03	3.00E-02
				Cs-137	0.254	2.54E-01	1.70E-02	3.30E-02
				K-40	11.15	1.12E+01	3.70E-01	3.00E-01
BMS-2700-094	Hallway 179 Sample Location #94	2/6/03	4/8/03	Ac/Th-228	0.262	2.62E-01	4.20E-03	1.30E-01
				Co-60	<MDA	9.00E-04	9.60E-03	3.50E-02
				Cs-137	<MDA	2.32E-02	8.50E-03	2.50E-02
				K-40	9.22	9.22E+00	3.70E-01	3.10E-01
BMS-2700-101	Hallway 179 Sample Location #101	2/6/03	4/8/03	Ac/Th-228	0.241	2.41E-01	3.70E-02	1.40E-01
				Co-60	<MDA	-7.90E-03	9.90E-03	3.80E-02
				Cs-137	<MDA	-3.80E-03	9.60E-03	3.50E-02
				K-40	16.15	1.62E+01	4.70E-01	3.50E-01

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-2700-112	Room 204 Sample Location #112	1/28/03	4/8/03	Ac/Th-228	0.35	3.50E-01	3.40E-02	1.10E-01
				Co-60	<MDA	-1.45E-02	8.40E-03	3.30E-02
				Cs-137	<MDA	2.40E-03	7.50E-03	2.60E-02
				K-40	11.76	1.18E+01	3.40E-01	2.70E-01
BMS-2700-140	Room 208 Sample Location #140	1/28/03	4/8/03	Ac/Th-228	0.443	4.43E-01	3.00E-02	9.70E-02
				Co-60	<MDA	9.00E-04	5.70E-03	2.10E-02
				Cs-137	0.037	3.70E-02	7.00E-03	2.40E-02
				K-40	4.8	4.80E+00	2.10E-01	2.40E-01
BMS-2700-144	Room 208 Sample Location #144	1/28/03	4/8/03	Ac/Th-228	0.526	5.26E-01	2.80E-02	9.20E-02
				Co-60	<MDA	-1.35E-02	6.10E-03	2.50E-02
				Cs-137	<MDA	6.10E-03	7.50E-03	2.60E-02
				K-40	3.08	3.08E+00	1.70E-01	2.40E-01
BMS-2700-145	Room 208 Sample Location #145	1/28/03	4/9/03	Ac/Th-228	0.36	3.60E-01	3.90E-02	1.40E-01
				Co-60	<MDA	1.70E-03	8.40E-03	3.10E-02
				Cs-137	<MDA	2.70E-03	9.20E-03	3.30E-02
				K-40	3.69	3.69E+00	2.60E-01	3.50E-01
BMS-2700-164	Room 191 Sample Location #164	1/28/03	4/9/03	Ac/Th-228	0.301	3.01E-01	3.70E-02	1.10E-01
				Co-60	<MDA	-4.70E-03	8.70E-03	3.40E-02
				Cs-137	<MDA	7.90E-03	9.60E-03	3.30E-02
				K-40	6.97	6.97E+00	3.30E-01	3.00E-01

SURVEY PACKAGE D0100 – Soil Below the Building 124 Tank Vaults

Package D0100	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	0.002	0.004	0.002	0.008	5	3.8	0.05%
Cs-137pCi/g	-0.001	0.006	-0.002	0.008		11.0	-0.01%

