

University of Missouri - Columbia Sinclair Farm Phase 1 Final Status Report

**Sinclair Farm
South Sinclair Road
Columbia, MO 65201**

**Performed Under:
Chase Environmental Group's
Commonwealth of Kentucky
Radioactive Materials
License No. 201-605-90**

June 2011



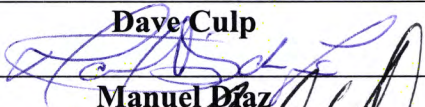
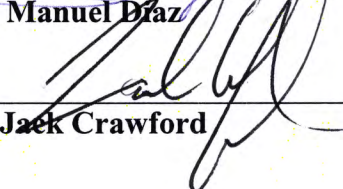


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June 24, 2011

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ACRONYM LIST

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
CRSO	Corporate Radiation Safety Officer
DAW	Dry Active Waste
DCF	Dose Conversion Factor
DCGL _{EMC}	Derived Concentration Guideline Level – Elevated Measurement Comparison
DCGL _w	Derived Concentration Guideline Level – Wilcoxon Rank Sum
DOT	Department of Transportation
DWP	Decommissioning Work Plan
DQA	Data Quality Assessment
DQO	Data Quality Objective
DSV	Default Screening Value
FSS	Final Status Survey
FSSR	Final Status Survey Report
HASP	Health and Safety Plan
HSA	Historical Site Assessment
HSE	Health, Safety and Environment
LBGR	Lower Bound of the Gray Region
LSC	Liquid Scintillation Counter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MU	University of Missouri-Columbia
NRC	U.S. Nuclear Regulatory Commission
NIST	National Institute of Standards and Technology
PM	Project Manager
PPE	Personal Protective Equipment
QA	Quality Assurance
QAP	Quality Assurance Procedures
QAPP	Quality Assurance Project Plan
QM	Quality Manager
RCS	Radiation Control Supervisor
RCT	Radiation Control Technician
RPP	Radiation Protection Program
RSM	Radiation Safety Manual
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
TEDE	Total Effective Dose Equivalent
TLD	Thermo Luminescent Dosimeter

1 INTRODUCTION

The University of Missouri (MU) plans to demolish buildings 13641, 13646, 13648, 13650, 13661, and 13667 located at the Sinclair Farm Site in Columbia, Missouri. Because most operations in these buildings were historically used for activities involving radioactive materials under the Missouri University Research Reactor (MURR) or MU US Nuclear Regulatory Commission (NRC) Broad Scope Type A radioactive materials license No. 24-00513-32, MU must demonstrate that they meet the release criteria for unrestricted use prior to demolition. A map of the site is provided in Appendix A.

Radioactive materials used at these facilities consisted of C-14 and H-3, and additionally, mixed fission and activation products for the MURR Barn, building 13641. Survey design was such that adequate instrument detection sensitivity was achieved for other beta-gamma emitting nuclides below their screening values for the buildings contained in this report.

MU procured Chase Environmental Group, Inc. (Chase) to perform MARSSIM-based surveys to provide statistically-based survey data to support release and to provide independent third party verification that the structures meet the unrestricted release criteria for residual radioactive materials. On-site activities were conducted under the Chase Commonwealth of Kentucky Radioactive Materials License 201-605-90 utilizing a reciprocal agreement with the NRC and in accordance with the "University of Missouri – Columbia, Sinclair Farm Phase 1, Radiological Survey Plan" (Plan) dated May 2, 2011. On site activities were performed from May 9, 2011 to May 13, 2011.

The Plan was developed using the guidance provided in NUREG 1757, "Consolidated NMSS Decommissioning Guidance" and NUREG 1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM). The plan provided the approach, methods, and techniques for radiological surveys of impacted areas of the facility. Final status surveys were designed to implement the protocols and guidance provided in MARSSIM to ensure that technically defensible data was generated to demonstrate that structures met the release criteria for unrestricted use specified in 10CFR20.1402: "Radiological criteria for unrestricted use". The criteria are that residual radioactivity that is distinguishable from background radiation does not result in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group in excess of 25 mrem per year and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

In addition, MU established conservative ALARA goals based on NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment." Specifically, the following surface contamination limits were applied:

- 5,000 dpm/100cm² total surface contamination (averaged over 1m²)
- 15,000 dpm/100cm² maximum total surface contamination (limited to 100 cm²)
- 1,000 dpm/100cm² removable surface contamination

Although the facility met the release criteria without remediation, it did not meet the ALARA goal without remediation. Several discreet locations on the floor within about a 10' x 10' area in the MURR Barn were identified with residual radioactivity above ALARA goals and were remediated.

This report presents sufficient data to support the conclusion that the facilities surveyed meet the NRC's release criteria. Final status surveys demonstrate that building structural surfaces and systems included in the scope of this report are orders of magnitude below release criteria and are suitable for unrestricted release. All final status surface contamination measurements were a small fraction of the DSVs. Based on the Building Occupancy Scenario of NRC DandD dose modeling software Version 2.1, **the Total Effective Dose Equivalent (TEDE) to an average member of the critical group would be < 0.71 mrem/year (2.8% of the release criterion of 25 mrem/yr)** using the results of the survey unit with the highest average activity. Additionally, a reasonable effort was made by Chase to decontaminate any detectable residual radioactivity in support of the ALARA principle.

2 SITE DESCRIPTION AND HISTORY

2.1 Historical Site Assessments

Chase and the MU Environmental Health and Safety Department performed a Historical Site Assessment (HSA) in March and May 2011. The purpose of the historical site assessment was to determine the current status of the facility including potential, likely, or known sources of radioactive contamination by gathering data from various sources. This data included physical characteristics and location of the site as well as information found in site operating records, including radiological surveys.

The reviewed records included: radioactive materials licenses, license applications, amendment requests, radiological surveys, radionuclide receipt and distribution records, incident reports, and facility renovation records.

2.2 Site Description

The MU Sinclair Research Farm, located on 543 acres at South Sinclair Road in Columbia, Missouri was historically used for radioactive materials research, incineration, land disposal, and radioactive materials storage. Four (4) barns (buildings 13646, 13648, 13650, and 13667), the MURR Barn (building 13641), and a small clinic (building 13661) were included in the Plan. Buildings were recently surveyed by MU staff with no elevated activity detected. The MURR Barn was historically used to store items from the reactor facility, and a small area of contaminated concrete was previously remediated. Two lagoon systems are included in the Plan. One of the lagoons has a potential for C-14 activity via buried piping from rinsing milk, urine, and feces from barn surfaces during C-14 studies. (note: One lagoon on the west side of S. Sinclair Rd. is served by the surveyed barns and is a single lagoon. The second lagoon on the west side of the road was not sampled and is not known to be connected to the barns. An attempt to sample was made to verify this assumption, however the lagoon could not be accessed due to overgrowth and foliage.

The 2 lagoons on the east side of S. Sinclair Rd. (the MURR barn side) are a two unit system and are connected in series to each other. These lagoons are not associated with any of the buildings surveyed during this scope of work. These lagoons are connected to buildings that primarily used H-3 and C-14; however, use of other radionuclides was authorized. This lagoon system was sampled during characterization to ensure no residual activity existed.

Future plans include a survey of all west-side lagoons and leach fields.

2.3 Ownership

The site is owned by MU. MU has no plans to sell the site after demolition.

2.4 Potential Contaminants

Based on information provided by MU, the nuclides of concern are H-3 and C-14 in all areas, and additionally, mixed fission and activation products in the MURR Barn.

2.5 Impacted Building Descriptions

The Plan included five barns and a small clinic with a history of radioactive materials usage. Four of the barns (2,940 ft²/each) and a necropsy clinic (1517ft²) are grouped together on the west side of S. Sinclair Road. The MURR Barn (5,160 ft²) is located about 300 yards northeast of the other facilities on the east side of S. Sinclair Road. The barns are constructed with sheet metal walls and concrete floors. Barns 13648 and 13667 contain stalls, and barn 13650 contains a large internal animal pen. The clinic is of similar construction, and formerly contained office, labs spaces, and animal holding pens. The entire clinic was gutted, so that all that remained were walls and floors, prior to Chase's arrival.

2.6 Impacted Systems

Buildings 13646, 13648, 13650, 13661, and 13667 floor drains are directed into a lagoon near the barns. Buildings 13646, 13648, 13650, and 13667 contained inoperable general exhaust ventilation systems. None of the Sinclair Farm facilities contain vacuum systems. The MURR Barn (Building 136041) contains no systems.

3 FACILITY RELEASE CRITERIA

The radiological release criteria of NRC 10 CFR 20 Subpart E for unrestricted use were used for decommissioning the buildings. Specifically, buildings were surveyed in accordance with the guidance contained in MARSSIM to demonstrate compliance with the criteria of 10 CFR 20.1402: *"Radiological criteria for unrestricted use: A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take*

into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal."

4 DERIVED CONCENTRATION GUIDELINE LEVELS (DCGLs)

The NRC has published default screening values (DSVs) in NUREG 1757, Volume 1, Appendix B for commonly used radionuclides. The DSVs are the average concentrations of residual radioactivity that would equate to 25 mrem/yr to an average member of the critical group using default parameter values in the DandD dose modeling software. Structural surfaces DSVs for the nuclides of concern are presented in Table 4-1.

Table 4-1: NRC Screening Values

Isotope	Half-Life (yr)	Half-Life < 120 days?	Radiation Type	Default Screening Value (dpm/100cm ²)
C-14	5.7E+03	NO	Weak Beta	3.7E+06
H-3	1.2E+01	NO	Weak Beta	1.2E+08
Co-60 ¹	5.3E+01	NO	Beta/Gamma	7.1E+03

DSVs are the basis for developing Derived Concentration Guideline Levels for building structural surfaces. The DCGL is the radionuclide-specific surface area concentration that could result in a dose equal to the release criterion. DCGL_w is the concentration limit if the residual activity is essentially evenly distributed over a large area. For this project, DCGL_w is equal to the DSV. An important assumption of the dose model is that removable contamination is <10% of total contamination. Smear surveys were taken to verify this assumption and compared to a removable DCGL equal to 10% of the total DCGL.

Based on history, usage, etc., C-14 and H-3 were the nuclides of concern for all areas, and additionally, mixed fission and activation products for the MURR Barn. All fission products are beta-gamma emitters due to a high neutron/proton ratio. Many are gases and/or have short half-lives, such that a majority of the dose from fission products several months to decades after production is due to Cs-137 and Sr-90. The dose from activated corrosion products (primarily isotopes of Co, Mn, Fe, and Ni) is dominated by Co-60. The actual distribution of the fission product and corrosion product activity that may be present is unknown. However, Co-60 has the lowest DSV of any beta-gamma emitter (except for beta emitters that have alpha-emitting progeny such as Pb-210, Ra-228 and Pu-241). Therefore, the Co-60 DSV of 7,100 dpm/100cm² is conservatively used as a gross beta DSV for the MURR barn. This method also ensures hard-to-detect nuclides, such as Fe-55 and Ni-63, which are typically a small fraction of the nuclide distribution are maintained below their screening values.

¹ For the MURR Barn, gross beta measurements were performed using the Co-60 DSV as the limiting DCGL for mixed fission and corrosion products.

Because H-3 and other hard-to-detect nuclides cannot be efficiently detected by direct methods, they were evaluated by removable contamination measurements only. Considering the extremely conservative ALARA goals, the dose conversion factors and the ratio of hard-to-detect nuclides compared to detectable nuclides, this method ensures the dose contribution from hard-to-detect nuclides is an insignificant component of the total dose.

5 ALARA GOALS

ALARA goals were established for all impacted surfaces based on the release criteria for equipment and materials specified in NUREG 1556, Volume 7, Table Q.2, "*Acceptable Surface Contamination Levels for Equipment*." Specifically, the following surface contamination limits were applied:

- 5,000 dpm/100cm² total surface contamination (averaged over 1m²)
- 15,000 dpm/100cm² maximum total surface contamination (limited to 100 cm²)
- 1,000 dpm/100cm² removable surface contamination (710 dpm/100cm² for the MURR barn)

Additionally, a reasonable effort was made by Chase to decontaminate any detectable residual radioactivity in support of the ALARA principle. Because of the conservatism of the ALARA goals, these criteria were applied on a nuclide-specific basis and the unity rule was not applied. However, the number of measurements required by MARSSIM to demonstrate compliance with the release criteria was calculated using DCGLs.

Data Quality Objectives (DQOs) were designed to ensure instrument detection sensitivities were below the ALARA goals.

6 ALARA ANALYSIS

Due to the low doses associated with residual radioactivity at or below the ALARA goals, an explicit quantitative ALARA analysis was not required per NUREG 1757, Volume 2, Appendix N. Additionally, a reasonable effort was made to decontaminate any detectable contamination in support of the ALARA principle.

7 PROJECT MANAGEMENT AND ORGANIZATION

Chase implemented their Commonwealth of Kentucky radioactive materials license at the site. MU oversaw decommissioning activities and maintained responsibility for building maintenance, fire, and security functions. There was a clear separation of licensed activities between Chase and MU. Chase and MU coordinated activities such that neither party violated the license of the other party. For remediation and invasive sampling, Chase clearly posted and controlled areas to prevent inadvertent entry by unauthorized personnel. The following management structure was utilized for administration and implementation of this Plan.

7.1 Corporate Radiation Safety Officer (CRSO)

The Chase CRSO was responsible for the corporate management of the radiological control and safety program and for directing the program to limit occupational radiation exposures to levels ALARA as specified in the Chase radioactive materials license.

The CRSO had the authority to order the suspension of any operation that presented an imminent radiological or safety threat or hazard to the employees, the environment, or the general public. The CRSO's responsibilities included the following:

- Establishing company policy to comply with state and federal statutes, rules, regulations, and license conditions regarding occupational safety and health
- Providing selection criteria for equipment, supplies, and services for radiological work and personnel exposure monitoring
- Establishing standards for personnel protection to assure that exposures to ionizing radiation and radioactive contamination were ALARA
- Implementing the radiological control and safety audit program
- Ensuring the quality of protective equipment for personnel and prescribing usage standards, and
- Establishing procedures for radiological protection and monitoring, which included the ALARA program

Manuel Diaz was the CRSO and can be reached at 865-621-0158.

7.2 Director, Radiological Services (DRS)

The DRS reports to the Chase Board of Directors and was responsible for providing corporate and technical support to field projects.

The DRS was also responsible for ensuring the project was completed under the direction of Project Managers in full compliance with the requirements of all applicable licenses, permits, and regulations.

John O'Neil was the DRS and can be reached at 865-384-7555.

7.3 Field Services Manager (FSM)

The FSM directs all aspects of operations including radiological activities. The FSM established policies and procedures to assure regulatory compliance and oversaw all aspects to ensure regulatory compliance and adherence to the ALARA principle.

The FSM assigned the PM to the project and provided technical support. Technical support encompassed health physics, occupational safety, and /or administrative support. The FSM reports to the DRS.

Dave Culp was the FSM and can be reached at 865-207-3664.

7.4 Project Manager (PM)

The Project Manager was responsible for project operations from initiation through completion. The PM's duties include the following:

- Maintaining compliance with conditions of site operating licenses, permits, rules, and regulations
- Maintaining working conditions which assure health, safety, and protection for all employees and visitors
- Providing physical examinations for employees as required by company policy, local, state, and federal regulations
- Ensuring that employees are instructed regularly, or as required by law, on precautions, procedures, and practices to be followed to minimize exposure to radioactive materials and to conduct operations safely
- Notifying the RSO, applicable State agency or the NRC, promptly, of any operation or condition which appears to present a radiological hazard to employees, the public, or the environment
- Furnishing proper personnel protective equipment, ensuring that employees are instructed in its proper use, and enforcing rules for the equipment's utilization
- Ensuring that sufficient staffing for the project is present and consists of individuals able to conduct daily operations in compliance with regulatory requirements and to maintain a safe working environment, and
- Maintaining project radiation exposures ALARA.

Ken Gavlik was the Project Manager and can be reached at 865-851-5202.

7.5 Radiation Control Supervisor (RCS)

The RCS reported directly to the PM and was responsible for the implementation of the Radiation Protection Program (RPP) at the project. Responsibilities included:

- Monitoring site conditions to ensure compliance with the RPP and the Chase Radioactive Materials License
- Determining appropriate PPE
- Ensuring that the CRSO is notified of conditions or situations that present a radiological hazard, concern, or exceed limitations set forth in the RSM or applicable procedures and work plans
- Issuing Radiation Work Permits (RWP), and
- Maintaining records related to the RPP in an auditable condition for the duration of the project

Ryan Dibble was the Radiation Control Supervisor and can be reached at 865-603-2618.

7.6 Radiation Control Technicians (RCTs)

RCTs reported to the RCS and acted as the RCS's representatives in specifically implementing the RPP. Responsibilities included:

- Performing and documenting radiological surveys
- Maintaining, inspecting, and performing operational checks of field instrumentation
- Identifying and controlling radiation protection hazards, and
- Performing job coverage duties, (i.e., surveys, contamination control, air sampling, sample analysis, environmental sampling, custody control, etc.)

8 PROJECT TRAINING REQUIREMENTS

Chase provided all project personnel with radiation worker training required by the radioactive materials license, as well as training for project-specific programs, plans, and procedures.

8.1 Radiological Training

Radiological training was completed and documented in accordance with Chase license requirements.

8.2 Project Specific Training

Prior to project start-up, personnel attended an initial project-specific training session conducted by the PM. The training session included the following items:

- Review of the Decommissioning Work Plan
- Discussion regarding the scope of work and planned work activities
- Review of chemical, physical, and radiological hazards associated with the project
- Discussion of posting requirements
- Types and use of available personal protective equipment
- Project security control and operational work zones
- Emergency response and site evacuation procedures
- Project communications
- General safe work practices
- Data quality and chain of custody procedures, and
- Review of applicable regulatory standards as applied to project operations

8.3 General Safety Briefings

General safety meetings were held by the PM at the beginning of each work shift. The purpose of these meetings was to discuss project status, potential problem areas, general safety concerns, and to reiterate DWP requirements.

8.4 Transportation Training

Persons who prepared hazardous materials for transportation were trained in accordance with the requirements of 49 CFR 172, subpart H.

9 RADIATION PROTECTION

Radiological work was performed according to the Chase radioactive materials license Radiation Protection Program (RPP). Selected sections of particular relevance to this project were:

9.1 Radiation Work Permit

A Radiation Work Permit (RWP) was generated for any invasive project activity and provided information on radiological conditions present in the work areas and requirements for personnel protective clothing, respiratory protection, safety and dosimetry. The RWP included the following information:

- Job description
- Permit Start and Expiration dates
- Work locations
- ALARA Limits
- Radiation and contamination levels
- Airborne radioactivity concentrations
- Personnel Protective Equipment requirements
- Dosimetry requirements
- Respiratory Protection requirements
- Additional permits that may be required
- Health Physics coverage requirements
- Instructions to workers
- Access Review
- Radiological Conditions

9.2 Posting and Controls

Radiological work was performed according to the Chase radioactive materials license RPP. Controlled areas were posted in accordance with the Chase Radiation Safety Manual section 4.13.2 and NRC regulations 10 CFR 19 and 10 CFR 20.

9.3 Dosimetry

Due to the cleanliness of the facility, radiation doses from internal and external sources were well below 10% of the occupational dose limits, therefore external and internal dosimetry procedures was not required. However, thermoluminescent dosimeters (TLDs) were used to monitor occupational exposures of personnel performing activities under this plan. All decontamination activities were performed using the RWP process.

10 HEALTH AND SAFETY PROGRAM

The decommissioning project was performed under a Chase project-specific Health and Safety Plan (HASP), and in accordance with the MU Safety Program requirements. In addition, radiological work was performed according to the RWP process, the Chase radioactive materials license and the Radiation Safety Manual under the management and supervision of the CRSO.

11 ENVIRONMENTAL MONITORING PROGRAM

Due to the small quantities of materials present at the facility, an environmental monitoring program was not required. However remediation activities were conducted to control the spread of contamination and to prevent the release of radioactive materials from the buildings.

12 RADIOACTIVE WASTE MANAGEMENT

All waste generated during licensed activities were put into DOT approved containers and turned over to MU staff for incorporation into their waste streams for ultimate disposal.

13 QUALITY ASSURANCE PROGRAM

Due to the limited scope of the planned activities, project-specific quality requirements were included in the plan, and were supported by the Chase corporate Quality Assurance (QA) program and met the guidelines of MARSSIM Section 9. QA criteria were applied in a graded manner to achieve a balance between the rigor of application of quality assurance measures and the scale, cost, and complexity of the work involved.

14 SURVEY INSTRUMENTATION

14.1 Instrument Calibration

Radiation detection instruments were calibrated at least annually with National Institute of Standards and Technology (NIST) traceable sources and to radiation emission types and energies that provided detection capabilities similar to the isotopes of concern. Field instruments had an efficiency determined by a licensed calibration facility using NIST traceable sources. Calibration records for field instruments are provided in Appendix B. Calibration records for the liquid scintillation counter are maintained by MU.

14.2 Datalogging

Beta-gamma surface scans were performed using datalogging instrumentation. While scanning, in addition to the surveyor listening to the audible output, integrated counts were recorded. Logged data was downloaded and processed using data management software to perform data analyses and reporting. Reporting includes graphical (4-plot) presentation, as well as summary statistics functions. The 4-plot consists of a run sequence plot, a lag plot, a histogram, and a normal probability plot. The 4-plot is a simple, efficient, and powerful way to graphically view a data set. The purpose of the 4-plot is to provide a graphical representation of the scan data to verify assumptions of normality and to identify any anomalies.

14.3 Functional Checks

Instrument functional checks were performed at least daily when in use. The background, source check, and field measurement count times for radiation detection instrumentation were specified by procedure to ensure measurements were statistically valid. Background readings were taken as part of the daily instrument check and compared with the acceptance range for instrument and site conditions.

14.4 Counting Times and Minimum Detectable Concentrations (MDCs)

Minimum counting times for background determinations and measurement of total and removable contamination were chosen to provide MDCs that meet the Data Quality Objectives (DQOs) specified in the plan. MARSSIM equations relative to building surfaces have been modified to convert to units of dpm/100cm². Count times and scanning rates were determined using the following equations:

14.4.1 Static Counting MDC

Static counting MDC at a 95% confidence level was calculated using the following equation, which is an expansion of NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", Table 3.1 (Strom & Stansbury, 1992):

$$MDC_{static} = \frac{3 + 3.29 \sqrt{B_R \cdot t_S \cdot (1 + \frac{t_S}{t_B})}}{t_S \cdot E_{tot} \cdot \frac{A}{100}}$$

Where:

- MDC_{static} = minimum detectable concentration (dpm/100cm²)
 B_R = background count rate (counts per minute)
 t_B = background count time (minutes)
 t_S = sample count time (minutes)
 E_{tot} = total detector efficiency for radionuclide emission of interest (cpm/dpm)
 A = detector probe area (cm²)

14.4.2 Ratemeter Scanning MDC

Scanning MDC at a 95% confidence level was calculated using the following equation, which is a combination of MARSSIM equations 6-8, 6-9, and 6-10:

$$MDC_{scan} = \frac{d' \sqrt{b_i} \left(\frac{60}{i} \right)}{\sqrt{p} \cdot E_{tot} \cdot \frac{A}{100cm^2}}$$

Where:

- MDC_{scan} = minimum detectable concentration (dpm/100cm²)
- d' = desired performance variable (1.38)
- b_i = background counts during the residence interval (counts)
- i = residence interval (seconds)
- p = surveyor efficiency (0.5)
- E_{tot} = total detector efficiency for radionuclide emission of interest (cpm/dpm)
- A = detector probe area (cm²)

14.4.3 Smear Counting MDC

Smear counting MDC at a 95% confidence level was calculated using the following equation, which is an expansion of NUREG 1507, Table 3.1 (Strom & Stansbury, 1992):

$$MDC_{SMEAR} = \frac{3 + 3.29 \sqrt{B_R \cdot t_s \cdot \left(1 + \frac{t_s}{t_b} \right)}}{t_s \cdot E}$$

Where:

- MDC_{smear} = minimum detectable concentration (dpm/100cm²)
- B_R = background count rate (counts per minute)
- t_b = background count time (minutes)
- t_s = sample count time (minutes)
- E_{tot} = Instrument efficiency for radionuclide emission of interest (cpm/dpm)

14.5 Uncertainty

The uncertainty for each measurement was calculated using equation 6-15 from MARSSIM:

$$\sigma = 1.96 \sqrt{\frac{C_{s+b}}{T_{s+b}^2} + \frac{C_b}{T_b^2}}$$

Where:

- σ = Uncertainty
- 1.96 = multiplier to achieve a 95% confidence level
- C_{s+b} = gross sample counts
- T_{s+b} = sample count time (min.)
- C_b = gross background counts
- T_b = background count time (min.)