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-D0100-001	B-124 Valve Pit #1	10/31/02	4/21/03	Ac/Th-228	0.851	8.51E-01	2.50E-02	9.40E-02
				Co-60	<MDA	1.80E-03	6.70E-03	2.30E-02
				Cs-137	<MDA	-5.40E-03	6.40E-03	2.20E-02
				K-40	11.2	1.12E+01	2.20E-01	3.00E-01
BMS-D0100-002	B-124 Valve Pit #2	10/31/02	4/22/03	Ac/Th-228	0.196	1.96E-01	2.30E-02	9.60E-02
				Co-60	<MDA	7.50E-03	6.50E-03	2.20E-02
				Cs-137	<MDA	-2.00E-04	5.90E-03	2.00E-02
				K-40	21.26	2.13E+01	2.80E-01	2.50E-01
BMS-D0100-003	B-124 Tank Vault #3	12/17/02	4/28/03	Ac/Th-228	0.371	3.71E-01	2.90E-02	1.00E-01
				Co-60	<MDA	-2.00E-03	6.90E-03	2.50E-02
				Cs-137	<MDA	7.70E-03	7.70E-03	2.60E-02
				K-40	14.39	1.44E+01	3.10E-01	2.30E-01
BMS-D0100-004	B-124 Tank Vault #4	12/19/02	4/21/03	Ac/Th-228	0.35	3.50E-01	2.10E-02	8.70E-02
				Co-60	<MDA	-3.10E-03	6.10E-03	2.10E-02
				Cs-137	<MDA	-1.60E-03	5.90E-03	2.00E-02
				K-40	20.55	2.06E+01	2.60E-01	2.40E-01
	Tank Vault West Side #1	12/12/02	4/21/03	Ac/Th-228	1.598	1.60E+00	3.70E-02	1.50E-01
				Co-60	<MDA	4.60E-03	9.60E-03	3.20E-02
				Cs-137	<MDA	-6.70E-03	9.20E-03	3.10E-02
				K-40	31.99	3.20E+01	3.90E-01	3.80E-01

SURVEY PACKAGE D0100 – Characterization Data for Soil By Building 124 Tank Vaults

Package D0100 CHAR	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-57 pCi/g	0.023	0.099	0.0000	0.430	19	54	0.04%
Co-60 pCi/g	0.000	0.000	0.0000	0.000		3.8	0.00%
Cs-134pCi/g	0.012	0.033	0.0000	0.114		3.4	0.36%
Cs-137pCi/g	0.012	0.021	0.0000	0.053		11.0	0.11%
Mn-54 pCi/g	0.004	0.015	0.0000	0.067		5.40	0.07%

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-032-1	Soil Sample (0 - 2 ft Deep)	1/9/02	2/9/02	AC-228	0.9145	9.15E-01	3.16E-01	1.14E-01
				CO-57	<MDA	0.00E+00	0.00E+00	5.31E-01
				CO-60	<MDA	0.00E+00	0.00E+00	6.86E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.87E-02
				CS-137	<MDA	0.00E+00	0.00E+00	9.11E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.62E-02
BMS-SML-032-4	Soil Sample (6 - 8 ft Deep)	1/9/02	2/9/02	AC-228	0.5550	5.55E-01	2.32E-01	9.25E-02
				CO-57	<MDA	0.00E+00	0.00E+00	4.83E-01
				CO-60	<MDA	0.00E+00	0.00E+00	9.75E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.95E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.88E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.36E-02
BMS-SML-032-7	Soil Sample (12 - 14 ft Deep)	1/9/02	2/9/02	AC-228	0.5210	5.21E-01	2.36E-01	1.31E-01
				CO-57	<MDA	0.00E+00	0.00E+00	4.19E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.06E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.72E-02
				CS-137	0.0485	4.85E-02	4.30E-02	4.13E-02
				MN-54	<MDA	0.00E+00	0.00E+00	5.56E-02
BMS-SML-032-9	Soil Sample (16 - 18 ft Deep)	1/9/02	2/9/02	AC-228	0.7242	7.24E-01	2.80E-01	1.05E-01
				CO-57	<MDA	0.00E+00	0.00E+00	5.29E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.97E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.74E-02
				CS-137	0.0526	5.26E-02	5.04E-02	4.96E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.01E-02
BMS-SML-032-10	Soil Sample (18 - 20 ft Deep)	1/9/02	2/9/02	AC-228	0.5994	5.99E-01	2.12E-01	1.71E-01
				CO-57	0.4297	4.30E-01	4.08E-01	2.81E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.58E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.85E-02
				CS-137	<MDA	0.00E+00	0.00E+00	3.22E-02
				MN-54	<MDA	0.00E+00	0.00E+00	2.70E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-033-6	Soil Sample (10 - 12 ft Deep)	1/9/02	2/11/02	AC-228	1.0432	1.04E+00	3.10E-01	9.07E-02
				CO-57	<MDA	0.00E+00	0.00E+00	5.61E-01
				CO-60	<MDA	0.00E+00	0.00E+00	2.99E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.83E-02
				CS-137	<MDA	0.00E+00	0.00E+00	4.87E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.31E-02
BMS-SML-033-9	Soil Sample (16 - 18 ft Deep)	1/9/02	2/11/02	AC-228	0.4080	4.08E-01	1.20E-01	1.08E-01
				CO-57	<MDA	0.00E+00	0.00E+00	2.58E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.09E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.28E-02
				CS-137	<MDA	0.00E+00	0.00E+00	3.31E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.40E-02
BMS-SML-034-2	Soil Sample (2 - 4 ft Deep)	1/9/02	2/11/02	AC-228	1.2925	1.29E+00	4.62E-01	2.24E-01
				CO-57	<MDA	0.00E+00	0.00E+00	4.40E-01
				CO-60	<MDA	0.00E+00	0.00E+00	3.81E-02
				CS-134	0.1136	1.14E-01	7.45E-02	5.26E-02
				CS-137	<MDA	0.00E+00	0.00E+00	8.12E-02
				MN-54	0.0672	6.72E-02	6.05E-02	5.40E-02
BMS-SML-034-5	Soil Sample (8 - 10 ft Deep)	1/9/02	2/11/02	AC-228	0.8186	8.19E-01	2.64E-01	8.45E-02
				CO-57	<MDA	0.00E+00	0.00E+00	5.73E-01
				CO-60	<MDA	0.00E+00	0.00E+00	3.81E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.85E-02
				CS-137	<MDA	0.00E+00	0.00E+00	4.77E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.10E-02
BMS-SML-034-6	Soil Sample (10 - 12 ft Deep)	1/9/02	2/11/02	AC-228	0.6642	6.64E-01	3.38E-01	2.16E-01
				CO-57	<MDA	0.00E+00	0.00E+00	4.54E-01
				CO-60	<MDA	0.00E+00	0.00E+00	1.15E-01