14.6 Instrumentation Specifications

The instrumentation used for facility decommissioning surveys is summarized in the following tables. Table 14-1 lists the standard features of each instrument such as probe size and efficiency. Table 14-2 lists the typical operational parameters such as scan rate, count time, and the associated Minimum Detectable Concentrations (MDC).

Table 14-1: Instrumentation Specifications

Detector Model	Detector Type	Detector Area (cm ²)	Meter Model	Window Thickness (mg/cm ²)	Typical Total Efficiency
Ludlum 43-68	Gas Flow Proportional	126	Ludlum 2221	0.8	10 % (C-14) 22% (Tc-99)
Ludlum 43-37 Floor Monitor	Gas Flow Proportional	582	Ludlum 2221	0.8	10 % (C-14) 22% (Tc-99)
Packard TriCarb (or Equivalent) ²	Liquid Scintillation	N/A	N/A	N/A	63% (H-3) 75% (C-14) 69% (CH3, >256 keV)

² Actual LSC efficiencies.

Table 14-2: Typical Instrument Operating Parameters and Sensitivities

Measurement Type	Detector Model	Max. Scan Rate (in/sec)	Count Time (sec)	Background (cpm)	MDC (dpm/100cm ²)
Surface Scans	Ludlum 43-68	10	N/A	500	4,558 (C-14) 2,072 (Tc-99)
Surface Scans	Ludlum 43-37	20	N/A	1,500	1,966 (C-14) 894 (Tc-99)
Total Surface Activity	Ludlum 43-68	N/A	6	500	2,849 (C-14) 1,295 (Tc-99)
Total Surface Activity	Ludlum 43-37	N/A	6	1,500	1,031 (C-14) 468 (Tc-99)
Removable Activity	Packard TriCarb	N/A	60	25 (H-3) 15 (C-14) 16 (CH3)	44 (H-3) 26 (C-14) 24 (CH3)

14.7 Efficiency Determination

The Investigation Levels/ALARA goals were conservatively based on the release criteria for equipment and materials specified in NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment" in which activities are determined using 4π instrument efficiency. MARSSIM methodology for building structures uses ISO-7503-1 methodology that takes into account the texture of the surface and the 2π detector efficiency. Under MARSSIM, the default surface efficiency for beta emitters with maximum energies less than 400 KeV is conservatively set at 0.25, resulting in a total efficiency of approximately half of the 4π efficiency. To reconcile this incongruity and to aid in data management, the 4π C-14 calibration efficiency was used to determine field measurement activities for C-14, and the calculated dose to demonstrate compliance with the facility release criteria for each survey unit was doubled to correct for the ISO 7503-1 surface efficiency. For measurements taken in the MURR Barn, the 2π Tc-99 efficiency and a surface efficiency of 0.5 were used. This methodology was chosen because:

- Application of the ISO-7503-1 surface efficiency would have significantly impacted final status survey time and data quality while providing no benefit. The impact would be in the form of slower scanning times and magnification of the variability of the natural background radioactivity present in some building materials.
- NUREG 1507 research indicates that ISO-7503-1 surface efficiencies for low energy beta emitters (including C-14) are overly conservative for typical decommissioning conditions and surface efficiencies closer to 0.5 are warranted.
- NUREG 1556, Volume 7, Table Q.2, criteria are not dose-based resulting in over-conservatism for low energy beta emitters.

15 CHARACTERIZATION SURVEYS

Radiological characterization was designed to identify areas of elevated activity that required remediation. Characterization consisted primarily of surface scans and smears for building structural surfaces and removable activity measurements on system internal surfaces. Characterization surveys were designed to meet the same data quality objectives as final status surveys such that characterization data was used as final status data where possible. If the initial characterization survey results indicated that contamination was not present in excess of the release criteria, then data from the survey was used as part of the final status survey. For areas that were remediated, the characterization survey data was used as part of the final status survey measurements provided that 1) the data used was only from areas with contamination levels below the release criteria, and 2) remediation work was controlled such that the survey location could not have become cross-contaminated. Additionally, characterization was designed to collect information regarding the activity concentration in soils surrounding the MURR Barn to verify the initial non-impacted classification, and to collect solid samples from lagoons.

15.1 Building Structural Surfaces

The survey protocol for building surfaces consisted of performing the scanning portion of the final status survey protocol, with judgmental smears and static measurements on the highest probability areas for residual radioactivity. Although not required by MARSSIM, the characterization protocol for inside the MURR Barn included 100% gamma scans utilizing a 2"x 2" sodium iodide detector. Judgmental static measurements and smears were also taken on vertical surfaces as part of the modified Class 2 final status survey protocols described in section 17.9.

The purpose of scanning was to identify locations of elevated activity. Nine discreet areas of elevated activity were identified on the floor in the MURR barn within an approximate 10' x 10' area as described in Section 16. Where elevated activity was identified, a static measurement and smear were taken at the location of highest activity identified during the scan. The extent and the magnitude of the residual contamination were determined and the area was marked for identification during the remediation phase. Twenty vertical locations in each survey unit were judgmentally selected to perform a static measurement and removable contamination measurement. All measurement results taken on vertical surfaces during characterization were less than the investigation levels.

15.2 Building Systems

The characterization survey protocol for building systems consisted of removable contamination measurements of internal surfaces of ventilation, and drains systems. One hundred percent of accessible openings in ventilation, and drain systems were surveyed in the Class 2 Areas. Chase used convenient accessible locations to obtain measurements. The small geometry of the openings made direct measurements impossible, so only removable activity measurements were made.

15.3 Outside Grounds

15.3.1 MURR Barn

Outside grounds were classified as non-impacted. However, limited surveys of the soils around the MURR Barn outside grounds were conducted as verification. The characterization protocol consisted of 100% gamma scans utilizing a 2"x 2" sodium iodide scan of surface soils within a 50 foot perimeter of the MURR Barn. Grassy areas exhibited higher activity results than bare surfaces. This was initially thought to be likely caused by elevated K-40 in the grassy areas due to the use of fertilizers at the farm. Subsequently, soil samples were taken from the three locations of highest activity as determined by gamma scans. Chase personnel collected three surface soil samples from 0 to 6 inch depth (samples C1103006S-001 through C1103006S-003) for gamma spectroscopy analysis at Teledyne Brown Engineering. Samples showed no residual licensed radioactivity, but did show higher than normal levels of K-40 (approximately 5 pCi/g higher than samples taken during previous MU site characterizations). Analysis results are provided in Appendix C. Sample locations are presented in Appendix J.

15.3.2 Lagoons

Sediment samples were taken in the lagoon where the barn drains discharged. Each lagoon had three samples taken around their respective inlets (samples C1103006M-001 through C1103006M-006). All samples were analyzed at Teledyne Brown Engineering for C-14, H-3 and gamma spectroscopy. All results were less than 1 pCi/g. Analysis results are provided in Appendix C. Sample locations are presented in Appendix I.

16 REMEDIATION ACTIVITIES

16.1 Remediation

Remediation was conducted to control the spread of contamination and keep personnel exposures ALARA. Newly exposed surfaces were characterized for residual radioactivity as remediation occurred. These surveys supplemented the characterization surveys. Remedial action surveys were performed to monitor the effectiveness of decontamination efforts and ensure that surrounding areas were not cross-contaminated from remediation actions.

Concrete surfacing/scarification activities were conducted in several discreet locations to remove the surficial layer of contaminated concrete in the MURR Barn. Chase used a shrouded hand-held scarifier and demolition hammer. All activities were conducted in a manner that controlled the spread of contamination and maintained personnel exposures ALARA. HEPA-filtered vacuums were attached to the scarifiers to control and remove loose radioactive materials from surfaces during remediation activities. A 2,000 cfm HEPA-filtered ventilation unit was used to maintain work areas at a negative pressure. All remediation activities were performed under a Radiation Work Permit (RWP).

Personal protective equipment was prescribed per the Chase RPP and under the guidance of a task-specific RWP. Air sampling for radioactive materials was performed during all invasive activities. The highest sample result was below the gross beta MDC of 2.3E-12 $\mu\text{Ci/ml}$. All nine discreet areas of elevated activity were small and within an area of about a 10' x 10'. Even though results were near the gross beta DCGL, the area was not upgraded to Class 1 because of the limited area of elevated activity, the conservative application of the Co-60 DCGL, the low MDC of the scanning method relative to the DCGL, and the fact that the Class 2 survey protocol includes a 100% scan survey of floor surfaces using datalogging instrumentation. These methods provide adequate assurance that small areas of elevated activity would be identified by the scanning method and increasing the sample density for the same purpose is not necessary. Areas where elevated activity was identified and remediated to below the ALARA goals are summarized in Table 16-1:

Table 16-1: Remediated Surfaces and Structures

Survey Unit	Location/ Size (ft ²)	Maximum Activity (dpm/100cm ²)		Remediation Method	Post-Remediation Maximum Activity (dpm/100cm ²)	
		Total	Removable		Total	Removable
041 - 1201	Floor (0.15)	5,946	5 - ³ H 8 - ¹⁴ C 0 - CH3	Jackhammered/ Scabbled	1,565	3 - ³ H 4 - ¹⁴ C 1 - CH3
041 - 1201	Floor (0.25)	2,292	4 - ³ H 7 - ¹⁴ C 0 - CH3	Jackhammered/ Scabbled	<MDC	3 - ³ H 5 - ¹⁴ C 0 - CH3
041 - 1201	Floor (0.25)	2,749	4 - ³ H 7 - ¹⁴ C 1 - CH3	Jackhammered/ Scabbled	<MDC	8 - ³ H 6 - ¹⁴ C 0 - CH3
041 - 1201	Floor (0.25)	2,773	12 - ³ H 8 - ¹⁴ C 7 - CH3	Jackhammered/ Scabbled	<MDC	3 - ³ H 2 - ¹⁴ C 1 - CH3
041 - 1201	Floor (0.25)	2,653	4 - ³ H 1 - ¹⁴ C 1 - CH3	Jackhammered/ Scabbled	491	13 - ³ H 8 - ¹⁴ C 0 - CH3
041 - 1201	Floor (0.15)	3,964	1 - ³ H 2 - ¹⁴ C 0 - CH3	Jackhammered/ Scabbled	<MDC	2 - ³ H 3 - ¹⁴ C 0 - CH3
041 - 1201	Floor (0.25)	3,313	6 - ³ H 10 - ¹⁴ C 0 - CH3	Jackhammered/ Scabbled	601	8 - ³ H 3 - ¹⁴ C 1 - CH3
041 - 1201	Floor (0.15)	3,896	6 - ³ H 9 - ¹⁴ C 2 - CH3	Jackhammered/ Scabbled	1,392	1 - ³ H 6 - ¹⁴ C 0 - CH3
041 - 1201	Floor (0.25)	2,695	5 - ³ H 7 - ¹⁴ C 1 - CH3	Jackhammered/ Scabbled	<MDC	6 - ³ H 0 - ¹⁴ C 1 - CH3

16.2 Remedial Action Surveys

Remedial action surveys were conducted to help determine when an area was ready for a final status survey. Remedial action surveys served to monitor the effectiveness of decontamination efforts and to ensure that surrounding areas were not cross-contaminated from remediation activities. These were conducted following remediation activities to establish the success or failure of decontamination efforts.

Remedial action surveys consisted of scan surveys, direct measurements, and removable contamination measurements. Results of the survey were the decision basis for continued remediation or conduct of final status surveys. Remedial action surveys were designed to meet the objectives of the final status surveys. To the extent allowed by MARSSIM, the results of the remedial action surveys were used to supplement the final status survey.

17 DESIGN AND PERFORMANCE OF FINAL STATUS SURVEYS

Final status surveys (FSS) demonstrated that residual radioactivity in each survey unit satisfied the predetermined criteria for release. The FSS was conducted by performing the appropriate combination of scan surveys, total activity measurements, and removable activity measurements as discussed further in this section. All final status surveys were performed according to written instructions. Survey data was documented on survey maps and/or associated data information sheets. Characterization and remedial action survey data was used as FSS data to the maximum extent possible.

17.1 Background Determination

Reference background areas or paired background comparisons were not necessary for this survey design. Material and ambient background levels were not significant in comparison to the DCGLs. Ambient background was determined for each survey to calculate the actual survey MDCs and associated counting errors.

For total surface activity measurements, ambient background levels were generally determined by performing a six-second timed count with the probe at waist level and away from survey unit surfaces. Ambient background was subtracted from each total activity gross measurement. Material background, the contribution from naturally-occurring radioactivity in building structural materials, was not accounted for (subtracted) since it was a small fraction of the DCGL.

Background subtraction was performed for removable activity measurements. The liquid scintillation counter was set up to report results in net dpm in each channel. All removable activity results are less than 200 dpm/100cm², and all three LSC channel removable activity results summed are less than 200 dpm/100cm²

17.2 Data Quality Objectives (DQO)

The Data Quality Objective process as described in MARSSIM was used throughout the design and implementation of decommissioning surveys. The following is a list of the DQOs for the survey design:

- Static measurements of structural surfaces were taken to achieve an MDC_{static} of less than the ALARA goal of 5,000 dpm/100cm² (2,500 dpm/100cm² for the MURR Barn).
- Scanning of structural surfaces was conducted at a rate to achieve an MDC_{scan} of less than the ALARA goal of 5,000 dpm/100cm² (2,500 dpm/100cm² for the MURR Barn).
- Removable contamination measurements were counted to achieve an MDC_{smear} of less than 200 dpm/100cm² in each channel.
- Individual measurements were made to a 95% confidence interval.
- Decision error probability rates were set at 0.05 for both α and β .
- The null hypothesis (H_0) and alternate null hypothesis (H_A) were that of NUREG 1505 scenario A:
 - H_0 was that the survey unit does not meet the release criteria
 - H_A was that the survey unit meets the release criteria
- Quality assurance surveys (duplicative measurements on building structural surfaces) were conducted at a rate of 5%.
- Characterization and remedial action support surveys were conducted under the same quality assurance criteria as FSSs such that the data may be used as FSS data to the maximum extent possible.

17.3 Area Classifications

Based on the facility operational history and previous survey results, facility areas were classified as impacted areas or non-impacted areas.

17.3.1 Non-Impacted Areas

Non-impacted areas are areas without residual radioactivity from licensed activities and were not surveyed during final status surveys. The following areas were classified as non-impacted:

- Structural surfaces above a two meter height
- Building exterior surfaces
- Surface and subsurface soils of outside grounds
- Pressurized mechanical system internals

Based on historical operations, a potential existed for residual contamination from spills or cross-contamination on surfaces less than a two meter height. Thorough surveys of building and impacted room entrances/exits and ventilation exhausts were conducted during characterization to provide adequate assurance that any residual contamination was contained within impacted areas.

17.3.2 Impacted Areas

Impacted areas are those areas that had potential residual radioactivity from licensed activities. All areas with a history of containing radioactive materials were considered impacted. There were no Class 1 or Class 3 areas. Based on the release criteria and historical operations provided by MU, all areas with a history of radioactive materials usage were classified as Class 2. Class 2 areas are areas that meet the following criteria: (1) impacted; (2) low potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.

The MURR Barn was classified as a Class 2 area, even though some floor surfaces were previously remediated. This decision was based on the surveys performed by MU post-remediation, the extremely conservative application of the Co-60 DCGL, the MDC of the scanning method relative to the DCGL, and the fact that the Class 2 survey protocol includes a 100% scan survey of floor surfaces using datalogging instrumentation. These methods providing adequate assurance that small areas of elevated activity would be identified by the scanning method and increasing the sample density for the same purpose is not necessary.

17.4 Survey Units

A survey unit was a geographical area of specified size and shape for which a separate decision was made whether or not that area met the release criteria. The survey units were entire buildings that were surveyed, evaluated and released as a single unit. Survey units were homogeneous in construction, contamination potential, and contamination distribution.

The number of discrete sampling locations needed to determine if a uniform level of residual radioactivity existed within a survey unit did not depend on the survey unit size. However, the sampling density reflected the potential for small elevated areas of residual radioactivity. Survey units were sized according to the potential for small elevated areas of residual radioactivity. Recommended maximum survey unit sizes for building structures, based on floor area, is Class 1: up to 100 m², Class 2: 100 m² to 1000 m² and Class 3: no limit.

Survey units were determined for final status surveys to facilitate mapping – See Table 17-1.

17.5 Survey Unit Numbering Protocol

Each survey unit is assigned a unique identification number consisting of the building number followed by a dash and then a four character alpha-numeric code consisting of the elevation, classification, and a two-digit identifier as follows:

MU Survey Unit Designations

Building Number³ – Elevation/Classification/Numerical Identifier

The default numeric identifier is 01

Elevations:

1=1st Floor

Example:

050-1201 is Barn 13650, first floor, class 2

048-1201 is Barn 13648, first floor, class 2

Table 17-1: Building Structural Survey Units

Building	Class	Survey Unit Number	Floor Area (GSF)
041	2	1201	5,160
046	2	1201	2,940
048	2	1201	2,940
050	2	1201	2,940
061	2	1201	1,517
067	2	1201	2,940

Building systems survey units were arranged by building and system type. There were two types of systems – ventilation and drains. Sinclair Farm had no vacuum systems at the time of these surveys. Each system survey unit encompassed all of a certain type within a particular building elevation i.e., all drains in building 046 are grouped into survey unit 046-1DR1. Building 13641 (MURR barn) did not contain any systems. The four digit identifier for systems surveys consisted of the first digit for the elevation (or first floor elevation for those survey units which encompassed an entire building), the second and third digits for the system code, and the fourth digit as a numerical identifier.

Elevation codes are: 1=1st Floor

System codes are DR=Drain, VA=Vacuum, VE=Ventilation.

The default numeric identifier is 1.

Examples:

046-1VE1 is Building 13646, first floor, ventilation

³ Because all the building numbers are five digits long and start with 136, only last two digits were used as the building number.

The building system survey units are presented in Table 17-2.

Table 17-2: Building Systems Survey Units

Building	Systems Survey Unit	
	Drain	Ventilation
046	046-1DR1	046-1VE1
048	048-1DR1	048-1VE1
050	050-1DR1	050-1VE1
061	061-1DR1	061-1VE1
067	067-1DR1	067-1VE1

17.6 Surface Scans

Scanning was used to identify locations that exceed the investigation level listed in Table 17-5. Scan surveys were conducted by moving the detector probe at a distance of about $\frac{1}{8}$ inch from the surface at the prescribed scan rate and listening for an increase in the audible response. While scanning, in addition to the surveyor listening to the audible output, integrated counts were recorded every second by datalogging instrumentation. Locations with an increased count rate were marked and received additional investigations to determine the extent and magnitude of contamination. Table 17-3 summarizes the percentage of accessible structural surfaces scanned based on classification.

Table 17-3: Scan Survey Area Coverage by Classification

Surface	Class 2
Floors	100%
Other Structures	10%

Floor areas near room entrances and exits received a 100% scan survey regardless of the area classification. Additionally, special attention was paid to fractures in the floor, and the structural edges of the MURR Barn floor surface, both inside and outside. Surveys provided no indication of the migration of residual contamination.

If elevated activity was detected during the scan surveys, the location was marked and total and removable surface activity measurements were taken to quantify the activity. However, total surface activity measurements were in addition to the static measurements required for the statistical test.

17.7 Total Surface Activity Measurements

Total surface activity (static) measurements were taken at each identified sample location. Scaler count times were determined to achieve the detection sensitivities stated in the DQOs. Field measurements were converted to an activity concentration using the following equation:

$$\text{Activity(dpm/100cm}^2\text{)} = \frac{\text{cpm}_{\text{sample}} - \text{cpm}_{\text{background}}}{E_{\text{total}} \cdot \frac{A}{100\text{cm}^2}}$$

Where:

- $\text{cpm}_{\text{sample}}$ = sample count rate in counts per minute
 $\text{cpm}_{\text{background}}$ = background count rate in counts per minute
 E_{tot} = total detector efficiency for radionuclide emission of interest (includes combination of instrument efficiency and surface efficiency)
 A = Active area of the detector in cm^2

Static measurements for total surface activity were performed by conducting a six-second timed count on the surface to be measured. Static measurements were used for survey unit statistical analyses and to determine compliance with release criteria. Direct surveys (static measurements) for total surface activity were taken on building surfaces. Due to small geometry, system internals were inaccessible and no direct measurements were performed. Additionally, locations of elevated activity identified and marked during the scan survey received static measurements.

17.8 Determination of the Number of Samples Required for the Sign Test

The minimum number of samples required for the Sign Test was calculated using equations in Section 5 of MARSSIM. A very conservative estimate of the standard deviation of total surface activity measurements ($1,000 \text{ dpm/100cm}^2$) was used for calculations. The Lower Bound Gray Region (Section 24.7.1) was set at one half of the DCGL. The calculation performed to determine the required number of samples in accessible areas is provided below.

17.8.1 Determination of the Relative Shift

The number of required samples depended on the ratio involving the activity level measured relative to the variability in the concentration. This ratio is called the Relative Shift, Δ/σ_s and is defined in MARSSIM as:

$$\Delta/\sigma_s = \frac{\text{DCGL} - \text{LBGR}}{\sigma_s}$$

Where:

- DCGL = derived concentration guideline level
LBGR = concentration at the lower bound of the gray region. The LBGR is the average concentration to which the survey unit should be cleaned in order to have an acceptable probability of passing the test
 σ_s = an estimate of the standard deviation of the residual radioactivity in the survey unit

The actual calculations are provided below:

For all areas:

$$\Delta/\sigma_s = \frac{3.7\text{E}6 \text{ dpm}/100\text{cm}^2 - 1.85\text{E}5 \text{ dpm}/100\text{cm}^2}{1,000 \text{ dpm}/100\text{cm}^2} = 1850$$

For the MURR Barn:

$$\Delta/\sigma_s = \frac{7,100 \text{ dpm}/100\text{cm}^2 - 3,550 \text{ dpm}/100\text{cm}^2}{1,000 \text{ dpm}/100\text{cm}^2} = 3.6$$

Since MARSSIM Table 5.5 does not include relative shifts above 3 and the number of samples required decreases with an increasing relative shift, the relative shift was conservatively set at 3.

17.8.2 Determination of Acceptable Decision Errors

A decision error is the probability of making an error in the decision on a survey unit by passing a unit that should fail (α decision error) or failing a unit that should pass (β decision error). MARSSIM uses the terminology α and β decision errors; this is the same as the more common terminology of Type I and Type II errors, respectively. The applicable decision errors (Type I Type II errors) were selected in accordance with the established Data Quality Objectives at 0.05 for Type I errors and 0.05 for Type II errors.

17.8.3 Determination of Number of Samples

For the purposes of the final status survey it was assumed that the contaminant was not present in background at significant levels compared to the DCGLs. Therefore, material-specific background was ignored and was not subtracted from the total surface activity measurements. Using this methodology, the Sign Test was chosen for the statistical evaluation of survey data.

The number of total surface activity measurements for a particular survey unit, employing the Sign Test, was determined from MARSSIM Table 5.5, which is based on the following equation (MARSSIM equation 5-2):

$$N = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(\text{SignP} - 0.5)^2}$$

Where:

N = number of samples needed in the survey unit
 $Z_{1-\alpha}$ = percentile represented by the decision error α
 $Z_{1-\beta}$ = percentile represented by the decision error β
SignP = estimated probability that a random measurement will be less than the DCGL when the survey unit median is actually at the LBGR

Note: SignP is determined from MARSSIM Table 5.4

MARSSIM recommends increasing the calculated number of measurements by 20% to ensure sufficient power of the statistical tests and to allow for possible data losses. MARSSIM Table 5.5 values include this additional 20%. The following calculations were made to determine this number:

$$N = \frac{(1.645 + 1.645)^2}{4(0.998650 - 0.5)^2} = 11$$

$Z_{1-\alpha}$ and $Z_{1-\beta}$ are equal to 1.645 using the error rate of 0.05 from MARSSIM Table 5.2. SignP is equal to 0.998650 from MARSSIM Table 5.4. Adding an additional 20% to account for data losses resulted in a value of 14.

Therefore, the determined number of samples per survey unit for the final status surveys was **14**.