				CS-134	<MDA	0.00E+00	0.00E+00	5.00E-02
				CS-137	<MDA	0.00E+00	0.00E+00	4.57E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.50E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-034-7	Soil Sample (12 - 14 ft Deep)	1/9/02	2/11/02	AC-228	0.9073	9.07E-01	2.48E-01	1.37E-01
				CO-57	<MDA	0.00E+00	0.00E+00	2.57E-01
				CO-60	<MDA	0.00E+00	0.00E+00	8.57E-02
				CS-134	0.0301	3.01E-02	2.32E-02	2.14E-02
				CS-137	<MDA	0.00E+00	0.00E+00	3.63E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.86E-02
BMS-SML-034-8	Soil Sample (14 - 16 ft Deep)	1/9/02	2/11/02	AC-228	1.3493	1.35E+00	4.06E-01	1.12E-01
				CO-57	<MDA	0.00E+00	0.00E+00	3.39E-01
				CO-60	<MDA	0.00E+00	0.00E+00	9.48E-02
				CS-134	0.0916	9.16E-02	5.58E-02	3.71E-02
				CS-137	<MDA	0.00E+00	0.00E+00	8.54E-02
				MN-54	<MDA	0.00E+00	0.00E+00	5.59E-02
BMS-SML-034-9	Soil Sample (16 - 18 ft Deep)	1/9/02	2/11/02	AC-228	1.2106	1.21E+00	3.52E-01	2.39E-01
				CO-57	<MDA	0.00E+00	0.00E+00	6.23E-01
				CO-60	<MDA	0.00E+00	0.00E+00	7.76E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.32E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.91E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.82E-02
BMS-SML-035-3	Soil Sample (4 - 6 ft Deep)	1/9/02	2/11/02	AC-228	0.7920	7.92E-01	2.66E-01	1.12E-01
				CO-57	<MDA	0.00E+00	0.00E+00	3.95E-01
				CO-60	<MDA	0.00E+00	0.00E+00	6.49E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.45E-02
				CS-137	0.0403	4.03E-02	3.31E-02	3.20E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.33E-02
BMS-SML-035-5	Soil Sample (8 - 10 ft Deep)	1/9/02	2/11/02	AC-228	0.5073	5.07E-01	2.05E-01	1.47E-01
				CO-57	<MDA	0.00E+00	0.00E+00	1.63E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.69E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.26E-02
				CS-137	<MDA	0.00E+00	0.00E+00	3.65E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.48E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-035-6	Soil Sample (10 - 12 ft Deep)	1/9/02	2/13/02	AC-228	0.7177	7.18E-01	2.98E-01	1.90E-01
				CO-57	<MDA	0.00E+00	0.00E+00	2.87E-01
				CO-60	<MDA	0.00E+00	0.00E+00	2.91E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.26E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.71E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.39E-02
BMS-SML-035-7	Soil Sample (12 - 14 ft Deep)	1/9/02	2/13/02	AC-228	0.5909	5.91E-01	2.50E-01	1.56E-01
				CO-57	<MDA	0.00E+00	0.00E+00	2.56E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.69E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.06E-02
				CS-137	0.0399	3.99E-02	2.89E-02	2.74E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.53E-02
BMS-SML-035-8	Soil Sample (14 - 16 ft Deep)	1/9/02	2/14/02	AC-228	0.9646	9.65E-01	3.04E-01	8.90E-02
				CO-57	<MDA	0.00E+00	0.00E+00	5.24E-01
				CO-60	<MDA	0.00E+00	0.00E+00	2.94E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.56E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.44E-02
				MN-54	<MDA	0.00E+00	0.00E+00	5.68E-02
BMS-SML-035-9	Soil Sample (16 - 18 ft Deep)	1/9/02	2/14/02	AC-228	1.0303	1.03E+00	2.95E-01	1.76E-01
				CO-57	<MDA	0.00E+00	0.00E+00	2.35E-01
				CO-60	<MDA	0.00E+00	0.00E+00	5.46E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.56E-02
				CS-137	0.0500	5.00E-02	4.76E-02	4.20E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.70E-02