17.9 Determination of Sample Locations (Static and Removable Samples)

Determination of Class 2 survey unit sample locations was accomplished by first determining sample spacing and then systematically plotting the sample locations from a randomly generated start location. The random starting point of the grid provided an unbiased method for obtaining measurement locations to be used in the statistical tests. A square grid was used in this survey design. The use of a systematic grid allowed the decision-maker to draw conclusions about the size of the potential areas of elevated activity based on the area between measurement locations.

Class 2 survey units consisted of entire buildings. Representing an entire building in a "fold-out" view to show all surfaces is difficult and time-consuming. The processes to identify, map, and locate measurement coordinates is further complicated due to the noncontiguous nature of the survey unit once walls are "folded-out".

For the reasons above, the MARSSIM sample measurement locations (i.e., static and smear measurements) for Class 2 survey units were determined only on horizontal surfaces as determined on floor plans. This protocol increased the sample density on the surfaces with the highest probability for residual contamination (floors). The appropriate percentages of all survey unit surfaces (including vertical surfaces) were scanned according to the survey unit classification.

Twenty judgmental static measurements and smears were taken on vertical surfaces as part of characterization. The survey technician judgmentally selected locations with the highest probability of contamination on vertical surfaces for a static measurement and smear. These measurements were in addition to and not included in the statistical analysis of the locations selected by MARSSIM protocols.

In Class 2 survey units, the sampling locations were established in a unique pattern beginning with the random start location and the determined sample spacing. After determining the number of samples needed in the survey unit, sample spacing is determined from MARSSIM equation 5-8:

$$L = \sqrt{\frac{A}{N}} \text{ for a square grid}$$

Where:

L	= sample spacing interval
A	= the survey unit area
N	= number of samples needed in the survey unit

Maps were generated of the survey unit's permanent horizontal surfaces included in the statistical tests. A random starting point was determined using computer-generated random numbers coinciding with the x and y coordinates of the total survey unit. A grid was plotted across the survey unit surfaces based on the random start point and the determined sample spacing. A measurement location was plotted at each intersection of the grid plot. Final Status Sample location maps are presented in Appendix D.

17.10 Removable Contamination Measurements

Removable contamination measurements were collected by wiping an area of approximately 100 cm² using paper smears or cotton swabs. The smears/swabs were counted to achieve the detection sensitivities stated in the DQOs. The liquid scintillation counter (LSC) was setup for three channel counting as follows:

Channel 1 (³ H):	0.0 – 12 keV
Channel 2 (¹⁴ C):	12 – 256 keV
Channel 3 (all others):	> 256 keV

Removable contamination measurements (smears) were collected on building structural surfaces at each sample location. Additionally, removable contamination measurements were collected for building system internals. An area of approximately 100cm² was wiped. The LSC was set up for background subtraction, so results are reported as net dpm/100cm².

17.11 Surveys of Building Mechanical System Internals

Surveys of various building system components were required. Survey design for these systems is out of the scope of MARSSIM. For the purposes of identifying potential residual contamination within these systems (ventilation and drain); scans, static measurements and removable contamination surveys were taken at system inlets, collection points and discharges to the extent possible due to geometric considerations. System survey requirements are summarized in Table 17-4.

Table 17-4: System Survey Coverage for Final Site Survey

System	Coverage
General Ventilation Exhaust Ducts and Fans	100%
Drain	100%

17.12 Investigation Levels

Investigation levels were used to flag locations that required special attention and further investigation to ensure areas were properly classified and adequate surveys were performed. These locations were marked and received additional investigations to determine the concentrations, area, and extent of the contamination. Investigation levels are summarized in Table 17-5.

Table 17-5: Survey Investigation Levels

Survey Unit Classification	Flag Static Measurement Result When: (dpm/100cm ²)	Flag Scanning Measurement Result When: (dpm/100cm ²)	Flag Removable Measurement Result When: (dpm/100cm ² in any channel)
All	>5,000	>5,000	>200 net

18 SURVEY DOCUMENTATION AND DATA MANAGEMENT

18.1 Survey Packages

Each survey unit was surveyed under a survey package approved by the Project Manager and specifying the survey protocol to be followed. The survey package contained the following elements to ensure the DQOs were met:

- Survey protocol instructions such as the number of samples, sample spacing, sample locations, areas to be scanned, etc.

- Random number generations to determine survey locations
- Instrumentation to be used
- Scan rates, static count times, and/or minimum sample volumes
- Scaled survey unit maps
- Checklists for the survey technician

18.2 Location Codes

To ensure proper data management and organization, each static and removable activity measurement location was assigned a unique alpha-numeric location code consisting of a sequence of identifiers to indicate specific information about that location, such as the building, survey unit, structural surface, structural material, and a numerically sequenced location number within the survey unit. This system was used so that survey data could be properly entered and organized in the Final Status Survey Database. A breakdown of the location code and specific code components are provided in Table 18-1.

Table 18-1: Location Code Description

A unique location code was assigned to each individual survey location to ensure proper data management of the survey results. The following format was used to ensure consistency throughout the final status survey process:	
BBB-RRRR-SS-M-LLL	
Where:	
BBB:	Building Code. This field represents the building number. (3 characters)
RRRR:	Survey Unit Number. This is the assigned survey unit number. (4 characters)
SS:	Structural Surface Code. This field represents the structural surface such as floor, wall, ceiling, etc. (2 characters)
	<div style="display: flex; justify-content: space-between;"> <div>D2 = Floor Drains D3 = Sink Drains</div> <div>F1 = Floor E2 = General Exhaust</div> <div>E3 = Exhaust Fan</div> </div>
M:	Structural Material Code. This field represents the type of structural material on which a particular measurement is taken. (1 Character)
	The purpose of this code is to allow a material-specific background subtraction for those materials that exhibit elevated counts due to naturally-occurring radioactive material. Because the material background was not significant relative to the DCGLs, all materials were given a default value of "M"
LLL:	Numerical Identifier. This field represents the survey location number. The field "001" means survey point location number 1. Numerical identifiers are unique within a survey unit. (3-characters)

18.3 Sample Chain-of-Custody

The sample chain-of-custody maintains the integrity of the sample; that is, there is an accurate record of sample collection, transport, analysis, and disposal. This ensures that samples are neither lost nor tampered with, and that the sample analyzed in the laboratory is actually and verifiably the sample taken from a specific location in the field. Samples sent off-site for analysis used an approved Chain of Custody Procedure.

19 DATA QUALITY ASSESSMENT (DQA) AND INTERPRETATION OF SURVEY RESULTS

The statistical guidance contained in Section 8 of MARSSIM was used to determine if areas were acceptable for unrestricted release, and whether additional surveys or sample measurements were needed.

19.1 Data Validation

Field data was reviewed and validated to ensure:

- Completeness of forms.
- The type of survey was correctly assigned to the survey unit.
- The MDCs for measurements met the established data quality objectives.
- Independent calculations were performed for a representative sample of data sheets and survey areas.
- Instrument calibrations and daily functional checks were performed accurately and at the required frequency.

Additionally, all final status survey data was entered into the Final Status Survey Database. This provided the means to sort survey data, verify activity calculations, and to compute the associated MDC and counting errors. Once data entry for a survey unit was complete, a verification report was printed and compared to original data sheets to ensure correct data entry.

The final status database reports for building structural surfaces and systems are provided in Appendices F and G, respectively.

19.2 Preliminary Data Review

A preliminary data review was performed for each survey unit to identify any patterns, relationships or potential anomalies. Additionally, measurement data was reviewed and compared with the DCGLs and investigation levels to identify areas of elevated activity and confirm the correct classification of survey units.

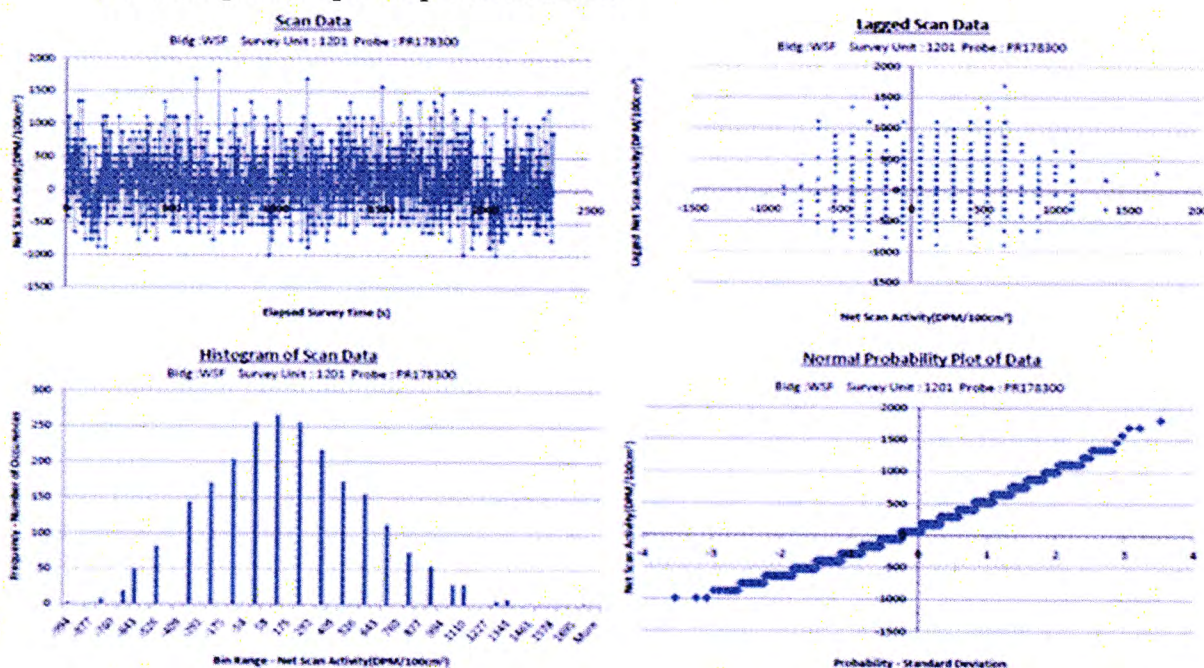
The following preliminary data reviews were performed for each survey unit:

- Calculations of the survey unit mean median, maximum, minimum, and standard deviation for each type of reading.
- Comparison of the actual standard deviation to the assumed standard deviation used for calculating the number of measurements. If the actual standard deviation was greater than estimated, the minimum number of samples was calculated using the actual standard deviation to ensure a sufficient number of samples were obtained.
- Comparison of survey data with applicable investigation levels.
- Review of graphical outputs

The data management software produced 4-plot graphical output of scan data to enhance data visualization. A 4-plot consists of the following:

- A **run sequence plot** presents logged data in chronological order, providing a time history of the survey data.
- A **lag plot** checks whether a data set or time series is random or not. Random data should not exhibit any identifiable structure in the lag plot.
- A **histogram plot** graphically summarizes the distribution of a univariate data set, showing center (i.e., the location) of the data, spread (i.e., the scale) of the data, skewness of the data, presence of outliers, and presence of multiple modes.
- A **probability plot** is a goodness-of-fit test used to verify the distributional model. The normal probability plot is a graphical technique for assessing whether or not a data set is approximately normally distributed. The data is plotted against a theoretical normal distribution in such a way that the points should form an approximate straight line. Departures from this straight line indicate departures from normality.

An example four-plot is provided below.



19.3 Review of 4 Plots

A 4-Plot was produced for each survey instrument used within each survey unit (i.e., survey unit 041-1201 has two 4-plots; one for each instrument used). 4-plots are separated in this manner because combining all populations into one 4-plot for each survey unit introduces additional variability in the results due to instrument-specific systematic errors (i.e., differences in calibration efficiency, background count rate, etc.). This additional variability reduces the usefulness of the 4-Plot for identifying anomalies in the scan data. 4-Plot graphs indicate that most survey units have a near normal distribution. Some distributions appear bimodal, likely because measurements are not corrected for naturally-occurring radioactivity in building materials. For example, populations that consist primarily of concrete floors should have a normal distribution around a net positive mean due to natural radioactivity in concrete, while a population that consists primarily of metal walls would have a normal distribution around a mean near zero. When a population contains a significant fraction of each type of material, a bimodal distribution is evident in the 4-plot.

Survey units anomalies are described in Table 23-1 and 4-Plot graphs in Appendix E.

Table 19-1: 4-Plot Anomalies

Survey Unit	Anomaly Description
041-1201	Elevated activity was found on the floor of the MURR barn. This survey unit was re-scanned post-remediation as survey unit 041-QA01.
061-1201	The data has many peaks and valleys. This is indicative of the transitions from floors to walls, and carpet to concrete in the clinic.
041-QA01	The QA survey of the MURR barn shows some peaks, but well under ALARA goals.

19.4 Data Summary Tables

Static measurement and smear data are presented below. The total activity results had a slight positive bias, likely due to the naturally occurring radioactivity in concrete floors.

Table 19-2: Structural Surfaces Total Beta Surface Activity (Static Measurements)

Survey Unit	# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 5,000?
		(dpm/100 cm ²)					
041-1201	18	202	912	244	-184	588	NO
046-1201	14	483	1,053	257	103	1,084	NO
048-1201	16	657	1,394	180	386	991	NO
050-1201	16	461	1,545	364	0	1,377	NO
061-1201	20	242	1,615	480	-771	991	NO
067-1201	21	194	1,521	302	-275	771	NO

Table 19-3: Building Structural Surfaces Removable ³H Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(net dpm/100 cm ²)				
041-1201	18	26	11	11	49	NO
046-1201	14	32	12	17	55	NO
048-1201	16	51	20	25	99	NO
050-1201	16	47	9	31	62	NO
061-1201	20	32	8	21	45	NO
067-1201	21	41	15	4	70	NO

Table 19-4: Building Structural Surfaces Removable ¹⁴C Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
041-1201	18	8	7	0	23	NO
046-1201	14	9	5	1	8	NO
048-1201	16	9	6	0	20	NO
050-1201	16	8	6	0	19	NO
061-1201	20	8	6	0	24	NO
067-1201	21	9	6	0	23	NO

Table 19-5: MURR Barn Structural Surfaces Removable Channel 3 Summary⁴

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(net dpm/100 cm ²)				
041-1201	18	1	3	0	10	NO

⁴ Channel 3 results were used qualitatively in all survey units other than 041-1201 (MURR Barn) to verify the assumption that C-14 and H-3 are the only nuclides of concern. As such, Channel 3 data is only reported for the survey unit 04101201.

Table 19-6: Building Systems Removable ³H Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(net dpm/100 cm ²)				
046--1DR1	19	57	14	39	93	NO
046-1VE1	7	74	12	58	92	NO
048-1DR1	16	39	14	21	80	NO
048-1VE1	5	62	15	38	76	NO
050-1DR1	13	63	13	36	86	NO
050-1VE1	8	73	14	58	98	NO
061-1DR1	10	85	17	64	116	NO
061-1VE1	9	76	15	64	110	NO
067-1DR1	17	70	16	48	105	NO
067-1VE1	5	71	16	48	90	NO

Table 19-7: Building Systems Removable ¹⁴C Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
046-1DR1	19	10	6	0	25	NO
046-1VE1	7	6	4	0	11	NO
048-1DR1	16	7	6	0	18	NO
048-1VE1	5	13	5	8	19	NO
050-1DR1	15	10	6	0	19	NO
050-1VE1	8	8	8	0	24	NO
061-1DR1	10	9	4	0	14	NO
061-1VE1	9	9	6	0	20	NO
067-1DR1	17	6	3	1	12	NO
067-1VE1	5	7	8	0	16	NO

19.5 Determining Compliance for Building Structural Surfaces and Structures Post Remediation

Removable contamination measurements were compared directly to the applicable investigation levels and DCGLs. No contingency was established for elevated removable contamination. All removable contamination measurements collected during the final status surveys were less than the applicable investigation level and significantly less than the removable DCGL, so compliance is determined based on total activity measurements.

All total surface activity measurements were compared directly to the investigation levels and DCGL to determine if an area was properly classified or required further action. A sufficient number of samples were taken in all survey units and all total activity results were less than the applicable investigation level and DCGL, so all survey units pass the Sign test and are suitable for release for unrestricted use.

The results of the data quality assessment and calculations of the dose from each structural surface survey unit are presented in Table 19-8.

Table 19-8: Structural Surfaces Total Beta Surface Activity Dose Calculations

Survey Unit	Standard Deviation (dpm/100 cm ²)	# of Samples	Mean (dpm/100 cm ²)	Calculated Annual TEDE ⁵ (mrem/yr)	Any Result Exceeding TEDE of 25 mrem/yr?
041-1201	244	18	202	7.1E-01	NO
046-121	257	14	483	6.5E-03	NO
048-1201	180	16	657	8.9E-03	NO
050-1201	364	16	461	6.2E-03	NO
061-1201	480	20	242	3.3E-03	NO
067-1201	302	21	194	2.6E-03	NO
Maximum:				7.1E-01	

19.6 Mechanical System Survey Data Analysis

Results of ventilation and drain system removable activity measurements were compared directly with the investigation level and removable DCGL. Direct measurements were not possible due to the small geometry of the system internals. All removable activity measurements were less than the investigation level and removable DCGL, therefore the systems meet the release criterion and are suitable for release.

20 QUALITY ASSURANCE SURVEYS

Quality Assurance (QA) measurements were performed according to the quality assurance requirements of the plan and consisted of duplicating the final status survey protocol for building structural surfaces at a rate of 5% to include scans, static measurements, and smears. The following survey unit was re-surveyed for QA: 041-1201.

⁵ The TEDE shown for the MURR Barn, survey unit 041-1201 is calculated by multiplying 25 mrem/yr by the ratio of the mean total surface activity to the Co-60 DCGL of 7,100 dpm/100cm². The TEDE shown for all other survey units is calculated by multiplying 25 mrem/yr by the ratio of the mean total surface activity to the C-14 DCGL of 3.7E6 dpm/100cm², and then multiplying by 2 to account for the ISO 7503-1 surface efficiency as described in Section 14.7.

20.1 QA Survey Results

The conclusions reached based on QA surveys were the same as those based on the initial surveys. QA survey results are presented in Appendix H and are summarized in the tables below.

Table 20-1: QA Survey Building Structural Surfaces Total Activity (Static Measurement) Summary

Survey Unit	# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(dpm/100 cm ²)						
41-QA01	18	967	1,472	295	496	1,707	5,000	NO

Table 20-2: QA Survey Building Structural Surfaces Removable ³H Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm ²)					
41-QA01	18	41	10	27	59	200	NO

Table 20-3: QA Survey Building Structural Surfaces Removable ¹⁴C Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm ²)					
41-QA01	18	8	7	0	20	200	NO

Table 20-4: QA Survey Building Structural Surfaces Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(net dpm/100 cm ²)				
41-QA01	18	1	2	0	8	NO

21 REFERENCES

- NRC Regulations
- Chase Commonwealth of Kentucky Radioactive Materials License Number 201-605-90
- Chase Environmental Groups Radiation Safety Manual.
- NUREG-1575, Revision 1, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," August 2000
- NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions," June 1998
- NUREG 1757, Volume 1, Revision 2, "Consolidated NMSS Decommissioning Guidance, Decommissioning Process for Materials Licensees," September, 2006
- NUREG 1757, Volume 2, Revision 1, "Consolidated NMSS Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria," September, 2006
- "Decommissioning Health Physics, A Handbook for MARSSIM Users," Abelquist, 2001
- "Handbook of Health Physics and Radiological Health", 3rd Edition, 1998
- ISO-7503-1, "Evaluation of Surface Contamination – Part 1: Beta Emitters and Alpha Emitters." 1988
- NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment," December 1999

APPENDIX A – SITE PLAN
West Side of S. Sinclair Road
Experimental Pig and Animal Shelter Barns, Main Office and Clinic



East Side of S. Sinclair Road
MURR Barn Area





CALIBRATION CERTIFICATE FOR

2241-3

SERIAL#

253346

Owner: CHASE ENV

DATE: 03/30/11

LOCATION:

Griffin Inst

TECH: E.M. Glenn

DATE LAST CAL EXPIRES:

04/07/11

Reason For Calibration:

☒ Due For Calibration☐ Repair (See Remarks)☐ Other (See Remarks)☐ Due and Repair (See Remarks)

NIST TRACEABLE EQUIPMENT USED DURING CALIBRATION

MODEL: M-500

SERIAL #: 114512

CAL. DUE: 07/28/11

MODEL:

SERIAL #:

CAL DUE:

☒ Fast/Slow Switch working properly☒ Audio Response☒ Geotroplism

CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ☐ Yes ☒ No

BATTERY CHECK: Sat

HV TEST ☐ N/A ☒ Sat ☐ Unsat

AF INPUT SENSITIVITY (mV) #1: 4

AL INPUT SENSITIVITY (mV) #1: A.F.

AF INPUT SENSITIVITY (mV) #2: 4

AL INPUT SENSITIVITY (mV) #2: A.F.

AF INPUT SENSITIVITY (mV) #3: 4

AL INPUT SENSITIVITY (mV) #3: A.F.

AF INPUT SENSITIVITY (mV) #4: 4

AL INPUT SENSITIVITY (mV) #4: A.F.

RATE CPM AS FOUND % ERROR AS LEFT % ERROR

250	250	0.0%	A.F.	
2500	2499	0.0%	A.F.	
25K	24.991 K	0.0%	A.F.	
250K	249.901 K	0.0%	A.F.	

Is the As Found Data Within 2% of the Set Point?:

☒ Yes ☐ No

DETECTOR 1:

DETECTOR 2:

DETECTOR 3:

DETECTOR 4:

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

0000 S-6

A.F.

0000 S-6

A.F.

0000 S-6

A.F.

0000 S-6

A.F.

0100 -2

A.F.

0100 -2

A.F.

0100 -2

A.F.

0100 -2

A.F.

c/

A.F.

c/

A.F.

c/

A.F.

c/

A.F.

m

A.F.

m

A.F.

m

A.F.

m

A.F.

1

A.F.

1

A.F.

1

A.F.

1

A.F.

000s

A.F.

000s

A.F.

000s

A.F.

000s

A.F.

REMARKS:

Does Instrument Meet Final Acceptance Criteria?:

☒ Yes☐ No

Calibration Sticker Attached?:

☒ Yes☐ No

Date Instrument is Due For Next Calibration:

03/30/12

INSTRUMENT MARRIED WITH

#

Performed/Reviewed by:

Date: 3/30/2011

Entered by: Initials



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR 43-37 PROBE # PR259902

Owner: CHASE ENV

DATE: 03/30/11
TECH: E.M. GlennLOCATION: Griffin Inst
DATE LAST CAL EXPIRES: 04/07/11

REASON FOR CALIBRATION:

☒ Due For Calibration ☐ Repair (See Remarks) ☐ Other (See Remarks) ☐ Due and Repair

CABLE LENGTH: 10'

INPUT SENSITIVITY: 4mV

NIST TRACEABLE EQUIPMENT AND STANDARDS USED DURING CALIBRATION

MODEL: 2241-3 SERIAL #: 253346 CAL. DUE: 03/30/12

NIST TRACEABLE SOURCES USED

Source Number	Isotope	4 pi Activity	Assay Date	2 pi Activity
00TC470-0854	Tc99 SS	17,300 dpm	06/15/09	10,800 cpm
2697-00	Sr90	12,200 dpm	03/01/00	8,530 cpm
PX 726	C14	48,780 dpm	01/21/08	18,660 cpm
94TH470-1593	Th230	16,700 dpm	06/16/09	8,170 cpm
2696-00	Pu239	18,500 dpm	12/02/09	9,370 cpm

Efficiencies from last cal.:

Condition: ☒ Sat ☐ Unsat

Pu: 23.68% Th: 21.91% Sr: 41.80%

Tc ss: 27.39% C14: 14.60% Tc Ni:

As Found (AF) Efficiencies:

HV / Vernier:	Tc-99 Source Response Nickel (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Tc-99 Source Response Stainless Steel (CPM):		
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.	A ch.	B ch.	Net Eff.
1300 a / 1850 b				4511		24.35%	7	1216		6141	28.47%

Net A to B
Xtalk: <10%B to A Xtalk:
<1%

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
AF CPM:	4511		6141	3883	5362	9110
AF 4 pi eff:	24.35%		28.47%	23.21%	44.29%	16.18%
AF 2 pi eff:	48.07%		45.60%	47.44%	63.35%	42.30%

Is as found efficiency within 20% of the efficiency from the last cal?

☒ Yes ☐ No (See Remarks)

Note: If the as found data is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the plateau section and go directly to remarks.