SURVEY PACKAGE E0100 – Building 122 and Building 124 Undisturbed Soils

Package E0100	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	0.006	0.008	0.0057	0.016	16	3.8	0.15%
Cs-137pCi/g	0.214	0.143	0.2195	0.429		11.0	1.95%

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-E0200-21	Sample Location # 21 S. of B-124	3/26/03	5/7/03	Ac/Th-228	0.959	9.59E-01	0.041	0.170
				Co-60	<MDA	5.30E-03	0.010	0.033
				Cs-137	0.378	3.78E-01	0.018	0.042
				K-40	14.49	1.45E+01	0.340	0.490
BMS-E0200-55	Sample Location # 55 S. of B-124	3/26/03	5/7/03	Ac/Th-228	1.086	1.09E+00	0.041	0.170
				Co-60	<MDA	1.50E-02	0.011	0.036
				Cs-137	0.384	3.84E-01	0.019	0.046
				K-40	15.01	1.50E+01	0.340	0.510
BMS-E0200-116	Sample Location # 116 S. of B-124	3/26/03	5/7/03	Ac/Th-228	1.031	1.03E+00	0.038	0.160
				Co-60	<MDA	-1.00E-02	0.010	0.035
				Cs-137	0.357	3.57E-01	0.017	0.040
				K-40	14.47	1.45E+01	0.310	0.420
BMS-E0200-129	Sample Location # 129 SW of B-124	3/26/03	5/9/03	Ac/Th-228	1.359	1.36E+00	0.038	0.140
				Co-60	<MDA	1.60E-02	0.010	0.033
				Cs-137	0.23	2.30E-01	0.015	0.041
				K-40	17.73	1.77E+01	0.330	0.440
BMS-E0200-135	Sample Location # 135 SW of B-124	3/26/03	5/9/03	Ac/Th-228	0.643	6.43E-01	0.023	0.110
				Co-60	<MDA	3.40E-03	0.007	0.023
				Cs-137	0.2356	2.36E-01	0.011	0.025
				K-40	11.32	1.13E+01	0.210	0.341
BMS-E0200-180	Sample Location # 180 SW of B-124	3/26/03	5/9/03	Ac/Th-228	0.954	9.54E-01	0.025	0.100
				Co-60	<MDA	1.28E-02	0.007	0.024
				Cs-137	0.1994	1.99E-01	0.010	0.027
				K-40	14.08	1.41E+01	0.220	0.340

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-E0200-260	Sample Location # 260 SW of B-124	3/26/03	5/16/03	Ac/Th-228	0.969	9.69E-01	0.030	0.120
				Co-60	<MDA	6.10E-03	0.008	0.026
				Cs-137	0.429	4.29E-01	0.014	0.032
				K-40	13.73	1.37E+01	0.250	0.320
BMS-E0200-281	Sample Location # 281 SW of B-124	3/26/03	5/9/03	Ac/Th-228	1.079	1.08E+00	0.034	0.130
				Co-60	<MDA	1.44E-02	0.009	0.030
				Cs-137	0.384	3.84E-01	0.016	0.037
				K-40	15.19	1.52E+01	0.290	0.370
BMS-E0200-362	Sample Location # 362 W. of B-124	3/26/03	5/16/03	Ac/Th-228	0.766	7.66E-01	0.029	0.120
				Co-60	<MDA	5.10E-03	0.008	0.026
				Cs-137	0.187	1.87E-01	0.012	0.031
				K-40	14.34	1.43E+01	0.270	0.360
BMS-E0200-371	Sample Location # 371 W. of B-124	3/26/03	5/16/03	Ac/Th-228	0.884	8.84E-01	0.029	0.110
				Co-60	<MDA	7.60E-03	0.008	0.025
				Cs-137	0.22	2.20E-01	0.012	0.030
				K-40	12.41	1.24E+01	0.250	0.330
BMS-E0200-402	Sample Location # 402 W. of B-124	3/26/03	5/7/03	Ac/Th-228	0.604	6.04E-01	0.030	0.110
				Co-60	<MDA	-6.90E-03	0.009	0.032
				Cs-137	0.049	4.90E-02	0.010	0.032
				K-40	14.94	1.49E+01	0.310	0.380
BMS-E0200-552	Sample Location # 552 E. of B-124	3/26/03	5/9/03	Ac/Th-228	0.537	5.37E-01	0.031	0.130
				Co-60	<MDA	2.90E-03	0.008	0.028
				Cs-137	0.071	7.10E-02	0.011	0.035
				K-40	14.94	1.49E+01	0.290	0.400
BMS-E0200-592	Sample Location # 592 E. of B-124	3/26/03	5/7/03	Ac/Th-228	0.488	4.88E-01	0.031	0.120
				Co-60	<MDA	5.00E-04	0.009	0.031
				Cs-137	<MDA	3.10E-02	0.011	0.036
				K-40	14.75	1.48E+01	0.330	0.390
BMS-E0200-658	Sample Location # 658 S. of B-124	3/26/03	5/16/03	Ac/Th-228	0.533	5.33E-01	0.028	0.130
				Co-60	<MDA	8.10E-03	0.008	0.026
				Cs-137	0.219	2.19E-01	0.009	0.030
				K-40	12.51	1.25E+01	0.280	0.370

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-E0200-693	Sample Location # 693 S. of B-124	3/26/03	5/22/03	Ac/Th-228	0.37	3.70E-01	0.027	0.110
				Co-60	<MDA	1.51E-02	0.008	0.026
				Cs-137	0.03	3.00E-02	0.006	0.018
				K-40	17.93	1.79E+01	0.290	0.310
BMS-E0200-726	Sample Location # 726 S. of B-124	3/26/03	5/16/03	Ac/Th-228	0.38	3.80E-01	0.027	0.120
				Co-60	<MDA	-2.20E-03	0.008	0.028
				Cs-137	<MDA	1.92E-02	0.008	0.024
				K-40	19.1	1.91E+01	0.310	0.340

SURVEY PACKAGE E0200 – Undisturbed Soils around Building 83 Tanks

Package E0200	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	-0.003	0.006	-0.003	0.004	3	3.8	-0.07%
Cs-137pCi/g	-0.012	0.008	-0.009	-0.006		11.0	-0.11%

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-E0200-1	Sample Location # 1 Under B-83 Tanks	10/22/02	4/21/03	Ac/Th-228	1.452	1.45E+00	0.039	0.130
				Co-60	<MDA	3.70E-03	0.010	0.033
				Cs-137	<MDA	-2.10E-02	0.010	0.037
				K-40	27.43	2.74E+01	0.410	0.320
BMS-E0200-2	Sample Location # 2 Under B-83 Tanks	10/22/02	4/21/03	Ac/Th-228	1.095	1.10E+00	0.034	0.130
				Co-60	<MDA	-2.70E-03	0.008	0.027
				Cs-137	<MDA	-5.50E-03	0.008	0.028
				K-40	20.62	2.06E+01	0.340	0.290
BMS-E0200-3	Sample Location # 3 Under B-83 Tanks	10/22/02	5/2/03	Ac/Th-228	0.839	8.39E-01	0.041	0.140
				Co-60	<MDA	-8.90E-03	0.009	0.033
				Cs-137	<MDA	-9.10E-03	0.010	0.034
				K-40	18.15	1.82E+01	0.380	0.320

SURVEY PACKAGE E0200 – Characterization Data for Soil By Building 83 Tanks

Package E0200 CHAR	Mean	Standard Deviation	Median	Maximum	Measurements	DCGL (pCi/g)	DCGL (%)
Co-60 pCi/g	0.000	0.000	0.0000	0.000	33	3.8	0.00%
Cs-134pCi/g	0.002	0.009	0.0000	0.045		3.4	0.07%
Cs-137pCi/g	0.014	0.028	0.0000	0.114		11.0	0.13%
Mn-54 pCi/g	0.001	0.004	0.0000	0.023		5.40	0.01%