GRIFFIN INSTRUMENTS



PROBE #: **PR259902**

Date: 03/30/11

PLATEAU AND SET POINT DATA

HV / Vernier:	Tc-99 Source Response SS (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Net A to B Xtalk: <10%	B to A Xtalk: <1%
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.		
N/A										

Alpha / Beta Bkg (cpm)		7	1216				
HV / Vernier	Pu-239	Tc-99 NI	Tc-99 SS	Th-230	C-14	Sr-90	
130 a /1850 b	CPM: 4511		6141	3883	9110	5362	
4 pi AL Efficiencies:	24.35%		28.47%	23.21%	16.18%	44.29%	
2 pi AL Efficiencies:	47.97%		45.60%	47.44%	42.30%	63.35%	

REMARKS: Replaced mylar due to multiple repaired holes.

Does Instrument Meet Final Acceptance Criteria?: ☒ Yes ☐ No

Calibration Sticker Attached?: ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 03/30/12

INSTRUMENT MARIED WITH

2241-3

253346

Performed/Reviewed by:

E. H. Glavin

Date: 3/30/2011

Entered by: *EC* Initials

2 pi efficiencies denoted in Italics.

Calibrations performed to ANSI N323A-1997 standards.



CALIBRATION CERTIFICATE FOR

2241-3

SERIAL#

253356

Owner: CHASE ENV

DATE: 04/06/11

LOCATION:

Griffin Inst

TECH: Joanne Glenn

DATE LAST CAL EXPIRES:

03/12/11

Reason For Calibration:

☒ Due For Calibration☐ Repair (See Remarks)☐ Other (See Remarks)☐ Due and Repair (See Remarks)

NIST TRACEABLE EQUIPMENT USED DURING CALIBRATION

MODEL: M-500

SERIAL #: 114512

CAL. DUE: 07/28/11

MODEL:

SERIAL #:

CAL DUE:

☒ Fast/Slow Switch working properly☒ Audio Response☐ Geotrolism

CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ☒ Yes ☐ No

BATTERY CHECK: Sat

HV TEST ☐ N/A ☒ Sat ☐ Unsat

AF INPUT SENSITIVITY (mV) #1:

4

AL INPUT SENSITIVITY (mV) #1:

A.F.

AF INPUT SENSITIVITY (mV) #2:

4

AL INPUT SENSITIVITY (mV) #2:

A.F.

AF INPUT SENSITIVITY (mV) #3:

4

AL INPUT SENSITIVITY (mV) #3:

A.F.

AF INPUT SENSITIVITY (mV) #4:

4

AL INPUT SENSITIVITY (mV) #4:

A.F.

RATE CPM AS FOUND % ERROR AS LEFT % ERROR

250	249	0.4%	A.F.	
2500	2496	0.2%	A.F.	
25K	24.962 K	0.2%	A.F.	
250K	249.616 K	0.2%	A.F.	

Is the As Found Data Within 2% of the Set Point?:

☒ Yes ☐ No

DETECTOR 1:

DETECTOR 2:

DETECTOR 3:

DETECTOR 4:

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

0000 S-6

A.F.

0000 S-6

A.F.

0000 S-6

A.F.

0000 S-6

A.F.

0100 -2

A.F.

0100 -2

A.F.

0100 -2

A.F.

0100 -2

A.F.

c/

A.F.

c/

A.F.

c/

A.F.

c/

A.F.

m

A.F.

m

A.F.

m

A.F.

m

A.F.

1

A.F.

1

A.F.

1

A.F.

1

A.F.

000s

A.F.

000s

A.F.

000s

A.F.

000s

A.F.

REMARKS: Det 1, 43-68, #PR289219, B; Det 2, 43-37, #PR281040, B; Det 3, 43-68, #PR289219, a; Det 4, 43-37, #PR281040, a.

Does Instrument Meet Final Acceptance Criteria?:

☒ Yes☐ No

Calibration Sticker Attached?:

☒ Yes☐ No

Date Instrument is Due For Next Calibration:

04/06/12

INSTRUMENT MARRIED WITH

#

Performed/Reviewed by:

Date: 4/6/2011

Entered by: Initials



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR

43-37

PROBE #

PR281040

Owner: CHASE ENV

DATE: 04/06/11
TECH: E.M. GlennLOCATION: Griffin Inst
DATE LAST CAL EXPIRES: 03/12/11

REASON FOR CALIBRATION:

☒ Due For Calibration ☐ Repair (See Remarks) ☐ Other (See Remarks) ☐ Due and Repair

CABLE LENGTH: 10'

INPUT SENSITIVITY: 4mV

NIST TRACEABLE EQUIPMENT AND STANDARDS USED DURING CALIBRATION

MODEL: 2241-3 SERIAL #: 253356 CAL. DUE: 04/06/12

NIST TRACEABLE SOURCES USED

Source Number	Isotope	4 pi Activity	Assay Date	2 pi Activity
00TC470-0654	Tc99 SS	17,300 dpm	06/15/09	10,800 cpm
2697-00	Sr90	12,200 dpm	03/01/00	8,530 cpm
PX 726	C14	48,780 dpm	01/21/08	18,860 cpm
2696-00	Pu239	18,500 dpm	12/02/09	9,370 cpm
94TH470-1593	Th230	16,700 dpm	06/16/09	8,170 cpm

Efficiencies from last cal.:

Condition: ☒ Sat ☐ Unsat

Pu: 25.05% Th: 22.25% Sr: 40.88%

Tc ss: 26.45% C14: 15.42% Tc Ni:

As Found (AF) Efficiencies:

HV / Vernier:	Tc-99 Source Response Nickel (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Tc-99 Source Response Stainless Steel (CPM):		
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.	A ch.	B ch.	Net Eff.
1250 a / 1800 b				4739		25.54%	15	932		5997	29.28%

Net A to B Xtalk: <10%	B to A Xtalk: <1%
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	<u>Pu239</u>	<u>Tc99 Ni</u>	<u>Tc99 ss</u>	<u>Th-230</u>	<u>Sr90</u>	<u>C-14</u>
AF CPM:	4739		5997	3859	4983	8808
AF 4 pi eff:	25.54%		29.28%	23.02%	43.36%	16.15%
AF 2 pi eff:	50.42%		46.90%	47.05%	62.02%	42.21%

Is as found efficiency within 20% of the efficiency from the last cal?

☒ Yes ☐ No (See Remarks)

Note: If the as found date is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the plateau section and go directly to remarks.



GRIFFIN INSTRUMENTS



PROBE #: PR281040

Date: 04/06/11

PLATEAU AND SET POINT DATA

HV / Vernier:	Tc-99 Source Response SS (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Net A to B Xtalk: <10%	B to A Xtalk: <1%
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.		
1100				1995		10.8%	2			
1150				3791		20.5%	3			
1200				4318		23.3%	3			
1250				4412		23.8%	6			
1300				4570		24.7%	6			

Alpha / Beta Bkg (cpm)		6	1118				
HV / Vernier		Pu-239	Tc-99 Ni	Tc-99 SS	Th-230	C-14	Sr-90
1250 a / 1800 b	CPM:	4387		5619	3614	8544	4795
	4 pi AL Efficiencies:	23.68%		26.02%	21.60%	15.22%	39.36%
	2 pi AL Efficiencies:	46.66%		41.68%	44.16%	39.80%	58.29%

REMARKS: Replaced mylar and screen due to high alpha bkg. Cleaned inside detector.

Does Instrument Meet Final Acceptance Criteria? ☒ Yes ☐ No

Calibration Sticker Attached? ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 04/06/12

INSTRUMENT MARRIED WITH 2241-3 # 253356

Performed/Reviewed by: *E. M. Glenn*

Date: 4/6/2011

Entered by: *EG* Initials

2 pi efficiencies denoted in italics.

Calibrations performed to ANSI N323A-1997 standards.



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR

2241-3

SERIAL# 253351

Owner: CHASE ENV

DATE: 04/06/11

LOCATION:

Griffin Inst

TECH: Joanne Glenn

DATE LAST CAL EXPIRES:

04/20/11

Reason For Calibration:

☒ Due For Calibration☐ Repair (See Remarks)☐ Other (See Remarks)☐ Due and Repair (See Remarks)

NIST TRACEABLE EQUIPMENT USED DURING CALIBRATION

MODEL: M-500

SERIAL #: 114512

CAL. DUE: 07/28/11

MODEL:

SERIAL #:

CAL DUE:

☒ Fast/Slow Switch working properly☒ Audio Response☐ Geotrolism

CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ☒ Yes ☐ No

BATTERY CHECK: Sat

HV TEST ☐ N/A ☒ Sat ☐ Unsat

AF INPUT SENSITIVITY (mV) #1:

4

AL INPUT SENSITIVITY (mV) #1:

A.F.

AF INPUT SENSITIVITY (mV) #2:

4

AL INPUT SENSITIVITY (mV) #2:

A.F.

AF INPUT SENSITIVITY (mV) #3:

4

AL INPUT SENSITIVITY (mV) #3:

A.F.

AF INPUT SENSITIVITY (mV) #4:

4

AL INPUT SENSITIVITY (mV) #4:

A.F.

RATE CPM AS FOUND % ERROR AS LEFT % ERROR

250		250	0.0%
2500		2497	0.1%
25K	K	24.963	0.1%
250K	K	249.631	0.1%

Is the As Found Data Within 2% of the Set Point?:

☐ Yes ☒ No

DETECTOR 1:

AF 1-6

AL 1-6

DETECTOR 2:

AF 1-6

AL 1-6

DETECTOR 3:

AF 1-6

AL 1-6

DETECTOR 4:

AF 1-6

AL 1-6

0703 S-6	0000 S-6	0000 S-6	A.F.	0000 S-6	A.F.	0000 S-6	A.F.
0100 -2	A.F.	0100 -2	A.F.	0100 -2	A.F.	0100 -2	A.F.
d	A.F.	d	A.F.	d	A.F.	d	A.F.
m	A.F.	m	A.F.	m	A.F.	m	A.F.
1	A.F.	1	A.F.	1	A.F.	1	A.F.
006s	000s	000s	A.F.	000s	A.F.	000s	A.F.

REMARKS: Det 1, 43-68, #PR216394, B; Det 2, 43-37, #PR178300, B; Det 3, 43-68, #PR216394, a; Det 4, 43-37, #PR178300, a. AF whacked display - soldered ground & reset connector

Does Instrument Meet Final Acceptance Criteria?:

☒ Yes ☐ No

Calibration Sticker Attached?:

☒ Yes ☐ No

Date Instrument is Due For Next Calibration:

04/06/12

INSTRUMENT MAILED WITH

#

Performed/Reviewed by:

Date: 4/6/2011

Entered by: Initials



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR

43-68

PROBE #

PR216394

Owner: CHASE ENV

DATE: 04/07/11
TECH: E.M. GlennLOCATION: Griffin Inst
DATE LAST CAL EXPIRES: 04/20/11

REASON FOR CALIBRATION:

☒ Due For Calibration ☐ Repair (See Remarks) ☐ Other (See Remarks) ☐ Due and Repair

CABLE LENGTH: 5'

INPUT SENSITIVITY: 4mV

NIST TRACEABLE EQUIPMENT AND STANDARDS USED DURING CALIBRATION

MODEL: 2241-3 SERIAL #: 253351 CAL. DUE: 04/06/12

NIST TRACEABLE SOURCES USED

Source Number	Isotope	4 pi Activity	Assay Date	2 pi Activity
00TC470-0854	Tc99 SS	17,300 dpm	06/15/09	10,800 cpm
2697-00	Sr90	12,200 dpm	03/01/00	8,530 cpm
PX 726	C14	48,780 dpm	01/21/08	18,660 cpm
2696-00	Pu239	18,500 dpm	12/02/09	9,370 cpm
94TH470-1593	Th230	16,700 dpm	06/16/09	8,170 cpm

Efficiencies from last cal.:

Condition: ☒ Sat ☐ Unsat

Pu: 24.97% Th: 22.66% Sr: 38.39%

Tc ss: 28.03% C14: 14.01% Tc Ni:

As Found (AF) Efficiencies:

HV / Vernier:	Tc-99 Source Response Nickel (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Tc-99 Source Response Stainless Steel (CPM):		
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.	A ch.	B ch.	Net Eff.
1250 a / 1650 b				4567		24.68%	1	268		5120	28.05%

Net A to B Xtalk: <10%	B to A Xtalk: <1%
---------------------------	----------------------

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
AF CPM:	4567		5120	3836	4142	7298
AF 4 pi eff:	24.68%		28.05%	22.96%	41.47%	14.41%
AF 2 pi eff:	48.73%		44.93%	46.94%	59.31%	37.67%

Is as found efficiency within 20% of the efficiency from the last cal?

☒ Yes ☐ No (See Remarks)

Note: If the as found data is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the plateau section and go directly to remarks.



GRIFFIN INSTRUMENTS



PROBE #: PR216394

Date: 04/07/11

PLATEAU AND SET POINT DATA

HV / Vernier:	Tc-99 Source Response SS (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Net A to B Xtalk: <10%	B to A Xtalk: <1%
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.		
N/A										

Alpha / Beta Bkg (cpm)		1	268			
HV / Vernier	Pu-239	Tc-99 NI	Tc-99 SS	Th-230	C-14	Sr-90
1250 a/1650 b	CPM: 4567		5120	3836	7298	4142
4 pl AL Efficiencies:	24.68%		28.05%	22.96%	14.41%	41.47%
2 pl AL Efficiencies:	48.63%		44.93%	46.94%	37.67%	59.31%

REMARKS: Cal due 04/06/12 to match the box.

Does Instrument Meet Final Acceptance Criteria?: ☒ Yes ☐ No

Calibration Sticker Attached?: ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 04/06/12

INSTRUMENT MARKED WITH 2241-3 # 253351

Performed/Reviewed by:

E.G. Glavin

Date: 4/7/2011

Entered by: *E.G.* Initials

2 pl efficiencies denoted in italics.

Calibrations performed to ANSI N323A-1997 standards.



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR 43-37 PROBE # PR178300

Owner: CHASE ENV

DATE: 04/07/11
TECH: E.M. GlennLOCATION: Griffin Inst
DATE LAST CAL EXPIRES: 04/20/11

REASON FOR CALIBRATION:

☐ Due For Calibration ☐ Repair (See Remarks) ☐ Other (See Remarks) ☒ Due and Repair

CABLE LENGTH: 10'

INPUT SENSITIVITY: 4mV

NIST TRACEABLE EQUIPMENT AND STANDARDS USED DURING CALIBRATION

MODEL: 2241-3 SERIAL #: 253351 CAL. DUE: 04/06/12

NIST TRACEABLE SOURCES USED

Source Number	Isotope	4 pi Activity	Assay Date	2 pi Activity
00TC470-0654	Tc99 SS	17,300 dpm	06/15/09	10,800 cpm
2697-00	Sr90	12,200 dpm	03/01/00	8,530 cpm
PX 726	C14	48,780 dpm	01/21/08	18,660 cpm
2696-00	Pu239	18,500 dpm	12/02/09	9,370 cpm
94TH470-1593	Th230	16,700 dpm	06/16/09	8,170 cpm

Efficiencies from last cal.:

Condition: ☒ Sat ☐ Unsat

Pu: 22.68% Th: 21.39% Sr:

Tc ss: 23.08% C14: 13.50% Tc Ni:

As Found (AF) Efficiencies:

HV / Vernier:	Tc-99 Source Response Nickel (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Tc-99 Source Response Stainless Steel (CPM):		
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.	A ch.	B ch.	Net Eff.
1250 a / 1800 b				4507		24.35%	2	1093		5731	26.81%

Net A to B
Xtalk: <10%
B to A Xtalk:
<1%

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
AF CPM:	4507		5731	3767	4894	8336
AF 4 pi eff:	24.35%		26.81%	22.54%	40.69%	14.86%
AF 2 pi eff:	48.08%		42.94%	46.08%	58.19%	38.82%

Is as found efficiency within 20% of the efficiency from the last cal?

☒ Yes ☐ No (See Remarks)

Note: If the as found data is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the plateau section and go directly to remarks.



GRIFFIN INSTRUMENTS



PROBE #: PR178300

Date: 04/07/11

PLATEAU AND SET POINT DATA

HV / Vernier:	Tc-99 Source Response SS (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Net A to B Xtalk: <10%	B to A Xtalk: <1%
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.		
N/A										

Alpha / Beta Bkg (cpm)		2	1093				
HV / Vernier	Pu-239	Tc-99 NI	Tc-99 SS	Th-230	C-14	Sr-90	
1250 a / 1800 b	CPM: 4507		5731	3767	8336	4894	
4 pi AL Efficiencies:	24.35%		26.81%	22.54%	14.85%	40.69%	
2 pi AL Efficiencies:	47.98%		42.94%	46.08%	38.82%	58.19%	

REMARKS: Replaced mylar due to multiple holes. Replaced 5 missing screws. Cal due 04/06/12 to match the box.

Does Instrument Meet Final Acceptance Criteria?: ☒ Yes ☐ No

Calibration Sticker Attached?: ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 04/06/12

INSTRUMENT MARRIED WITH 2241-3 # 253351

Performed/Reviewed by:

E. M. Glaser

Date: 4/7/2011

Entered by: *ck* Initials

2 pi efficiencies denoted in italics.

Calibrations performed to ANSI N323A-1997 standards.

CALIBRATION CERTIFICATE FOR

2241-3

SERIAL#

267113

Owner: CHASE ENV

DATE: 07/02/10

LOCATION:

Griffin Inst

TECH: Joanne Glenn

DATE LAST CAL EXPIRES:

05/02/11

Reason For Calibration:

☒ Due For Calibration

☐ Repair (See Remarks)

☐ Other (See Remarks)

☐ Due and Repair (See Remarks)

NIST TRACEABLE EQUIPMENT USED DURING CALIBRATION

MODEL: M-500

SERIAL #: 114512

CAL. DUE: 09/05/10

MODEL:

SERIAL #:

CAL DUE:

☒ Fast/Slow Switch working properly

☒ Audio Response

☐ Geotropism

CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ☐ Yes ☒ No

BATTERY CHECK: Sat

HV TEST ☐ N/A ☒ Sat ☐ Unsat

AF INPUT SENSITIVITY (mV) #1: 3.2

AL INPUT SENSITIVITY (mV) #1: 4

AF INPUT SENSITIVITY (mV) #2: 3.2

AL INPUT SENSITIVITY (mV) #2: 4

AF INPUT SENSITIVITY (mV) #3: 3.2

AL INPUT SENSITIVITY (mV) #3: 4

AF INPUT SENSITIVITY (mV) #4: 3.2

AL INPUT SENSITIVITY (mV) #4: 4

RATE CPM AS FOUND % ERROR AS LEFT % ERROR

250	250	0.0%	A.F.	
2500	2497	0.1%	A.F.	
25K	24.996 K	0.0%	A.F.	
250K	249.691 K	0.1%	A.F.	

Is the As Found Data Within 2% of the Set Point?:

☒ Yes ☐ No

DETECTOR 1:

DETECTOR 2:

DETECTOR 3:

DETECTOR 4:

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

0005 S-6

0000 S-6

0005 S-6

0000 S-6

0005 S-6

0000 S-6

0005 S-6

0000 S-6

0100 -2

A.F.

0100 -2

A.F.

0100 -2

A.F.

0100 -2

A.F.

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A.F.

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A.F.

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A.F.

1

A.F.

1

A.F.

000s

A.F.

000s

A.F.

000s

A.F.

000s

A.F.

REMARKS: Det 1, #PR285700, beta; Det 2, #PR286836, beta; Det 3, #PR285700, alpha; Det 4, #PR286836, alpha.

Does Instrument Meet Final Acceptance Criteria?: ☒ Yes ☐ No

Calibration Sticker Attached?: ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 07/02/11

INSTRUMENT MARRIED WITH

#

Performed/Reviewed by:

Joanne Glenn

Date: 7/2/2010

Entered by: *dg* Initials



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR

43-68

PROBE #

PR285700

Owner: CHASE ENV

DATE: 07/02/10
TECH: Joanne GlennLOCATION: Griffin Inst
DATE LAST CAL EXPIRES:

REASON FOR CALIBRATION:

☐ Due For Calibration ☐ Repair (See Remarks) ☒ Other (See Remarks) ☐ Due and Repair

CABLE LENGTH: 5'

INPUT SENSITIVITY: 4 mV

NIST TRACEABLE EQUIPMENT AND STANDARDS USED DURING CALIBRATION

MODEL: 2241-3 SERIAL #: 267113 CAL DUE: 07/02/11

NIST TRACEABLE SOURCES USED

Source Number	Isotope	4 pi Activity	Assay Date	2 pi Activity
00TC470-0654	Tc99 SS	17,300 dpm	06/15/09	10,800 cpm
94TH470-1593	Th230	16,700 dpm	06/16/09	8,170 cpm
2696-00	Pu239	18,500 dpm	12/02/09	9,370 cpm
2697-00	Sr90	12,200 dpm	03/01/00	8,530 cpm
PX 726	C14	48,780 dpm	01/21/08	18,660 cpm

Efficiencies from last cal.:

Condition: ☒ Sat ☐ UnsatPu: Th: Sr: Tc ss: C14: Tc Ni:

As Found (AF) Efficiencies:

HV / Vernier.	Tc-99 Source Response Nickel (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Tc-99 Source Response Stainless Steel (CPM):		
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.	A ch.	B ch.	Net Eff.
N/A											

Net A to B Xtalk: <10%	B to A Xtalk: <1%

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
AF CPM:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
AF 4 pi eff:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
AF 2 pi eff:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Is as found efficiency within 20% of the efficiency from the last cal?

☐ Yes ☒ No (See Remarks)

Note: If the as found data is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the plateau section and go directly to remarks.



GRIFFIN INSTRUMENTS



PROBE #: PR285700

Date: 07/02/10

PLATEAU AND SET POINT DATA

HV / Vernier:	Tc-99 Source Response SS (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Net A to B Xtalk: <10%	B to A Xtalk: <1%
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.		
1500		2007	11.4%					28		
1550		3259	18.5%					58		
1600		4204	23.6%					120		
1650		4867	26.9%					211		
1700								281		

Alpha / Beta Bkg (cpm)		213				
HV / Vernier		<u>Pu-239</u>	<u>Tc-99 NI</u>	<u>Tc-99 SS</u>	<u>Th-230</u>	<u>C-14</u>
1650 b	CPM:			4879		7713
						3815
	4 pi AL Efficiencies:			26.97%		15.38%
	2 pi AL Efficiencies:			43.20%		40.19%

PROBE #: PR285700

Date: 07/02/10

PLATEAU AND SET POINT DATA

HV / Vernier:	Tc-99 Source Response SS (CPM):			Pu-239 Source Response (CPM):			Background (CPM):		Net A to B Xtalk: <10%	B to A Xtalk: <1%
	A ch.	B ch.	Net Eff.	A ch.	B ch.	Net Eff.	A ch.	B ch.		
1100				4438		24.0%	3			
1150				4525		24.5%	1			
1200				4719		25.5%	2			
1250				4647		25.1%	2			
1300				4745		25.6%	1			

Alpha / Beta Bkg (cpm)		2				
HV / Vernier		<u>Pu-239</u>	<u>Tc-99 NI</u>	<u>Tc-99 SS</u>	<u>Th-230</u>	<u>C-14</u>
1250 a	CPM:	4750			3761	
	4 pi AL Efficiencies:	25.66%			22.51%	
	2 pi AL Efficiencies:	50.56%			46.01%	



GRIFFIN INSTRUMENTS



REMARKS: No previous cal data. Det 2, Beta; Det 4, alpha

Does Instrument Meet Final Acceptance Criteria?: ☒ Yes ☐ No

Calibration Sticker Attached?: ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 07/02/11

INSTRUMENT MARRIED WITH 2241-3 # 267113

Performed/Reviewed by:

Jaune Glanville

Date: 7/2/2010

Entered by: *P* Initials

2 pt efficiencies denoted in italics.

Calibrations performed to ANSI N325A-1997 standards.



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR

2241

SERIAL#

196624

Owner: CHASE ENV

DATE: 03/09/11

LOCATION:

Griffin Inst

TECH: E.M. Glenn

DATE LAST CAL EXPIRES:

03/26/11

Reason For Calibration:

☒ Due For Calibration☐ Repair (See Remarks)☐ Other (See Remarks)☐ Due and Repair (See Remarks)

NIST TRACEABLE EQUIPMENT USED DURING CALIBRATION

MODEL: M-500

SERIAL #: 42386

CAL. DUE: 04/21/11

MODEL:

SERIAL #:

CAL DUE:

☒ Fast/Slow Switch working properly☒ Audio Response☐ Geotropism

CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ☐ Yes ☒ No

BATTERY CHECK: Sat

HV TEST ☐ N/A ☒ Sat ☐ Unsat

AF INPUT SENSITIVITY (mV) #1:	10	AL INPUT SENSITIVITY (mV) #1:	A.F.
AF INPUT SENSITIVITY (mV) #2:	N/A	AL INPUT SENSITIVITY (mV) #2:	N/A
AF INPUT SENSITIVITY (mV) #3:	N/A	AL INPUT SENSITIVITY (mV) #3:	N/A
AF INPUT SENSITIVITY (mV) #4:	N/A	AL INPUT SENSITIVITY (mV) #4:	N/A

RATE CPM AS FOUND % ERROR AS LEFT % ERROR

250	250	0.0%	A.F.
2500	2503	0.1%	A.F.
25K	25.036 K	0.1%	A.F.
250K	250.318 K	0.1%	A.F.