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-036-1	Soil Sample (0 - 2 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	4.32E-02
				CS-134	<MDA	0.00E+00	0.00E+00	7.74E-02
				CS-137	<MDA	0.00E+00	0.00E+00	1.09E-01
				MN-54	<MDA	0.00E+00	0.00E+00	1.01E-01
BMS-SML-036-2	Soil Sample (2 - 4 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	3.08E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.00E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.26E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.22E-02
BMS-SML-036-3	Soil Sample (4 - 6 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	3.21E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.74E-02
				CS-137	<MDA	0.00E+00	0.00E+00	7.58E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.20E-02
BMS-SML-036-4	Soil Sample (16 - 18 ft Deep)	1/11/01	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	6.08E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.41E-02
				CS-137	0.114	1.14E-01	9.82E-02	5.13E-02
				MN-54	<MDA	0.00E+00	0.00E+00	5.43E-02
BMS-SML-036-5	Soil Sample (8 - 10 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	6.73E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.48E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.76E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.51E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-036-6	Soil Sample (10 - 12 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	3.50E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.16E-02
				CS-137	0.050	5.03E-02	4.89E-02	4.84E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.77E-02
BMS-SML-036-7	Soil Sample (12 - 14 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	3.11E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.87E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.57E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.56E-02
BMS-SML-036-8	Soil Sample (14 - 16 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	3.24E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.45E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.90E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.89E-02
BMS-SML-036-9	Soil Sample (16 - 18 ft Deep)	1/11/02	2/15/02	CO-60	<MDA	0.00E+00	0.00E+00	2.68E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.62E-02
				CS-137	0.037	3.69E-02	2.73E-02	2.58E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.53E-02
BMS-SML-037-1	Soil Sample (0 - 2 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	3.40E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.65E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.57E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.16E-02
BMS-SML-037-2	Soil Sample (2 - 4 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	2.14E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.70E-02
				CS-137	0.079	7.94E-02	3.72E-02	3.17E-02
				MN-54	0.023	2.34E-02	1.93E-02	1.65E-02
BMS-SML-037-3	Soil Sample (4 - 6 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	5.48E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.16E-02
				CS-137	0.046	4.60E-02	4.49E-02	4.46E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.80E-02
BMS-SML-037-5	Soil Sample (8 - 10 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	3.89E-02
				CS-134	<MDA	0.00E+00	0.00E+00	6.33E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.61E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.52E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-037-6	Soil Sample (10 - 12 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	5.91E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.88E-02
				CS-137	<MDA	0.00E+00	0.00E+00	7.49E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.35E-02
BMS-SML-037-7	Soil Sample (12 - 14 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	4.35E-02
				CS-134	<MDA	0.00E+00	0.00E+00	7.56E-02
				CS-137	<MDA	0.00E+00	0.00E+00	1.03E-01
				MN-54	<MDA	0.00E+00	0.00E+00	9.85E-02
BMS-SML-037-8	Soil Sample (14 - 16 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	1.07E-01
				CS-134	<MDA	0.00E+00	0.00E+00	4.73E-02
				CS-137	0.051	5.15E-02	5.06E-02	5.04E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.84E-02
BMS-SML-037-9	Soil Sample (16 - 18 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	6.97E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.65E-02
				CS-137	<MDA	0.00E+00	0.00E+00	1.10E-01
				MN-54	<MDA	0.00E+00	0.00E+00	6.60E-02
BMS-SML-038-1	Soil Sample (0 - 2 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	3.67E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.75E-02
				CS-137	<MDA	0.00E+00	0.00E+00	7.60E-02
				MN-54	<MDA	0.00E+00	0.00E+00	8.59E-02
BMS-SML-038-2	Soil Sample (2 - 4 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	1.85E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.68E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.44E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.33E-02
BMS-SML-038-3	Soil Sample (4 - 6 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	5.73E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.36E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.98E-02
				MN-54	<MDA	0.00E+00	0.00E+00	5.23E-02
BMS-SML-038-5	Soil Sample (8 - 10 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	3.52E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.96E-02
				CS-137	0.047	4.66E-02	4.41E-02	4.37E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.24E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-038-6	Soil Sample (10 - 12 ft Deep)	1/11/02	2/13/02	CO-60	<MDA	0.00E+00	0.00E+00	2.93E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.00E-02
				CS-137	<MDA	0.00E+00	0.00E+00	4.50E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.40E-02
BMS-SML-038-7	Soil Sample (12 - 14 ft Deep)	1/11/02	2/16/02	CO-60	<MDA	0.00E+00	0.00E+00	3.39E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.51E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.56E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.55E-02
BMS-SML-038-8	Soil Sample (14 - 16 ft Deep)	1/11/02	2/13/02	CO-60	<MDA	0.00E+00	0.00E+00	9.89E-03
				CS-134	<MDA	0.00E+00	0.00E+00	1.55E-02
				CS-137	<MDA	0.00E+00	0.00E+00	2.59E-02
				MN-54	<MDA	0.00E+00	0.00E+00	2.93E-02
BMS-SML-038-9	Soil Sample (16 - 18 ft Deep)	1/11/02	2/13/02	CO-60	<MDA	0.00E+00	0.00E+00	6.21E-02
				CS-134	0.045	4.49E-02	3.26E-02	2.55E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.60E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.72E-02
BMS-SML-039-1	Soil Sample (0 - 2 ft Deep)	1/11/02	2/19/02	CO-60	<MDA	0.00E+00	0.00E+00	5.57E-02
				CS-134	0.032	3.21E-02	2.75E-02	2.61E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.23E-02
				MN-54	<MDA	0.00E+00	0.00E+00	3.27E-02
BMS-SML-039-2	Soil Sample (2 - 4 ft Deep)	1/11/02	2/20/02	CO-60	<MDA	0.00E+00	0.00E+00	5.23E-02
				CS-134	<MDA	0.00E+00	0.00E+00	1.47E-02
				CS-137	0.038	3.79E-02	2.50E-02	2.42E-02
				MN-54	<MDA	0.00E+00	0.00E+00	2.81E-02
BMS-SML-039-4	Soil Sample (6 - 8 ft Deep)	1/11/02	2/19/02	CO-60	<MDA	0.00E+00	0.00E+00	4.77E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.36E-02
				CS-137	<MDA	0.00E+00	0.00E+00	4.13E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.63E-02
BMS-SML-039-5	Soil Sample (8 - 10 ft Deep)	1/11/02	2/19/02	CO-60	<MDA	0.00E+00	0.00E+00	7.99E-02
				CS-134	<MDA	0.00E+00	0.00E+00	4.93E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.55E-02
				MN-54	<MDA	0.00E+00	0.00E+00	7.24E-02

SAMPLE ID	SAMPLE DESCRIPTION	SAMPLE DATE	ANALYSIS DATE	NUCLIDE	RESULT (pCi/g)	RESULT (pCi/g)	1 Sigma (± pCi/g)	MDC (pCi/g)
BMS-SML-039-6	Soil Sample (10 - 12 ft Deep)	1/11/02	2/19/02	CO-60	<MDA	0.00E+00	0.00E+00	9.88E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.10E-02
				CS-137	<MDA	0.00E+00	0.00E+00	6.28E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.12E-02
BMS-SML-039-7	Soil Sample (12 - 14 ft Deep)	1/11/02	2/20/02	CO-60	<MDA	0.00E+00	0.00E+00	3.04E-02
				CS-134	<MDA	0.00E+00	0.00E+00	2.00E-02
				CS-137	<MDA	0.00E+00	0.00E+00	2.39E-02
				MN-54	<MDA	0.00E+00	0.00E+00	2.42E-02
BMS-SML-039-8	Soil Sample (14 - 16 ft Deep)	1/11/02	2/19/02	CO-60	<MDA	0.00E+00	0.00E+00	7.38E-02
				CS-134	<MDA	0.00E+00	0.00E+00	3.98E-02
				CS-137	<MDA	0.00E+00	0.00E+00	4.96E-02
				MN-54	<MDA	0.00E+00	0.00E+00	4.78E-02
BMS-SML-039-9	Soil Sample (16 - 18 ft Deep)	1/11/02	2/19/02	CO-60	<MDA	0.00E+00	0.00E+00	8.24E-02
				CS-134	<MDA	0.00E+00	0.00E+00	5.04E-02
				CS-137	<MDA	0.00E+00	0.00E+00	5.82E-02
				MN-54	<MDA	0.00E+00	0.00E+00	6.53E-02

8.0 APPENDICES

APPENDIX A: BMS FINAL STATUS SURVEY PACKAGES AND RESULTS BY SURVEY AREA

APPENDIX B: INSTRUMENT CALIBRATION AND SOURCE CHECK DATA

APPENDIX C: SOIL ANALYSIS DETAILED RESULTS

APPENDIX D: TRITIUM ANALYSIS DETAILED RESULTS