Is the As Found Data Within 2% of the Set Point?:

☒ Yes ☐ No

DETECTOR 1:

DETECTOR 2:

DETECTOR 3:

DETECTOR 4:

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

AF 1-6

AL 1-6

0000 S-6	A.F.	N/A	N/A	N/A	N/A	N/A	N/A
0100 -2	A.F.	N/A	N/A	N/A	N/A	N/A	N/A
d	A.F.	N/A	N/A	N/A	N/A	N/A	N/A
m	A.F.	N/A	N/A	N/A	N/A	N/A	N/A
1	A.F.	N/A	N/A	N/A	N/A	N/A	N/A
000s	A.F.	N/A	N/A	N/A	N/A	N/A	N/A

REMARKS:

Does Instrument Meet Final Acceptance Criteria?: ☒ Yes ☐ NoCalibration Sticker Attached?: ☒ Yes ☐ No

Date Instrument is Due For Next Calibration: 03/09/12

INSTRUMENT MARRIED WITH

44-10

PR201041

Performed/Reviewed by:

E.M. Glenn

Date: 3/9/2011

Entered by: *ELG* Initials



GRIFFIN INSTRUMENTS



CALIBRATION CERTIFICATE FOR

44-10

PROBE #

PR201041

Owner: CHASE ENV

DATE: 03/09/11

LOCATION:

Griffin Inst

TECH: E.M. Glenn

DATE LAST CAL EXPIRES:

03/26/11

☒ Due For Calibration☐ Other (See Remarks)

Cable Length: 5'

☐ Repair (See Remarks)☐ Due and Repair

I.S.: 10mV

NIST TRACEABLE EQUIPMENT AND STANDARDS USED DURING CALIBRATION

MODEL: 2241

SERIAL #:

196624

CAL. DUE:

03/09/12

SOURCE #: 99-1816

ISOTOPE: Cs137

ACTIVITY: 1.23 uCi

ASSAY DATE:

08/12/99

GEOMETRY: Jig upside down with source underneath, activity side up.

Physical Condition: ☒ Sat ☐ Unsat

Efficiency From Last Calibration: 5.1%

Previous HV Set Point: 1150 V

Counts (CPM)

Background (CPM)

Net CPM:

116550

7250

109300

AF Efficiency:

5.23%

Is the AF efficiency within 20% of the efficiency from the last calibration?

☒ Yes☐ No

Reproducibility:

116550

117660

115270

Average:

116493.33

Are the individual counts within 10% of the average?

☒ Yes☐ No

High Voltage:

Source Response (CPM):

Background (CPM):

Net CPM:

N/A

HV

RESPONSE

BACKGROUND

NET CPM

V

Efficiency:

REMARKS:

Does Instrument Meet Final Acceptance Criteria?:

☒ Yes☐ No

Calibration Sticker Attached?:

☒ Yes☐ No

Date Instrument is Due For Next Calibration:

03/09/12

INSTRUMENT MARRIED WITH

2241

196624

Performed/Reviewed by:

Date: 3/9/2011

Entered by: Initials



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

L46271 1 of 10

Project Manager
Chase Environmental Group, Inc.
109 Flint Rd.

Oak Ridge, TN 37830

Report of Analysis/Certificate of Conformance

06/03/2011

LIMS #: L46271
Project ID#: CH085-3EUNIVMO-09
Received: 05/13/2011
Delivery Date: 05/20/2011
P.O.#: SIGNED QUOTE
Release #:
SDG#:

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.


Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
C1103006S-001	L46271-1	
C1103006S-002	L46271-2	
C1103006S-003	L46271-3	

Method Reference Numbers

Matrix	Analysis	Method Reference
S	GAMMA	EPA 901.1



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

L46271 2 of 10

This report shall not be reproduced or distributed except in its entirety.

Report Analysis

06/03/11 12:56

L46271

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID: C1103006S-001		Collect Start: 05/12/2011 08:30				Matrix: Soil				(S)				
Station:		Collect Stop:				Volume:								
Description:		Receive Date: 05/13/2011				% Moisture: 35.46								
LIMS Number: L46271-1														
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values	
BE-7	2007	1.05E-01	5.28E-01	8.49E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
K-40	2007	1.50E+01	1.45E+00	7.17E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
MN-54	2007	-7.21E-03	5.95E-02	9.76E-02	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
CO-58	2007	1.46E-02	6.06E-02	1.02E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
FE-59	2007	9.90E-02	1.12E-01	1.98E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
CO-60	2007	4.06E-02	5.53E-02	9.67E-02	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
ZN-65	2007	4.61E-01	1.66E-01	2.87E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U*	No
ZR-95	2007	7.99E-02	1.30E-01	1.91E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
RU-103	2007	-4.18E-02	6.38E-02	1.00E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
RU-106	2007	-2.76E-01	6.08E-01	8.64E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
I-131	2007	-8.32E-03	1.08E-01	1.69E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
CS-134	2007	5.88E-01	8.78E-02	1.63E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U*	No
CS-137	2007	2.08E-01	7.51E-02	9.49E-02	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
BA-140	2007	-1.62E-01	2.88E-01	4.63E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
CE-141	2007	6.34E-02	1.03E-01	1.73E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
CE-144	2007	-1.42E-01	4.11E-01	6.60E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
TL-208	2007	9.28E-01	2.63E-01	2.82E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
PB-212	2007	9.78E-01	1.48E-01	1.66E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
BI-214	2007	1.25E+00	1.70E-01	1.99E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
BI-212	2007	2.05E+00	6.78E-01	1.27E+00	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
PB-214	2007	1.10E+00	1.50E-01	2.03E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
RA-226	2007	3.22E+00	1.29E+00	2.18E+00	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
AC-228	2007	1.20E+00	2.38E-01	3.42E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
RA-228	2007	1.21E+00	3.81E-01	5.19E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
TH-228	2007	9.78E-01	1.48E-01	1.66E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
TH-232	2007	1.20E+00	2.37E-01	3.42E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	+	Yes
TH-234	2007	-2.81E+00	4.50E+00	7.36E+00	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No
U-235	2007	3.24E-01	4.05E-01	6.89E-01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U	No

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- +
- U* = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- High = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- Spec = Activity concentration exceeds customer reporting value
- L = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

L46271

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006S-001				Collect Start: 05/12/2011 08:30				Matrix: Soil				(S)	
Station:				Collect Stop:				Volume:					
Description:				Receive Date: 05/13/2011				% Moisture: 35.46					
LIMS Number: L46271-1													
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
U-238	2007	6.92E+00	6.87E+00	1.20E+01	pCi/g Dry		227.08	g dry	05/12/11 08:30	05/19/11	6000	Sec	U No

Flag Values

U = Compound/Analyte not detected (< MDC) or less than 3 sigma
 + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
 U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
 High = Activity concentration exceeds customer reporting value
 Spec = MDC exceeds customer technical specification
 L = Low recovery
 H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

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MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46271

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006S-002	Collect Start: 05/12/2011 08:38	Matrix: Soil (S)
Station:	Collect Stop:	Volume:
Description:	Receive Date: 05/13/2011	% Moisture: 25.11
LIMS Number: L46271-2		

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
BE-7	2007	4.92E-01	4.40E-01	7.60E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
K-40	2007	1.47E+01	1.30E+00	7.17E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
MN-54	2007	1.76E-02	5.23E-02	8.67E-02	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
CO-58	2007	-1.33E-02	5.28E-02	8.47E-02	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
FE-59	2007	3.71E-02	1.07E-01	1.79E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
CO-60	2007	-2.31E-02	4.87E-02	7.65E-02	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
ZN-65	2007	3.94E-01	1.45E-01	2.46E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U* No
ZR-95	2007	5.01E-02	9.50E-02	1.52E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
RU-103	2007	-4.34E-02	5.04E-02	7.87E-02	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
RU-106	2007	2.39E-02	4.45E-01	7.40E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
I-131	2007	-3.82E-02	8.74E-02	1.39E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
CS-134	2007	3.70E-01	6.80E-02	1.24E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U* No
CS-137	2007	2.81E-02	5.39E-02	9.16E-02	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
BA-140	2007	9.67E-02	2.53E-01	4.20E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
CE-141	2007	1.13E-01	8.34E-02	1.42E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
CE-144	2007	-2.65E-01	3.18E-01	5.11E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No
TL-208	2007	1.17E+00	2.06E-01	2.20E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
PB-212	2007	1.27E+00	1.04E-01	1.35E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
BI-214	2007	1.26E+00	1.36E-01	1.63E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
BI-212	2007	1.04E+00	6.96E-01	9.98E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U Yes
PB-214	2007	1.17E+00	1.41E-01	1.68E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
RA-226	2007	2.71E+00	1.31E+00	1.72E+00	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
AC-228	2007	1.31E+00	2.68E-01	3.10E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
RA-228	2007	1.35E+00	3.60E-01	5.03E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
TH-228	2007	1.27E+00	1.04E-01	1.35E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	+ Yes
TH-232	2007	1.29E+00	2.69E-01	4.87E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U* No
TH-234	2007	1.69E+00	8.13E-01	4.74E+00	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U Yes
U-235	2007	3.77E-01	3.30E-01	5.61E-01	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U No

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
 + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
 U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
 High = Activity concentration exceeds customer reporting value
 Spec = MDC exceeds customer technical specification
 L = Low recovery
 H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46271

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006S-002					Collect Start: 05/12/2011 08:38					Matrix: Soil					(S)	
Station:					Collect Stop:					Volume:						
Description:					Receive Date: 05/13/2011					% Moisture: 25.11						
LIMS Number: L46271-2																
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values			
U-238	2007	3.06E+00	5.69E+00	9.77E+00	pCi/g Dry		303.77	g dry	05/12/11 08:38	05/19/11	6000	Sec	U	No		

Flag Values

U = Compound/Analyte not detected (< MDC) or less than 3 sigma
+ = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
High = Activity concentration exceeds customer reporting value
Spec = MDC exceeds customer technical specification
L = Low recovery
H = High recovery

Bolded text indicates reportable value.

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Yes = Peak identified in gamma spectrum

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MDC - Minimum Detectable Concentration

Report of Analysis

06/03/11 12:56

L46271

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Project Manager

Sample ID: C1103006S-003	Collect Start: 05/12/2011 08:46	Matrix: Soil	(S)
Station:	Collect Stop:	Volume:	
Description:	Receive Date: 05/13/2011	% Moisture: 24.92	
LIMS Number: L46271-3			

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
BE-7	2007	5.99E-02	3.29E-01	5.62E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
K-40	2007	1.60E+01	1.56E+00	5.79E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
MN-54	2007	7.38E-03	3.98E-02	6.67E-02	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
CO-58	2007	-4.74E-02	4.16E-02	5.98E-02	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
FE-59	2007	1.08E-02	9.09E-02	1.50E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
CO-60	2007	-2.46E-02	4.80E-02	7.11E-02	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
ZN-65	2007	4.52E-02	1.10E-01	1.64E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
ZR-95	2007	6.68E-02	7.34E-02	1.32E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
RU-103	2007	3.36E-03	3.73E-02	6.32E-02	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
RU-106	2007	-2.34E-01	3.61E-01	5.65E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
I-131	2007	-5.79E-02	6.97E-02	1.05E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
CS-134	2007	3.30E-03	4.44E-02	6.49E-02	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
CS-137	2007	3.69E-02	5.04E-02	8.84E-02	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
BA-140	2007	-5.43E-02	2.04E-01	3.34E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
CE-141	2007	7.42E-02	6.60E-02	1.15E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
CE-144	2007	-1.39E-01	2.56E-01	4.14E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U No
TL-208	2007	1.25E+00	2.48E-01	2.00E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
PB-212	2007	1.31E+00	1.30E-01	1.10E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
BI-214	2007	9.53E-01	1.62E-01	1.33E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
BI-212	2007	8.56E-01	7.84E-01	8.02E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U Yes
PB-214	2007	1.31E+00	1.50E-01	1.23E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
RA-224	2007	3.19E+00	1.32E+00	1.25E+00	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
RA-226	2007	3.62E+00	1.27E+00	1.33E+00	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
AC-228	2007	1.32E+00	3.35E-01	2.69E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
RA-228	2007	9.06E-01	4.26E-01	4.03E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
TH-228	2007	1.31E+00	1.30E-01	1.10E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
TH-232	2007	1.32E+00	3.34E-01	2.68E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	+ Yes
TH-234	2007	2.13E+00	1.04E+00	4.58E+00	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U Yes

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
- Spec = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46271

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Project Manager

Sample ID: C1103006S-003						Collect Start: 05/12/2011 08:46				Matrix: Soil				(S)	
Station:						Collect Stop:				Volume:					
Description:						Receive Date: 05/13/2011				% Moisture: 24.92					
LIMS Number: L46271-3															
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
U-235	2007	-1.18E-02	2.67E-01	4.40E-01	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U	No	
U-238	2007	2.10E+00	4.39E+00	7.67E+00	pCi/g Dry		237.19	g dry	05/12/11 08:46	05/19/11	6000	Sec	U	No	

Flag Values

U = Compound/Analyte not detected (< MDC) or less than 3 sigma
 + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
 U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
 High = Activity concentration exceeds customer reporting value
 Spec = MDC exceeds customer technical specification
 L = Low recovery
 H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

No. C01103006-02

Chase Environmental Group, Inc.
109 Flint Road, Oak Ridge, TN 37830
865-481-8801

Page 1 of 1

Purchase
Order #: C01103006

[illegible]

05/13/11 10:24

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report L46271 10 of 10

SR #: 3A27617

Client: CHASE ENVIRONMENTAL GROUP INC

Project #: CH085-3EUNIVMO-09

LIMS #L46271

Initiated By: JSIMMONS

Init Date: 05/13/11

Receive Date: 05/13/11

Notification of Variance

Person Notified:

Contacted By:

Notify Date:

Notify Method:

Notify Comment:

Client Response

Person Responding:

Response Date:

Response Method:

Response Comment

Criteria	Yes	No	NA	Comment
1 Shipping container custody seals present and intact.			NA	
2 Sample container custody seals present and intact.			NA	
3 Sample containers received in good condition	Y			
4 Chain of custody received with samples	Y			
5 All samples listed on chain of custody received	Y			
6 Sample container labels present and legible.	Y			
7 Information on container labels correspond with chain of custody	Y			
8 Sample(s) properly preserved and in appropriate container(s)			NA	
9 Other (Describe)			NA	
For Hazardous Materials Only:				
10 Paperwork shows TBE and shippers name, address and phone number			NA	
11 Paperwork shows sample quantity information			NA	



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

L46272 1 of 10

Project Manager
Chase Environmental Group, Inc.
109 Flint Rd.

Oak Ridge, TN 37830

Report of Analysis/Certificate of Conformance

06/02/2011

LIMS #: L46272
Project ID#: CH085-3EUNIVMO-09
Received: 05/13/2011
Delivery Date: 05/20/2011
P.O.#: SIGNED QUOTE
Release #:
SDG#:

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.


Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
C1103006M-001	L46272-1	
C1103006M-002	L46272-2	
C1103006M-003	L46272-3	

Method Reference Numbers

Matrix	Analysis	Method Reference
SL	GAMMA	EPA 901.1



TELEDYNE
BROWN ENGINEERING, INC.

A Teledyne Technologies Company

2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

L46272 2 of 10

This report shall not be reproduced or distributed except in its entirety.

Report of Analysis

06/02/11 15:33

L46272

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



**TELEDYNE
BROWN ENGINEERING, INC.**
A Teledyne Technologies Company

Sample ID: C1103006M-001	Collect Start: 05/11/2011 18:00	Matrix: Sludge (SL)
Station:	Collect Stop:	Volume:
Description:	Receive Date: 05/13/2011	% Moisture: 94.31
LIMS Number: L46272-1		

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
C-14	2003	-4.04E-01	3.86E-01	6.48E-01	pCi/g		2.8	g wet		05/26/11	60	M	U
H-3	2003	2.49E-01	4.67E-01	7.58E-01	pCi/g		2.8	g wet		05/27/11	60	M	U
BE-7	2007	1.53E+00	3.46E+00	6.01E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
K-40	2007	2.05E+01	1.03E+01	7.90E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	+
MN-54	2007	2.73E-01	4.00E-01	7.05E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
CO-58	2007	1.79E-01	3.36E-01	5.96E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
FE-59	2007	-3.87E-01	9.39E-01	1.47E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
CO-60	2007	-3.28E-01	3.44E-01	4.42E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
ZN-65	2007	-7.45E-01	9.12E-01	1.35E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
ZR-95	2007	2.90E-01	7.05E-01	1.22E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
RU-103	2007	-7.14E-02	4.26E-01	6.98E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
RU-106	2007	4.14E+00	3.02E+00	5.76E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
I-131	2007	6.26E-01	1.77E+00	2.93E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
CS-134	2007	4.82E-02	4.12E-01	6.01E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
CS-137	2007	-1.01E-01	3.60E-01	5.73E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
BA-140	2007	2.23E+00	3.59E+00	6.33E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
CE-141	2007	-3.00E-01	5.78E-01	9.37E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
CE-144	2007	-1.25E-01	1.73E+00	2.85E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
TL-208	2007	2.49E+00	2.20E+00	1.50E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
PB-212	2007	1.28E+00	8.04E-01	9.96E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	+
BI-214	2007	2.60E+00	1.38E+00	1.10E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	+
BI-212	2007	5.58E-01	4.43E+00	7.53E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
PB-214	2007	2.37E+00	8.97E-01	1.04E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	+
RA-226	2007	1.85E+00	7.04E+00	1.27E+01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
RA-228	2007	8.14E-02	2.58E+00	4.35E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
TH-228	2007	1.28E+00	8.04E-01	9.96E-01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	+
TH-232	2007	6.21E-01	1.58E+00	2.84E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U
TH-234	2007	-1.56E+01	2.02E+01	3.42E+01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- +
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
- Spec = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report of Analysis

06/02/11 15:33

L46272

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Project Manager

Sample ID: C1103006M-001				Collect Start: 05/11/2011 18:00				Matrix: Sludge				(SL)			
Station:				Collect Stop:				Volume:							
Description:				Receive Date: 05/13/2011				% Moisture: 94.31							
LIMS Number: L46272-1															
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
U-235	2007	9.95E-02	1.80E+00	3.03E+00	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U		No
U-238	2007	-2.59E+01	4.91E+01	7.64E+01	pCi/g Dry		6.03	g dry	05/11/11 18:00	06/01/11	6000	Sec	U		No

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- +
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U*
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High
- High = Activity concentration exceeds customer reporting value
- Spec
- Spec = MDC exceeds customer technical specification
- L
- L = Low recovery
- H
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report of Analysis

06/02/11 15:33

L46272

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Project Manager

Sample ID: C1103006M-002	Collect Start: 05/11/2011 18:05	Matrix: Sludge	(SL)
Station:	Collect Stop:	Volume:	
Description:	Receive Date: 05/13/2011	% Moisture: 82.59	
LIMS Number: L46272-2			

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
C-14	2003	9.96E-01	4.97E-01	7.90E-01	pCi/g		2.35	g wet		05/31/11	60	M	+
H-3	2003	1.36E-01	5.52E-01	9.03E-01	pCi/g		2.35	g wet		05/27/11	60	M	U
BE-7	2007	8.97E-01	2.21E+00	3.81E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
K-40	2007	2.55E+01	6.41E+00	4.00E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	+
MN-54	2007	-1.50E-01	2.31E-01	3.45E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
CO-58	2007	3.22E-02	2.56E-01	4.24E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
FE-59	2007	-2.18E-01	6.04E-01	9.59E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
CO-60	2007	9.59E-02	2.37E-01	4.18E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
ZN-65	2007	-5.25E-01	5.15E-01	7.34E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
ZR-95	2007	-3.22E-01	4.32E-01	6.35E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
RU-103	2007	9.80E-02	2.81E-01	4.82E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
RU-106	2007	-1.93E+00	2.12E+00	3.17E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
I-131	2007	-1.12E+00	1.17E+00	1.72E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
CS-134	2007	1.64E-01	2.42E-01	3.74E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
CS-137	2007	7.39E-03	2.21E-01	3.65E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
BA-140	2007	5.83E-01	2.15E+00	3.66E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
CE-141	2007	-1.78E-01	3.76E-01	6.08E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
CE-144	2007	-3.01E-01	1.10E+00	1.79E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
TL-208	2007	1.25E+00	1.04E+00	1.07E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
PB-212	2007	7.72E-01	5.60E-01	6.15E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
BI-214	2007	1.14E+00	7.37E-01	1.18E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
BI-212	2007	-2.57E+00	2.68E+00	4.05E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
PB-214	2007	6.86E-01	6.66E-01	1.00E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
RA-226	2007	9.38E-01	4.22E+00	7.28E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
RA-228	2007	7.67E-01	1.81E+00	3.15E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
TH-228	2007	7.72E-01	5.60E-01	6.15E-01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
TH-232	2007	1.59E+00	1.52E+00	1.29E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U
TH-234	2007	-1.03E+01	9.75E+00	1.59E+01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- +
- U* = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- High = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- Spec = Activity concentration exceeds customer reporting value
- L = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report of Analysis

06/02/11 15:33

L46272

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Project Manager

Sample ID: C1103006M-002				Collect Start: 05/11/2011 18:05				Matrix: Sludge				(SL)			
Station:				Collect Stop:				Volume:							
Description:				Receive Date: 05/13/2011				% Moisture: 82.59							
LIMS Number: L46272-2															
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
U-235	2007	6.39E-02	1.13E+00	1.89E+00	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U	No	
U-238	2007	8.29E+00	2.92E+01	4.87E+01	pCi/g Dry		12.14	g dry	05/11/11 18:05	06/01/11	6000	Sec	U	No	

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
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- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report of Analysis

06/02/11 15:33



L46272

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006M-003	Collect Start: 05/11/2011 18:09	Matrix: Sludge	(SL)
Station:	Collect Stop:	Volume:	
Description:	Receive Date: 05/13/2011	% Moisture: 76.75	
LIMS Number: L46272-3			

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
C-14	2003	-3.77E-01	4.04E-01	6.77E-01	pCi/g		2.68	g wet		05/26/11	60	M	U
H-3	2003	3.20E-01	4.90E-01	7.91E-01	pCi/g		2.68	g wet		05/27/11	60	M	U
BE-7	2007	1.48E-01	2.13E+00	3.46E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
K-40	2007	1.98E+01	6.29E+00	2.33E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	+
MN-54	2007	1.79E-01	2.27E-01	4.16E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
CO-58	2007	2.22E-01	2.82E-01	5.14E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
FE-59	2007	-3.60E-02	5.96E-01	9.62E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
CO-60	2007	-1.21E-01	2.03E-01	2.70E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
ZN-65	2007	-6.01E-01	6.23E-01	8.58E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
ZR-95	2007	1.70E-01	5.24E-01	9.06E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
RU-103	2007	-1.23E-01	2.44E-01	3.64E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
RU-106	2007	-1.04E+00	2.09E+00	3.31E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
I-131	2007	-2.76E-01	1.25E+00	2.00E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
CS-134	2007	1.82E-01	2.07E-01	3.49E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
CS-137	2007	2.48E-01	2.13E-01	4.08E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
BA-140	2007	1.11E+00	2.35E+00	3.98E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
CE-141	2007	-3.58E-02	3.26E-01	5.43E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
CE-144	2007	-6.80E-01	9.54E-01	1.53E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
TL-208	2007	1.99E+00	8.84E-01	9.53E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	+
PB-212	2007	1.79E+00	4.51E-01	4.61E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	+
BI-214	2007	1.28E+00	7.02E-01	6.78E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	+
BI-212	2007	2.75E+00	2.90E+00	5.38E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
PB-214	2007	1.47E+00	5.75E-01	6.25E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	+
RA-226	2007	1.30E+00	3.88E+00	6.83E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
RA-228	2007	2.03E-01	1.77E+00	3.07E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
TH-228	2007	1.78E+00	4.51E-01	4.61E-01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	+
TH-232	2007	1.01E+00	1.15E+00	1.28E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U
TH-234	2007	5.29E+00	8.86E+00	1.47E+01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- +
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
- Spec = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report of Analysis

06/02/11 15:33



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

L46272

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006M-003					Collect Start: 05/11/2011 18:09					Matrix: Sludge					(SL)	
Station:					Collect Stop:					Volume:						
Description:					Receive Date: 05/13/2011					% Moisture: 76.75						
LIMS Number: L46272-3																
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values			
U-235	2007	-1.18E+00	9.79E-01	1.51E+00	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U		No	
U-238	2007	-7.00E+00	2.59E+01	4.17E+01	pCi/g Dry		11.38	g dry	05/11/11 18:09	06/01/11	6000	Sec	U		No	

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- +
- U* = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- High = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- Spec = Activity concentration exceeds customer reporting value
- L = MDC exceeds customer technical specification
- H = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

No. C1103006-01

E18D

Page 1 of 1

Purchase
Order #: C1103006

462729 of 10

05/13/11 10:38

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report L46272 10 of 10

SR #: SR27618

Client: CHASE ENVIRONMENTAL GROUP INC

Project #: CH085-3EUNIVMO-09

LIMS #L46272

Initiated By: JSIMMONS

Init Date: 05/13/11

Receive Date: 05/13/11

Notification of Variance

Person Notified:

Contacted By:

Notify Date:

Notify Method:

Notify Comment:

Client Response

Person Responding:

Response Date:

Response Method:

Response Comment

Criteria	Yes	No	NA	Comment
1 Shipping container custody seals present and intact.			NA	
2 Sample container custody seals present and intact.			NA	
3 Sample containers received in good condition		Y		
4 Chain of custody received with samples		Y		
5 All samples listed on chain of custody received		Y		
6 Sample container labels present and legible.		Y		
7 Information on container labels correspond with chain of custody		Y		
8 Sample(s) properly preserved and in appropriate container(s)			NA	
9 Other (Describe)			NA	
For Hazardous Materials Only:				
10 Paperwork shows TBE and shippers name, address and phone number			NA	
11 Paperwork shows sample quantity information			NA	



TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company
2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

L46293 1 of 10

Project Manager
Chase Environmental Group, Inc.
109 Flint Rd.

Oak Ridge, TN 37830

Report of Analysis/Certificate of Conformance

06/03/2011

LIMS #: L46293
Project ID#: CH085-3EUNIVMO-09
Received: 05/16/2011
Delivery Date: 05/23/2011
P.O.#: SIGNED QUOTE
Release #:
SDG#:

This is to certify that Teledyne Brown Engineering - Environmental Services located at 2508 Quality Lane, Knoxville, Tennessee, 37931, has analyzed, tested and documented samples, as received by the laboratory, as specified in the applicable purchase order.

This also certifies that requirements of applicable codes, standards and specifications have been fully met and that any quality assurance documentation which verified conformance to the purchase order is on file and may be examined upon request.

I hereby certify that the above statements are true and correct.

Keith Jeter
Operations Manager

Cross Reference Table

Client ID	Laboratory ID	Station ID (if applicable)
C1103006M-004	L46293-1	
C1103006M-005	L46293-2	
C1103006M-006	L46293-3	

Method Reference Numbers

Matrix	Analysis	Method Reference
SL	GAMMA	EPA 901.1



TELEDYNE
BROWN ENGINEERING, INC.

A Teledyne Technologies Company

2508 Quality Lane
Knoxville, TN 37931-3133
865-690-6819

L46293 2 of 10

This report shall not be reproduced or distributed except in its entirety.

Report Analysis

06/03/11 12:56


TELEDYNE
BROWN ENGINEERING, INC.
 A Teledyne Technologies Company
L46293

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Sample ID: C1103006M-004	Collect Start: 05/13/2011 12:10	Matrix: Sludge (SL)
Station:	Collect Stop:	Volume:
Description:	Receive Date: 05/16/2011	% Moisture: 80.04
LIMS Number: L46293-1		

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
C-14	2003	-6.93E-01	4.74E-01	8.02E-01	pCi/g		2.26	g wet		05/26/11	60	M	U
H-3	2003	5.11E-01	5.84E-01	9.38E-01	pCi/g		2.26	g wet		05/27/11	60	M	U
BE-7	2007	3.52E+00	2.87E+00	5.13E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
K-40	2007	1.94E+01	7.38E+00	4.68E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	+ Yes
MN-54	2007	1.80E-02	2.99E-01	4.97E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
CO-58	2007	-2.59E-01	3.20E-01	4.78E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
FE-59	2007	3.99E-02	7.40E-01	1.21E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
CO-60	2007	4.93E-02	2.58E-01	4.45E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
ZN-65	2007	-1.63E-01	7.98E-01	1.26E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
ZR-95	2007	-1.34E-01	5.71E-01	9.24E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
RU-103	2007	-1.60E-01	3.69E-01	5.76E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
RU-106	2007	2.41E-01	2.74E+00	4.44E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
I-131	2007	-1.10E+00	1.16E+00	1.77E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
CS-134	2007	4.82E-02	3.36E-01	4.74E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
CS-137	2007	-4.98E-01	3.21E-01	4.60E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
BA-140	2007	-2.29E+00	2.73E+00	4.06E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
CE-141	2007	-2.21E-01	4.29E-01	6.85E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
CE-144	2007	1.35E+00	1.26E+00	2.18E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
TL-208	2007	1.60E+00	1.46E+00	1.29E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes
PB-212	2007	9.39E-01	6.63E-01	6.19E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes
BI-214	2007	1.76E+00	1.00E+00	8.71E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	+ Yes
BI-212	2007	4.88E+00	3.84E+00	7.12E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U No
PB-214	2007	1.45E+00	6.81E-01	8.81E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	+ Yes
RA-226	2007	2.99E+00	7.16E+00	7.53E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes
RA-228	2007	1.88E+00	2.07E+00	3.26E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes
TH-228	2007	9.39E-01	6.63E-01	6.19E-01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes
TH-232	2007	1.58E+00	1.72E+00	1.64E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes
TH-234	2007	3.59E+00	5.64E+00	1.76E+01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U Yes

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
 + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
 U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
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 L = Low recovery
 H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46293

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006M-004				Collect Start: 05/13/2011 12:10				Matrix: Sludge				(SL)			
Station:				Collect Stop:				Volume:							
Description:				Receive Date: 05/16/2011				% Moisture: 80.04							
LIMS Number: L46293-1															
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
U-235	2007	-1.16E+00	1.35E+00	2.12E+00	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U		No
U-238	2007	-2.55E+01	3.02E+01	4.55E+01	pCi/g Dry		11.31	g dry	05/13/11 12:10	06/01/11	6000	Sec	U		No

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
- Spec = MDC exceeds customer technical specification
- L = Low recovery
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Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

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MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46293

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09



Project Manager

Sample ID: C1103006M-005	Collect Start: 05/13/2011 12:15	Matrix: Sludge (SL)
Station:	Collect Stop:	Volume:
Description:	Receive Date: 05/16/2011	% Moisture: 78.04
LIMS Number: L46293-2		

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
C-14	2003	-1.02E+00	4.60E-01	7.88E-01	pCi/g		2.3	g wet		05/26/11	60	M	U
H-3	2003	6.56E-01	5.79E-01	9.22E-01	pCi/g		2.3	g wet		05/27/11	60	M	U
BE-7	2007	3.32E-01	1.87E+00	3.17E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
K-40	2007	9.52E+00	5.07E+00	3.49E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	+ Yes
MN-54	2007	1.33E-01	2.07E-01	3.77E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
CO-58	2007	7.96E-02	2.56E-01	4.30E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
FE-59	2007	-4.31E-02	4.57E-01	7.38E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
CO-60	2007	8.63E-02	2.66E-01	4.58E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
ZN-65	2007	-6.66E-01	5.50E-01	7.24E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
ZR-95	2007	-2.52E-01	3.85E-01	5.53E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
RU-103	2007	-6.20E-02	2.31E-01	3.72E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
RU-106	2007	1.05E+00	1.83E+00	3.20E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
I-131	2007	-2.40E-01	8.26E-01	1.28E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
CS-134	2007	-2.52E-03	2.18E-01	3.09E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
CS-137	2007	1.89E-01	2.13E-01	3.85E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
BA-140	2007	-1.62E+00	1.66E+00	2.39E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
CE-141	2007	-1.60E-02	2.97E-01	5.01E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
CE-144	2007	-2.60E-01	8.63E-01	1.42E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
TL-208	2007	1.35E+00	1.17E+00	8.91E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U Yes
PB-212	2007	3.73E-01	5.96E-01	4.63E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U Yes
BI-214	2007	1.14E+00	6.08E-01	4.68E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	+ Yes
BI-212	2007	1.32E+00	2.75E+00	4.71E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U No
PB-214	2007	1.67E+00	6.17E-01	5.41E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	+ Yes
RA-226	2007	2.65E+00	5.05E+00	4.83E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U Yes
AC-228	2007	2.98E+00	9.88E-01	1.13E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	+ Yes
RA-228	2007	2.16E+00	2.14E+00	2.68E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U Yes
TH-228	2007	3.73E-01	5.96E-01	4.63E-01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U Yes
TH-232	2007	2.96E+00	9.82E-01	1.12E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	+ Yes

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
- Spec = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

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MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56



L46293

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

Sample ID: C1103006M-005						Collect Start: 05/13/2011 12:15				Matrix: Sludge				(SL)	
Station:						Collect Stop:				Volume:					
Description:						Receive Date: 05/16/2011				% Moisture: 78.04					
LIMS Number: L46293-2															
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values		
TH-234	2007	2.67E+00	3.39E+00	1.40E+01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U	Yes	
U-235	2007	-1.33E-01	9.64E-01	1.62E+00	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U	No	
U-238	2007	-3.73E+00	2.47E+01	4.09E+01	pCi/g Dry		10.38	g dry	05/13/11 12:15	06/01/11	6000	Sec	U	No	

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
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- Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46293

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

Project Manager

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Sample ID: C1103006M-006	Collect Start: 05/13/2011 12:20	Matrix: Sludge	(SL)
Station:	Collect Stop:	Volume:	
Description:	Receive Date: 05/16/2011	% Moisture: 48.06	
LIMS Number: L46293-3			

Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values
C-14	2003	-9.09E-01	4.40E-01	7.52E-01	pCi/g		2.41	g wet		05/26/11	60	M	U
H-3	2003	-9.48E-02	5.31E-01	8.80E-01	pCi/g		2.41	g wet		05/27/11	60	M	U
BE-7	2007	4.64E-01	3.91E-01	7.04E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
K-40	2007	1.29E+01	1.31E+00	3.46E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
MN-54	2007	8.58E-03	4.09E-02	7.00E-02	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
CO-58	2007	1.20E-02	4.47E-02	7.40E-02	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
FE-59	2007	4.97E-02	9.72E-02	1.70E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
CO-60	2007	1.91E-02	4.03E-02	6.99E-02	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
ZN-65	2007	-5.95E-02	1.07E-01	1.36E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
ZR-95	2007	8.93E-03	8.42E-02	1.37E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
RU-103	2007	-1.65E-02	4.72E-02	7.59E-02	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
RU-106	2007	1.13E-01	3.92E-01	6.56E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
I-131	2007	-1.06E-01	1.98E-01	3.04E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
CS-134	2007	-3.58E-02	4.63E-02	5.95E-02	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
CS-137	2007	-1.04E-02	4.74E-02	6.46E-02	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
BA-140	2007	-1.10E-01	3.54E-01	5.69E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
CE-141	2007	6.47E-02	7.92E-02	1.37E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
CE-144	2007	3.05E-01	2.76E-01	4.34E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U No
TL-208	2007	1.03E+00	2.27E-01	2.05E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
PB-212	2007	1.12E+00	1.07E-01	1.05E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
BI-214	2007	1.14E+00	1.71E-01	1.19E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
BI-212	2007	1.36E+00	7.82E-01	8.00E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
PB-214	2007	1.12E+00	1.40E-01	1.39E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
RA-226	2007	2.36E+00	1.33E+00	1.41E+00	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
AC-228	2007	1.24E+00	3.20E-01	2.22E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
RA-228	2007	1.30E+00	4.03E-01	4.17E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
TH-228	2007	1.12E+00	1.07E-01	1.05E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes
TH-232	2007	1.23E+00	3.18E-01	2.21E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	+ Yes

Flag Values

- U = Compound/Analyte not detected (< MDC) or less than 3 sigma
- + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
- U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
- High = Activity concentration exceeds customer reporting value
- Spec = MDC exceeds customer technical specification
- L = Low recovery
- H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

Report Analysis

06/03/11 12:56

L46293

Chase Environmental Group, Inc.

CH085-3EUNIVMO-09

TELEDYNE
BROWN ENGINEERING, INC.
A Teledyne Technologies Company

Project Manager

Sample ID: C1103006M-006					Collect Start: 05/13/2011 12:20					Matrix: Sludge					(SL)	
Station:					Collect Stop:					Volume:						
Description:					Receive Date: 05/16/2011					% Moisture: 48.06						
LIMS Number: L46293-3																
Radionuclide	SOP#	Activity Conc	Uncertainty 2 Sigma	MDC	Units	Run #	Aliquot Volume	Aliquot Units	Reference Date	Count Date	Count Time	Count Units	Flag Values			
TH-234	2007	6.36E-01	2.46E+00	4.04E+00	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U		No	
U-235	2007	-1.09E-01	2.52E-01	4.17E-01	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U		No	
U-238	2007	-4.99E-02	4.35E+00	7.29E+00	pCi/g Dry		268.09	g dry	05/13/11 12:20	06/01/11	6000	Sec	U		No	

Flag Values

U = Compound/Analyte not detected (< MDC) or less than 3 sigma
 + = Activity concentration exceeds MDC and 3 sigma; peak identified(gamma only)
 U* = Compound/Analyte not detected. Peak not identified, but forced activity concentration exceeds MDC and 3 sigma
 High = Activity concentration exceeds customer reporting value
 Spec = MDC exceeds customer technical specification
 L = Low recovery
 H = High recovery

Bolded text indicates reportable value.

No = Peak not identified in gamma spectrum

Yes = Peak identified in gamma spectrum

**** Unless otherwise noted, the analytical results reported are related only to the samples tested in the condition they are received by the laboratory.

MDC - Minimum Detectable Concentration

No. C1103006-03

Chase Environmental Group, Inc.
109 Flint Road, Oak Ridge, TN 37830
865-481-8801

E19A

Page 1 of 1

Purchase
Order #: C1103006

[illegible]

05/16/11 13:21

Teledyne Brown Engineering
Sample Receipt Verification/Variance Report L46293 10 of 10

SR #: SR27639

Client: CHASE ENVIRONMENTAL GROUP INC Project #: CH085-3EUNIVMO-09

LIMS #L46293

Initiated By: JSIMMONS

Init Date: 05/16/11 Receive Date: 05/16/11

Notification of Variance

Person Notified:

Contacted By:

Notify Date:

Notify Method:

Notify Comment:

Client Response

Person Responding:

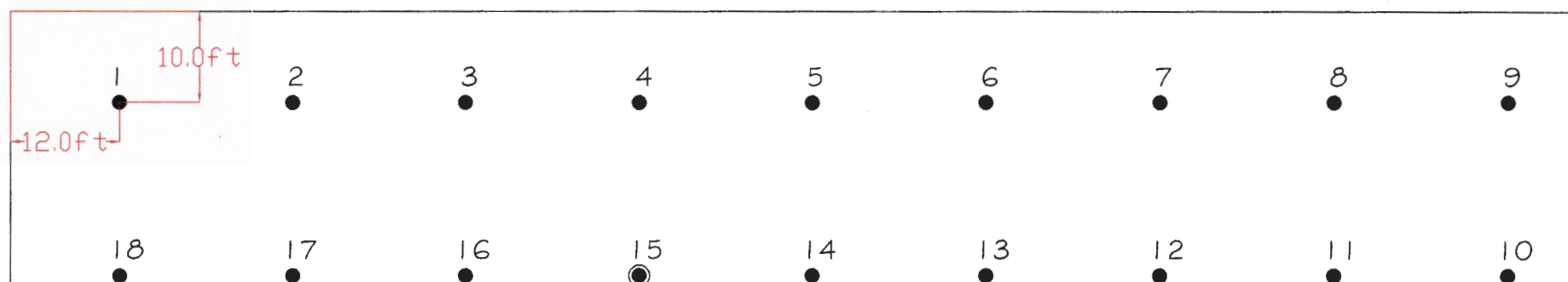
Response Date:

Response Method:

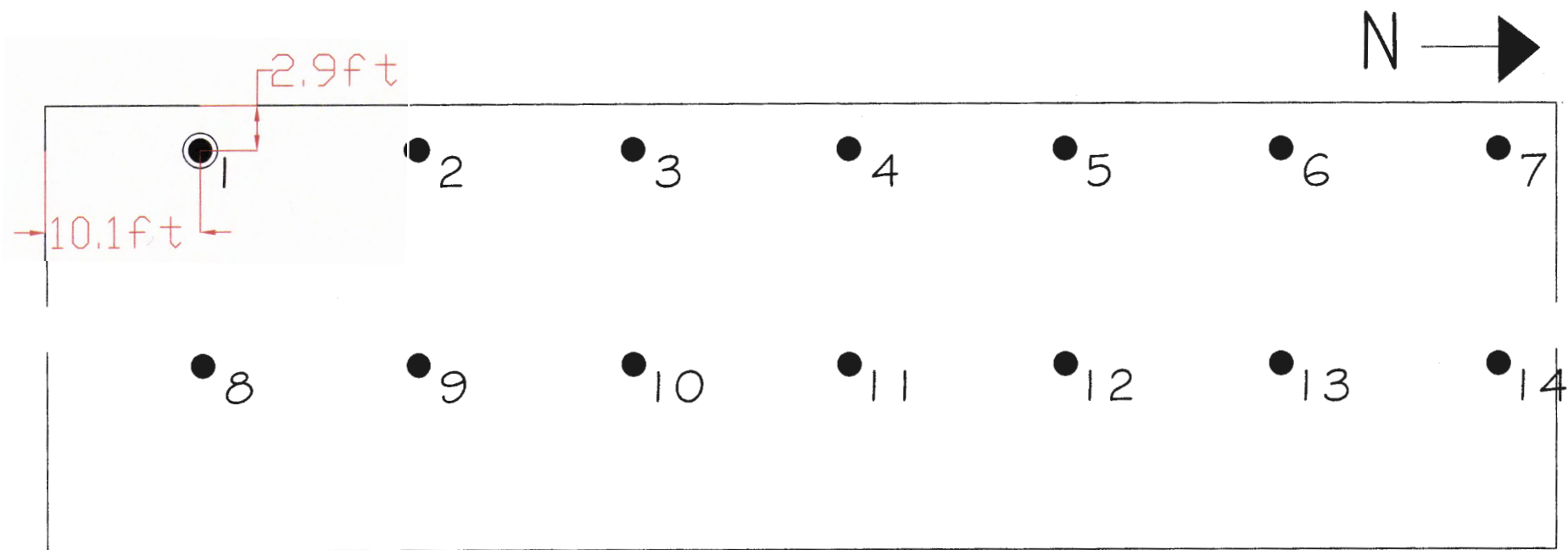
Response Comment


Criteria	Yes	No	NA	Comment
1 Shipping container custody seals present and intact.			NA	
2 Sample container custody seals present and intact.			NA	
3 Sample containers received in good condition		Y		
4 Chain of custody received with samples		Y		
5 All samples listed on chain of custody received		Y		
6 Sample container labels present and legible.		Y		
7 Information on container labels correspond with chain of custody		Y		
8 Sample(s) properly preserved and in appropriate container(s)			NA	
9 Other (Describe)			NA	
For Hazardous Materials Only:				
10 Paperwork shows TBE and shippers name, address and phone number			NA	
11 Paperwork shows sample quantity information			NA	

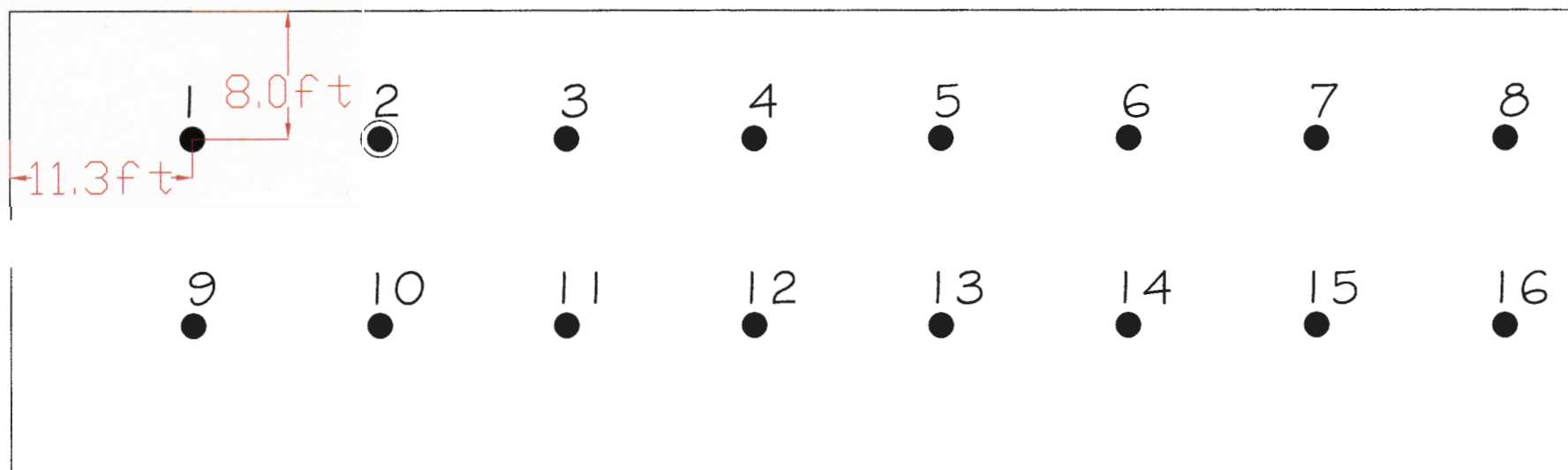
N →



● Random Start Location
Spacing = 19ft

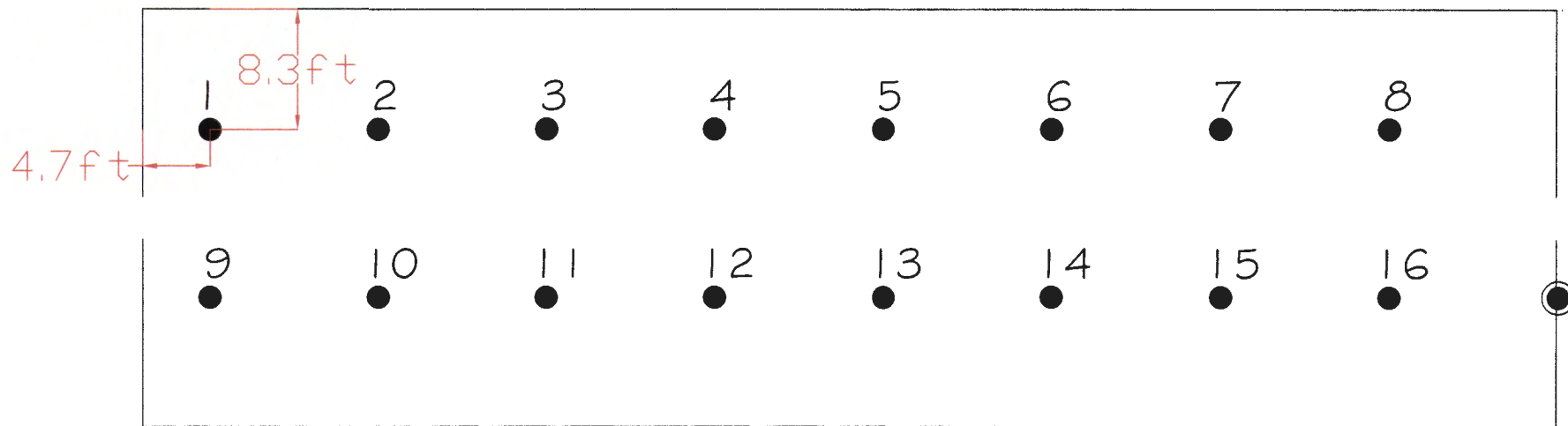


 Random Start Location
 Spacing = 14ft

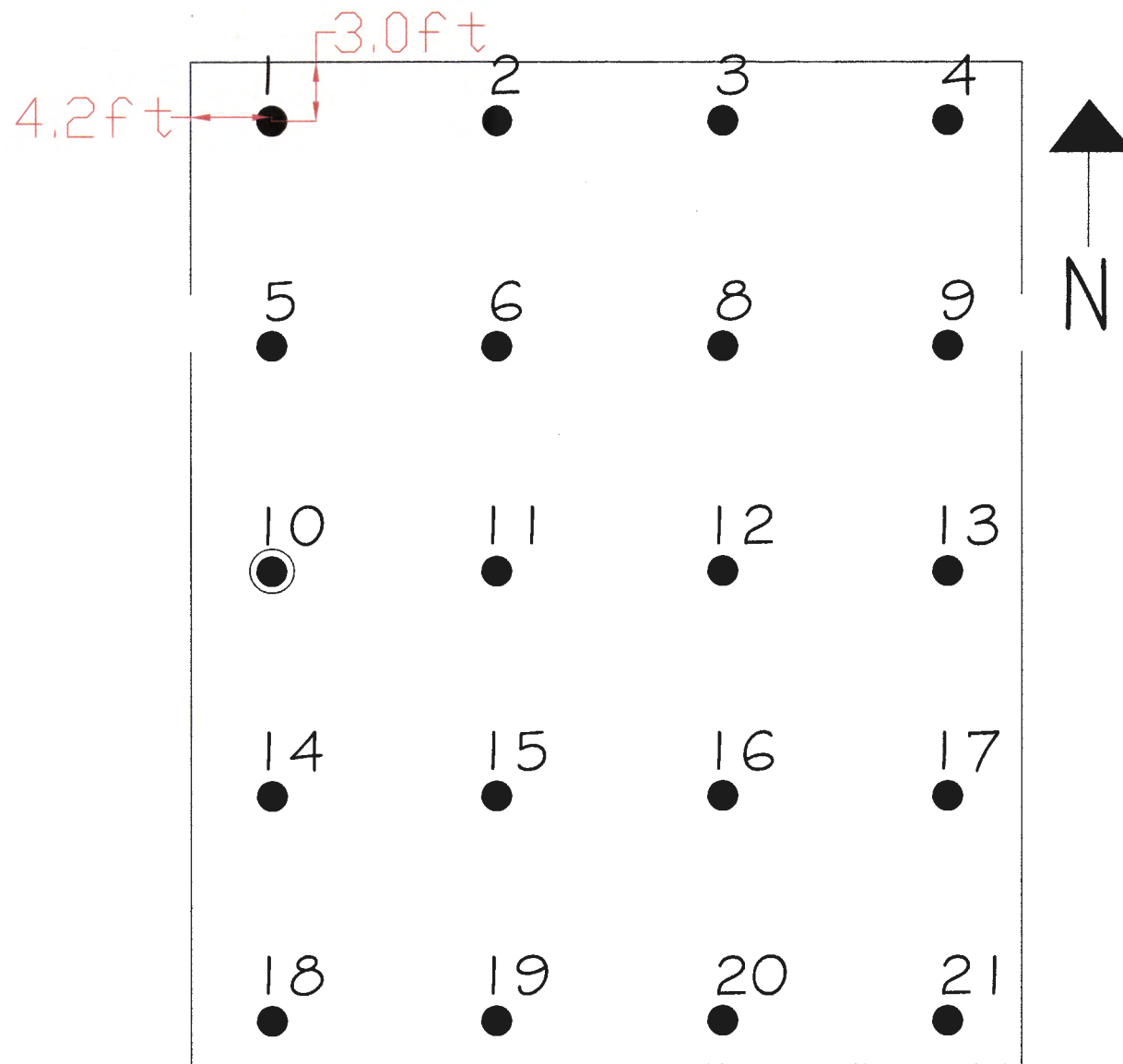



● Random Start Location
Spacing = 14ft

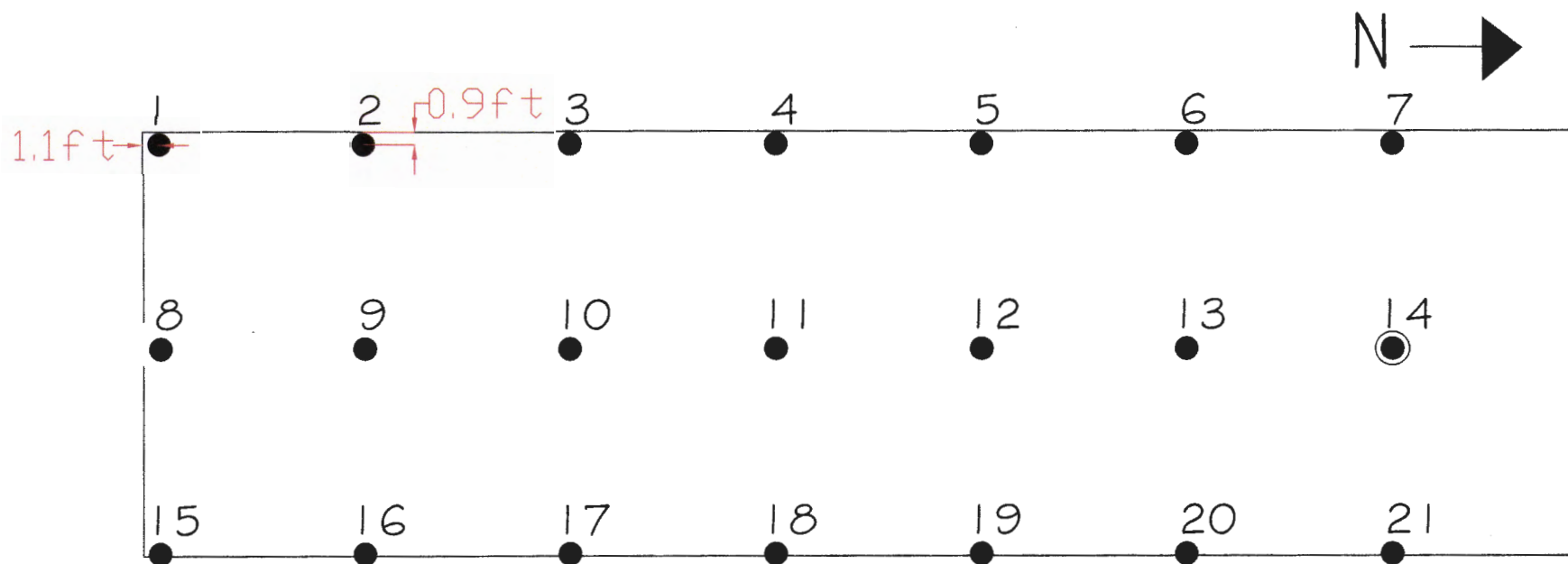
N →




● Random Start Location
Spacing = 14ft



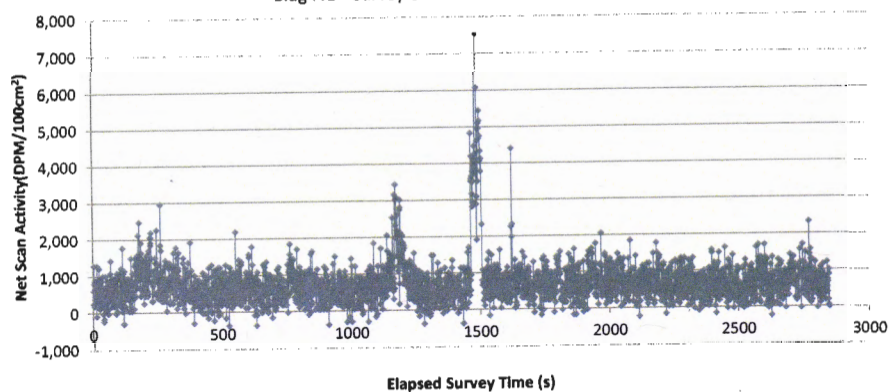
 Random Start Location
 Spacing = 10ft



 Random Start Location
 Spacing = 14ft

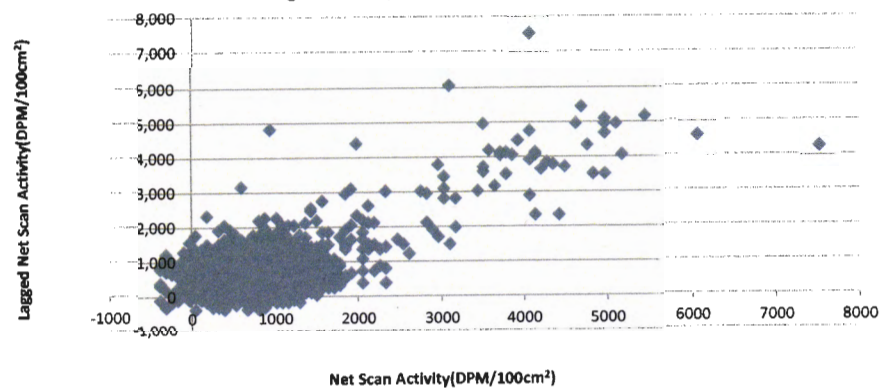
Scan Data

Bldg :41 Survey Unit : 1201 Probe : PR178300



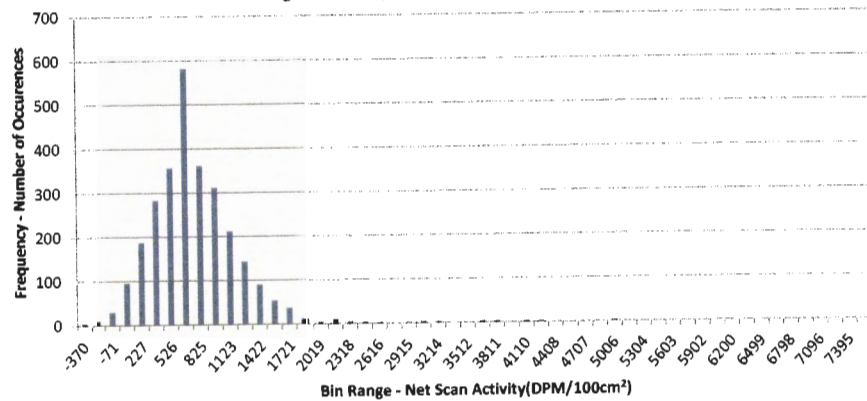
Lagged Scan Data

Bldg :41 Survey Unit : 1201 Probe : PR178300



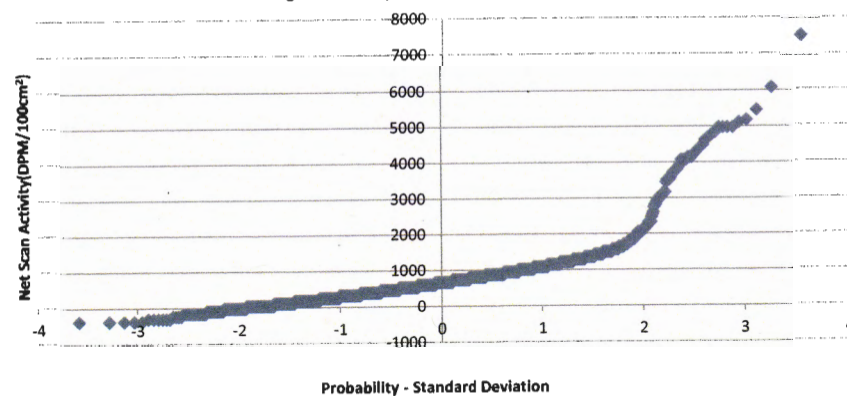
Histogram of Scan Data

Bldg :41 Survey Unit : 1201 Probe : PR178300



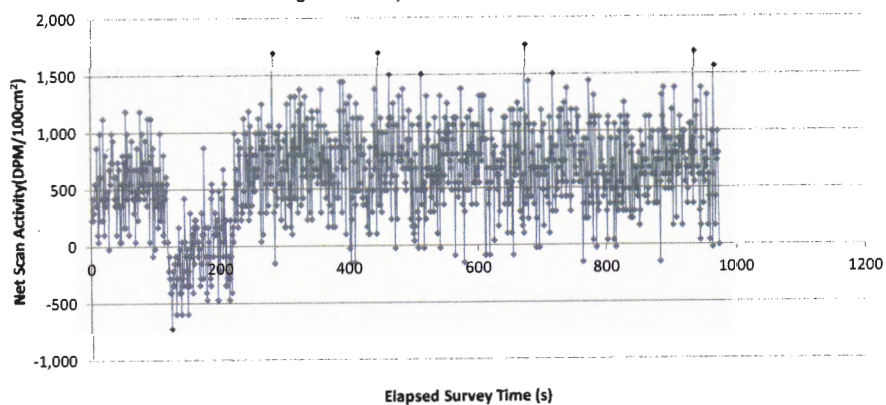
Normal Probability Plot of Data

Bldg :41 Survey Unit : 1201 Probe : PR178300



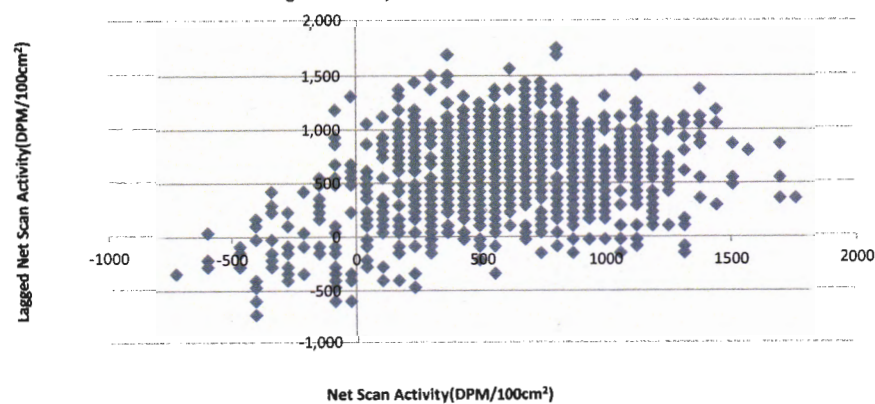
Scan Data

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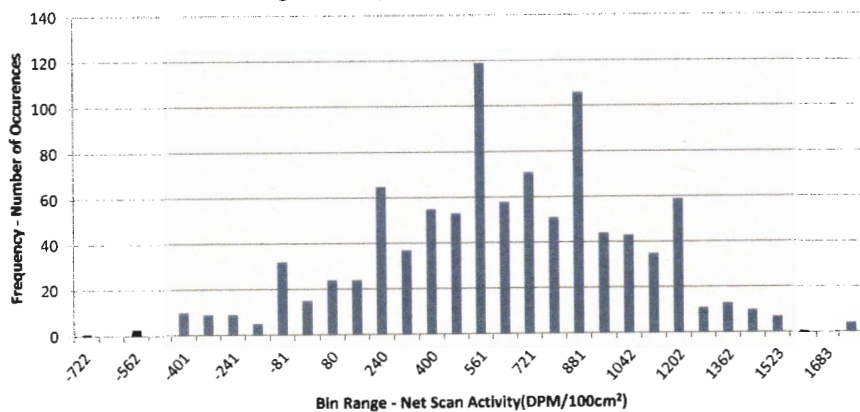
Lagged Scan Data

Bldg :41 Survey Unit : 1201 Probe : PR259902



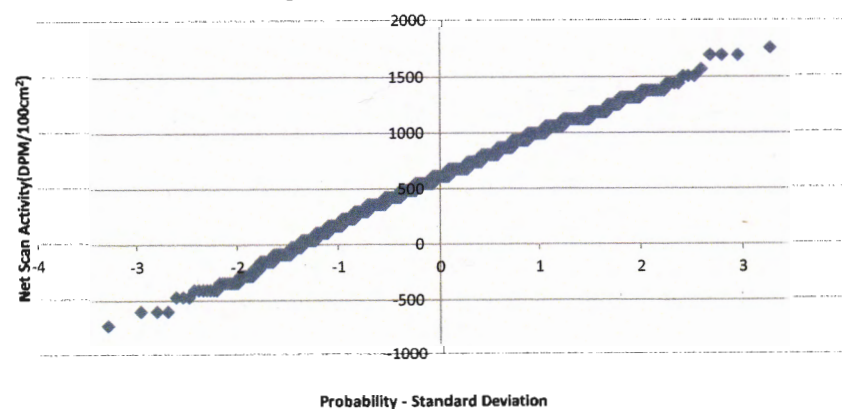
Histogram of Scan Data

Bldg :41 Survey Unit : 1201 Probe : PR259902



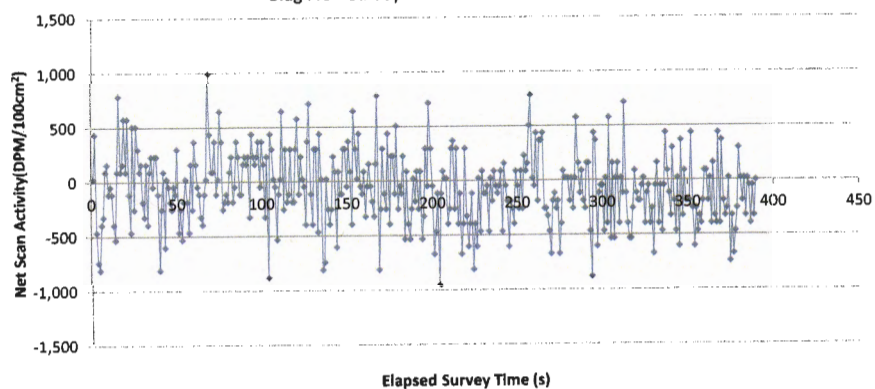
Normal Probability Plot of Data

Bldg :41 Survey Unit : 1201 Probe : PR259902



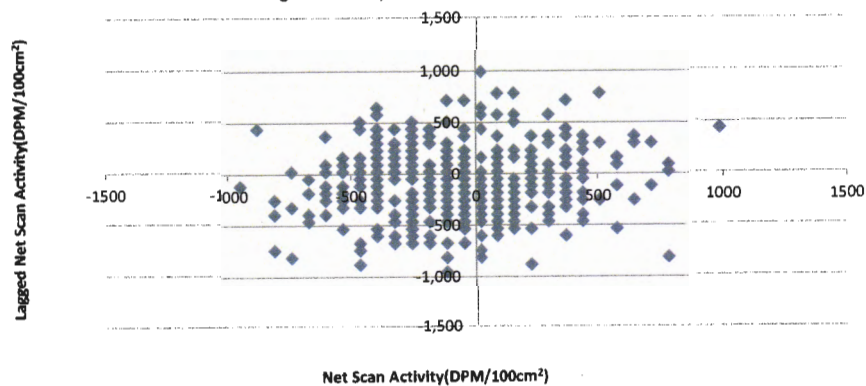
Scan Data

Bldg :46 Survey Unit : 1201 Probe : PR178300



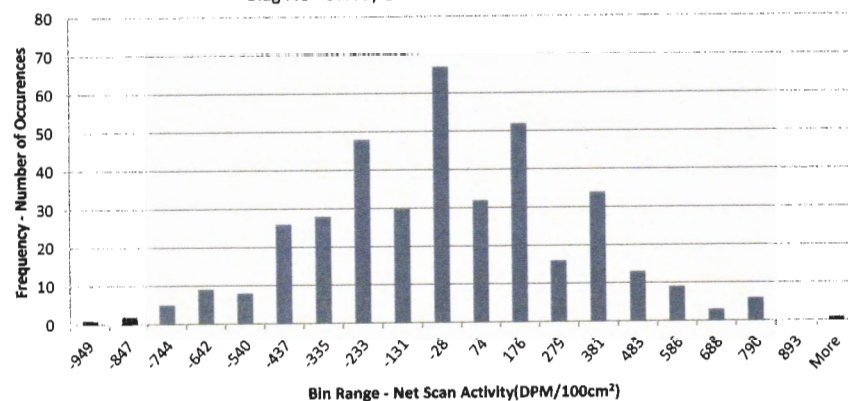
Lagged Scan Data

Bldg :46 Survey Unit : 1201 Probe : PR178300



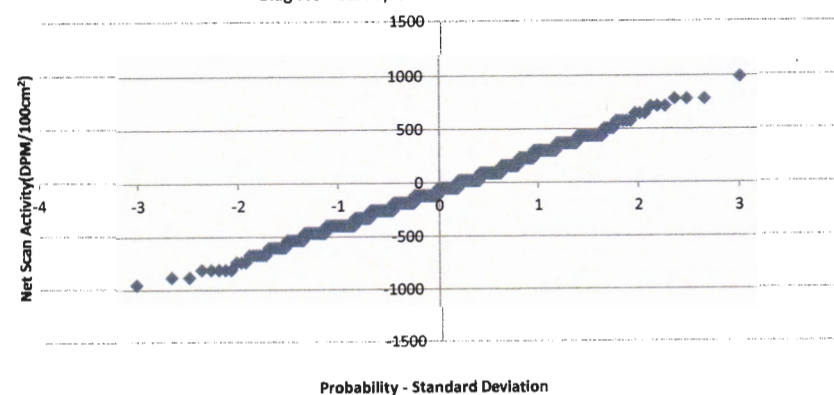
Histogram of Scan Data

Bldg :46 Survey Unit : 1201 Probe : PR178300



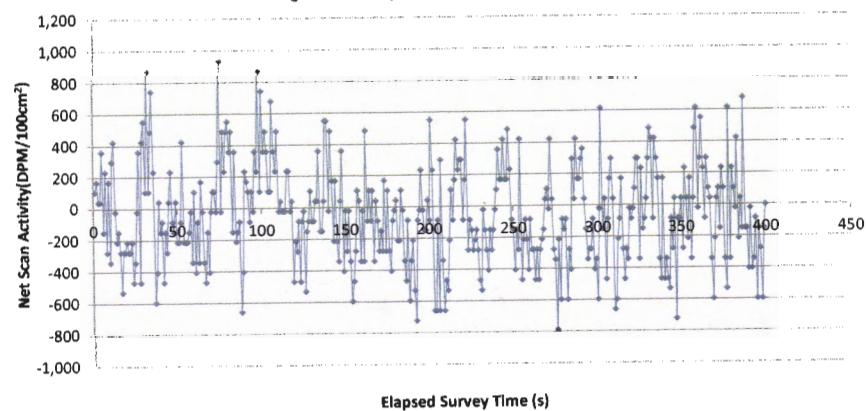
Normal Probability Plot of Data

Bldg :46 Survey Unit : 1201 Probe : PR178300



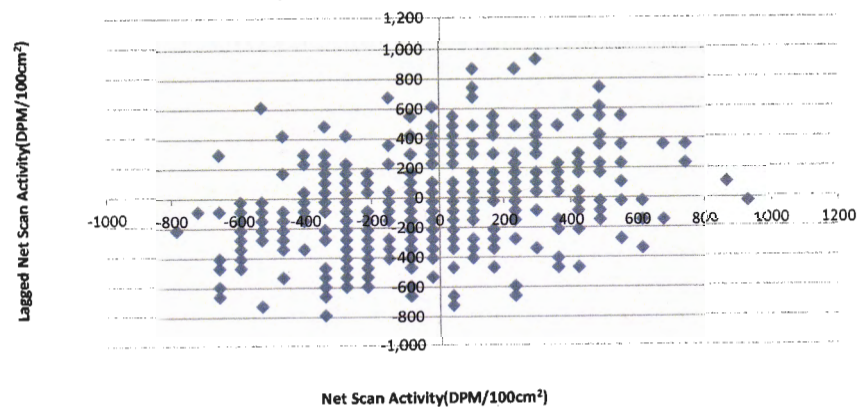
Scan Data

Bldg :46 Survey Unit : 1201 Probe : PR259902



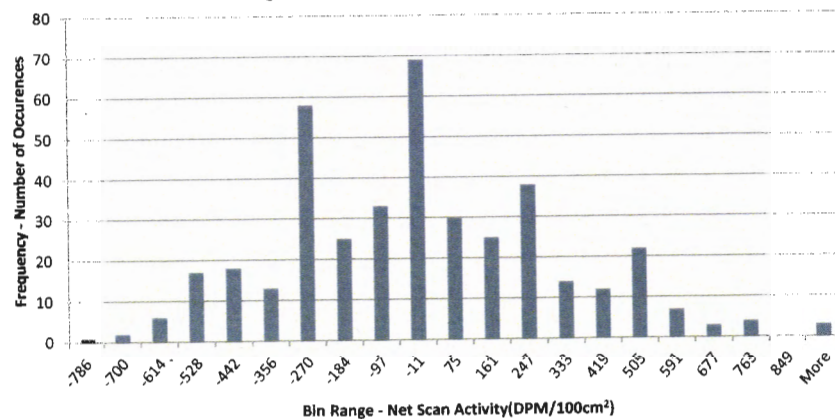
Lagged Scan Data

Bldg :46 Survey Unit : 1201 Probe : PR259902



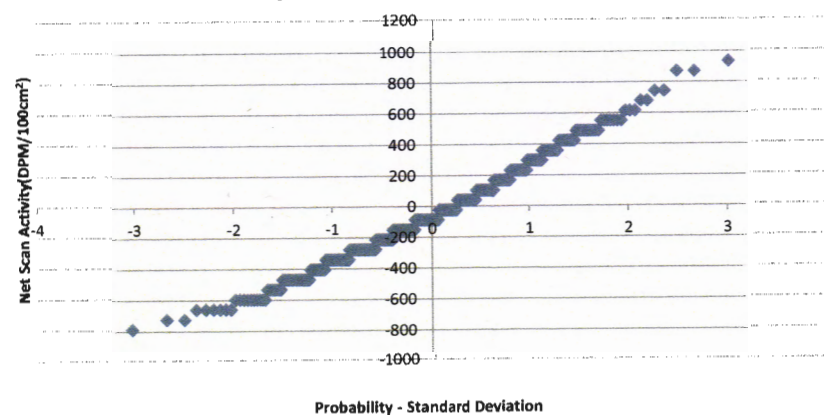
Histogram of Scan Data

Bldg :46 Survey Unit : 1201 Probe : PR259902



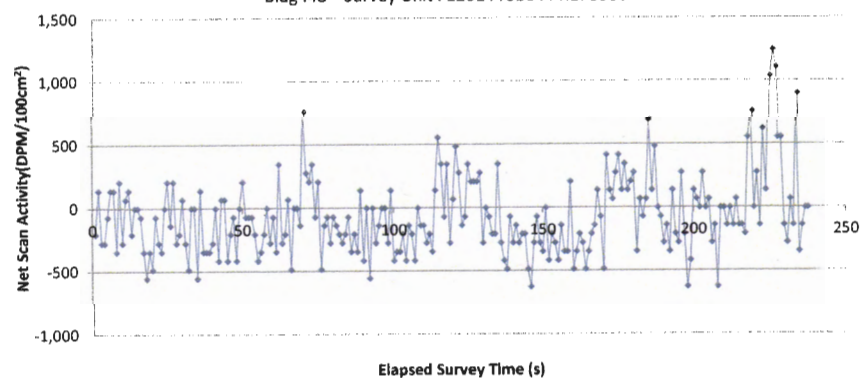
Normal Probability Plot of Data

Bldg :46 Survey Unit : 1201 Probe : PR259902



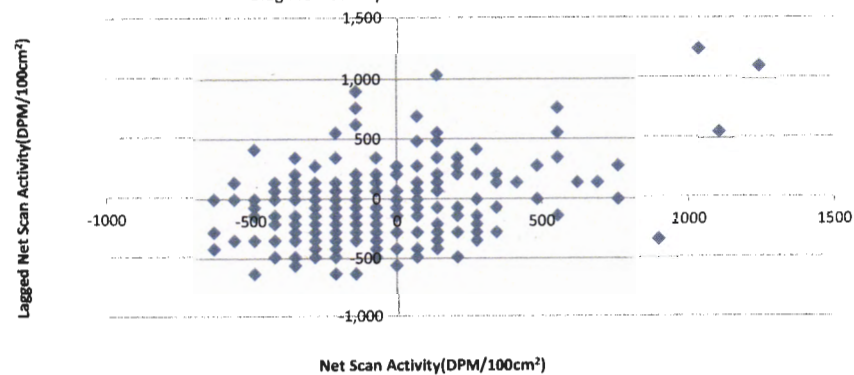
Scan Data

Bldg :48 Survey Unit : 1201 Probe : PR178300



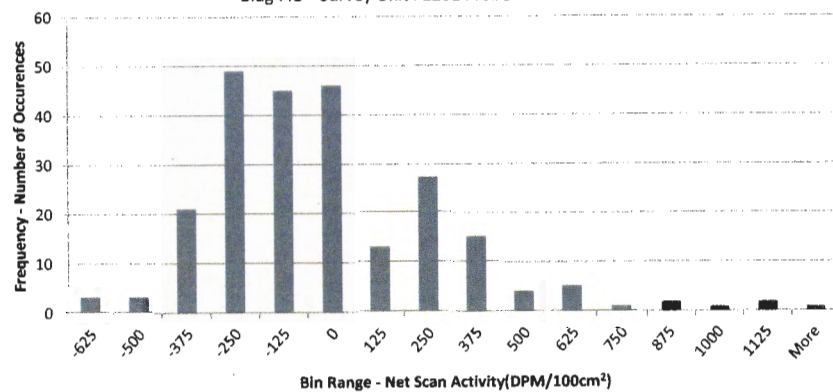
Lagged Scan Data

Bldg :48 Survey Unit : 1201 Probe : PR178300



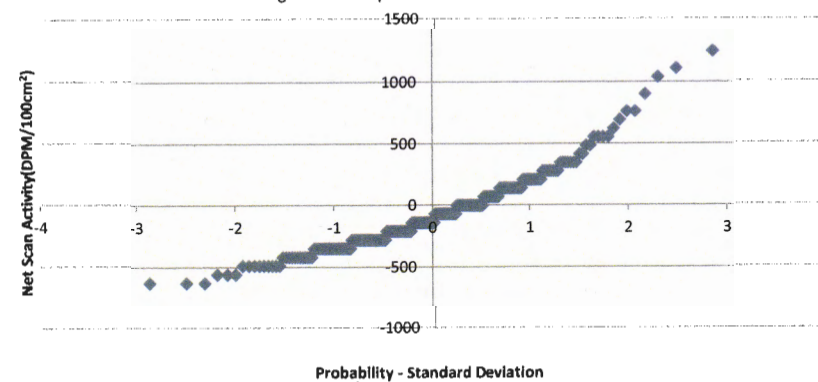
Histogram of Scan Data

Bldg :48 Survey Unit : 1201 Probe : PR178300



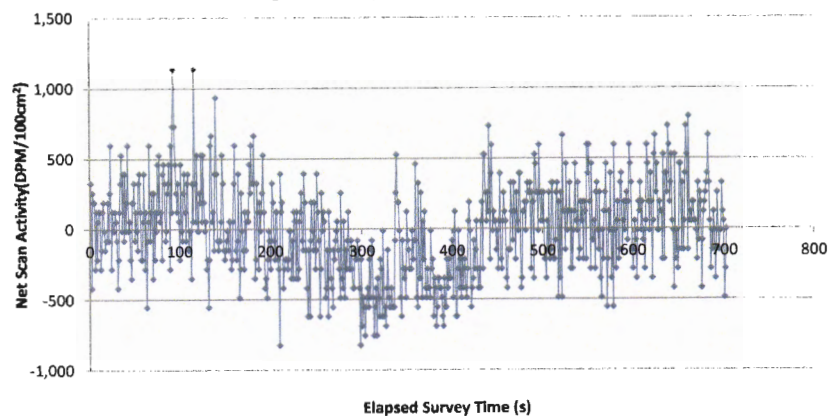
Normal Probability Plot of Data

Bldg :48 Survey Unit : 1201 Probe : PR178300



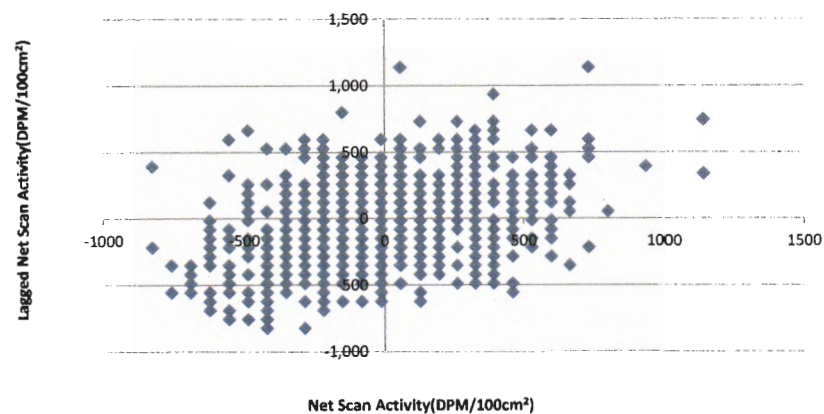
Scan Data

Bldg :48 Survey Unit : 1201 Probe : PR281040



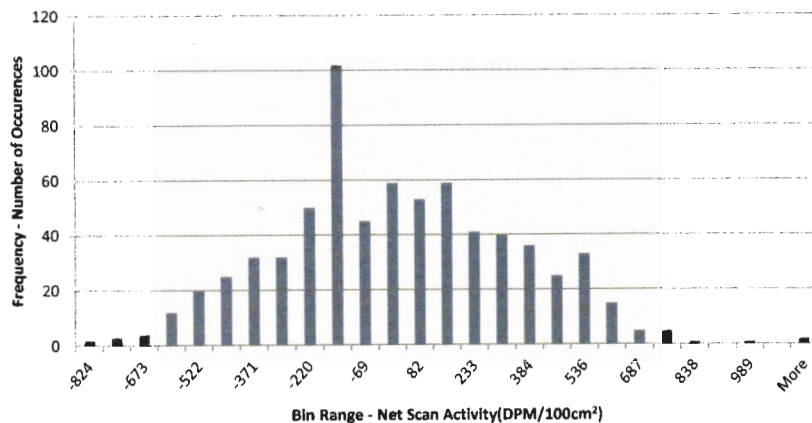
Lagged Scan Data

Bldg :48 Survey Unit : 1201 Probe : PR281040



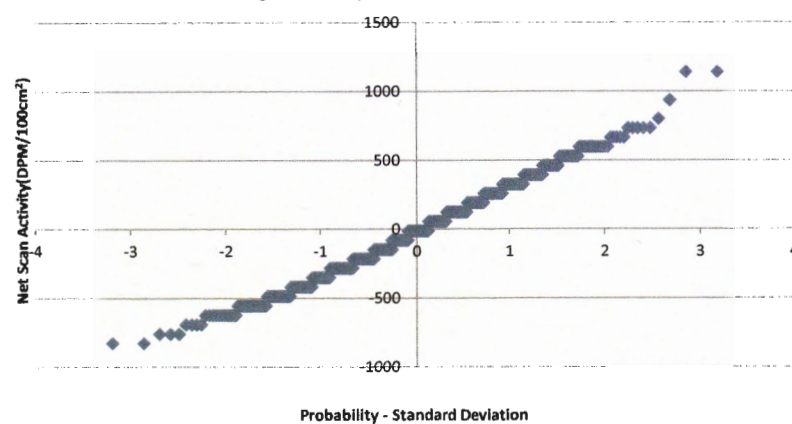
Histogram of Scan Data

Bldg :48 Survey Unit : 1201 Probe : PR281040



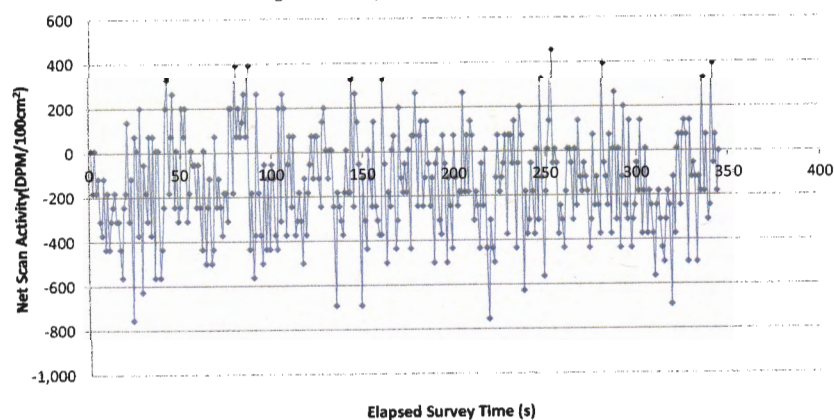
Normal Probability Plot of Data

Bldg :48 Survey Unit : 1201 Probe : PR281040



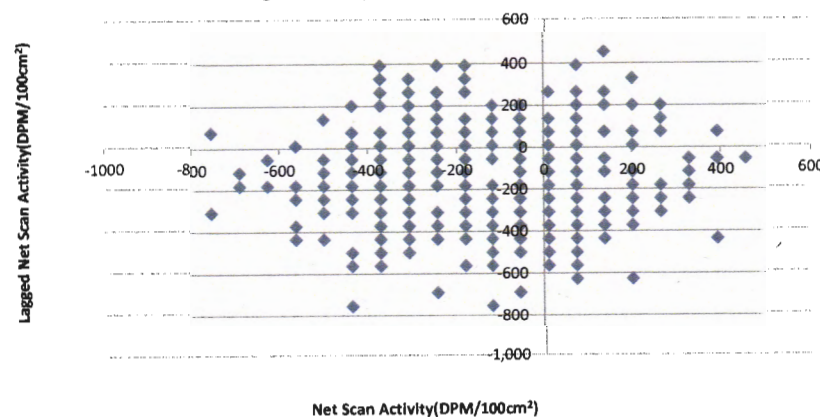
Scan Data

Bldg :50 Survey Unit : 1201 Probe : PR259902



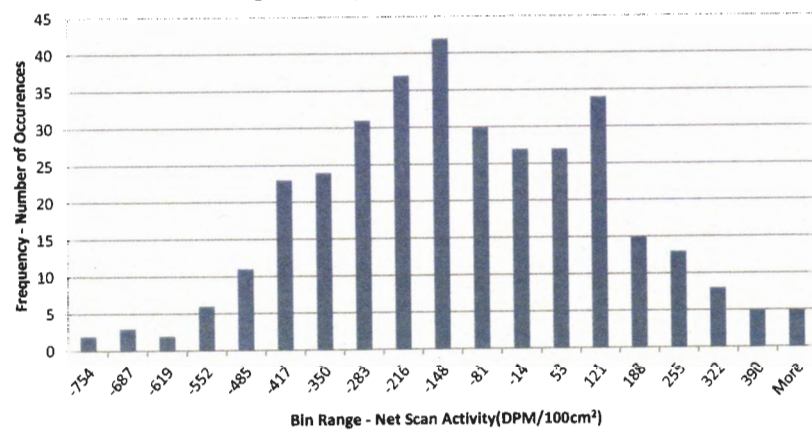
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Bldg :50 Survey Unit : 1201 Probe : PR259902



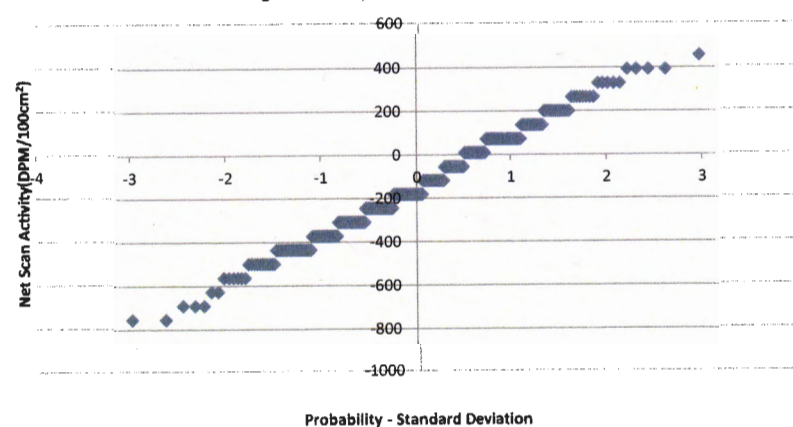
Histogram of Scan Data

Bldg :50 Survey Unit : 1201 Probe : PR259902



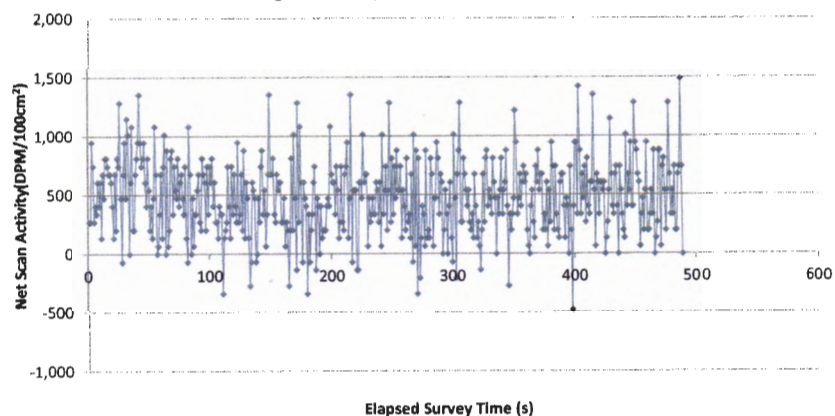
Normal Probability Plot of Data

Bldg :50 Survey Unit : 1201 Probe : PR259902



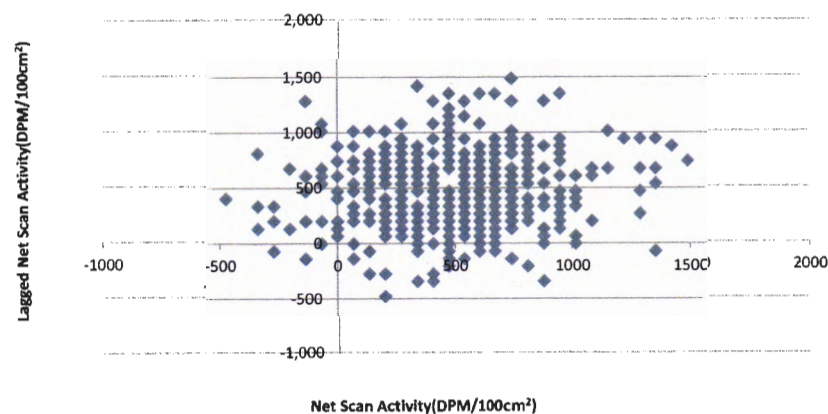
Scan Data

Bldg :50 Survey Unit : 1201 Probe : PR281040



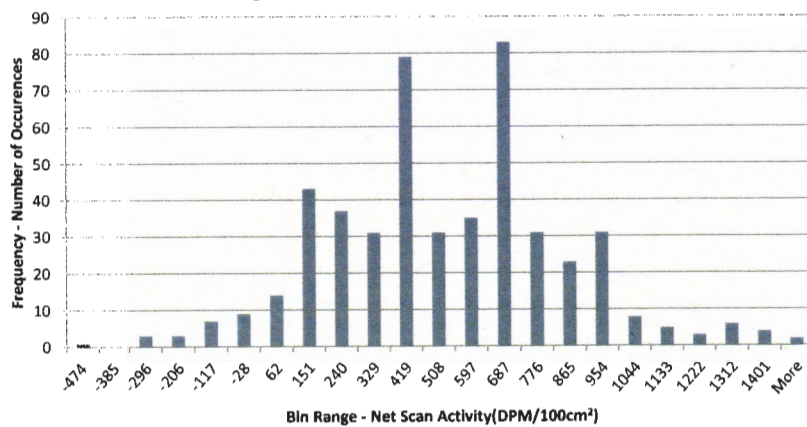
Lagged Scan Data

Bldg :50 Survey Unit : 1201 Probe : PR281040



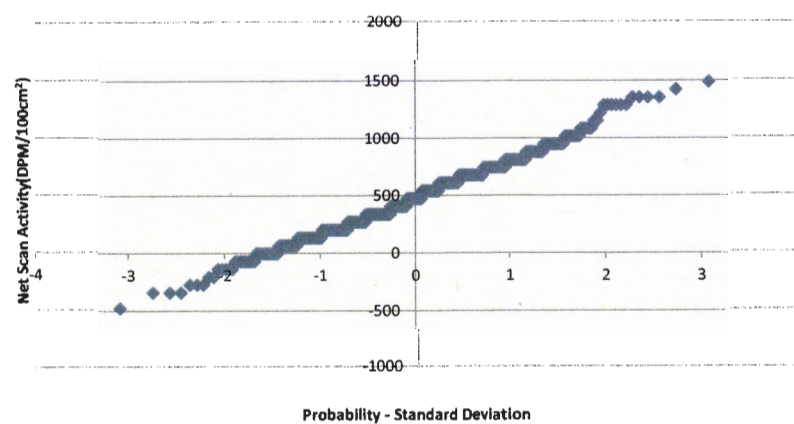
Histogram of Scan Data

Bldg :50 Survey Unit : 1201 Probe : PR281040



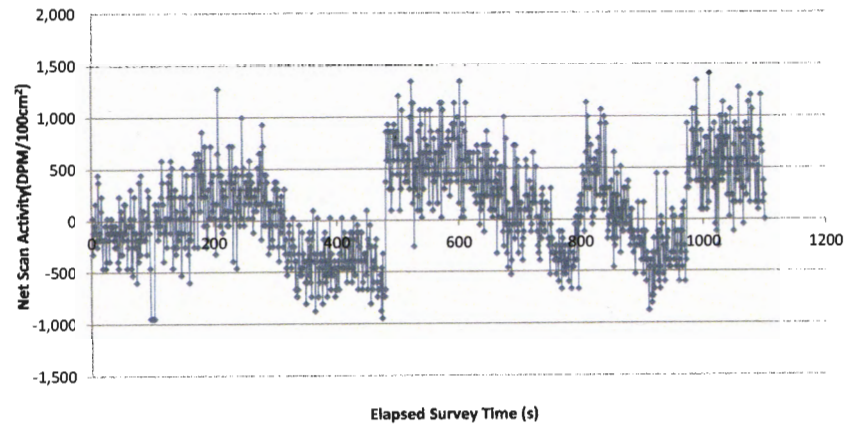
Normal Probability Plot of Data

Bldg :50 Survey Unit : 1201 Probe : PR281040



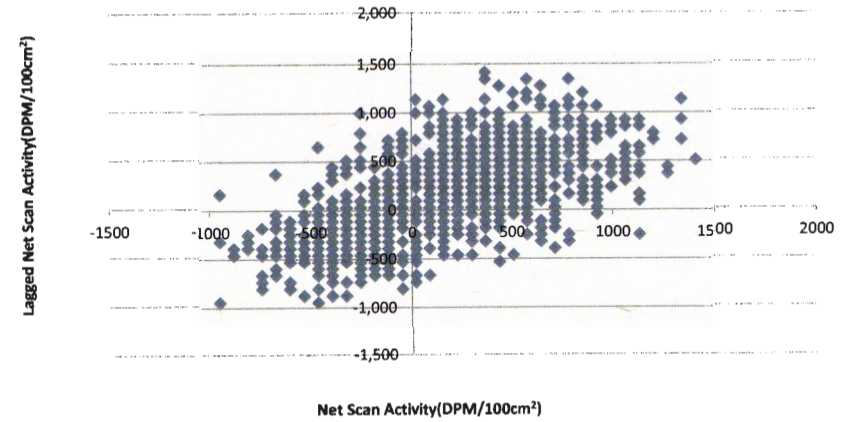
Scan Data

Bldg :61 Survey Unit : 1201 Probe : PR178300



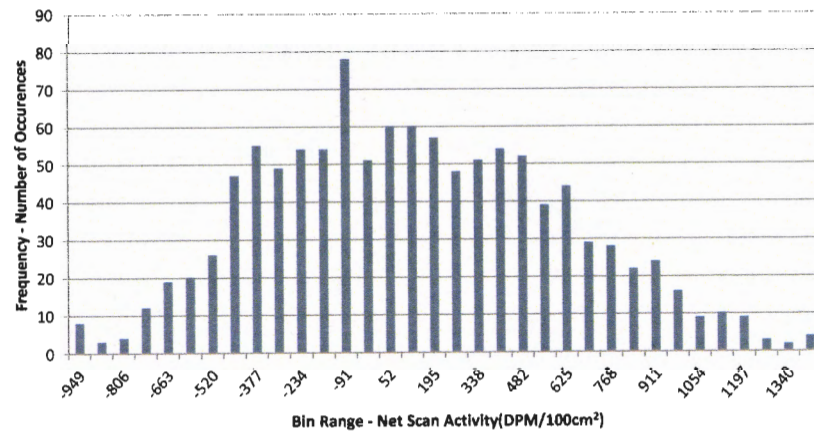
Lagged Scan Data

Bldg :61 Survey Unit : 1201 Probe : PR178300



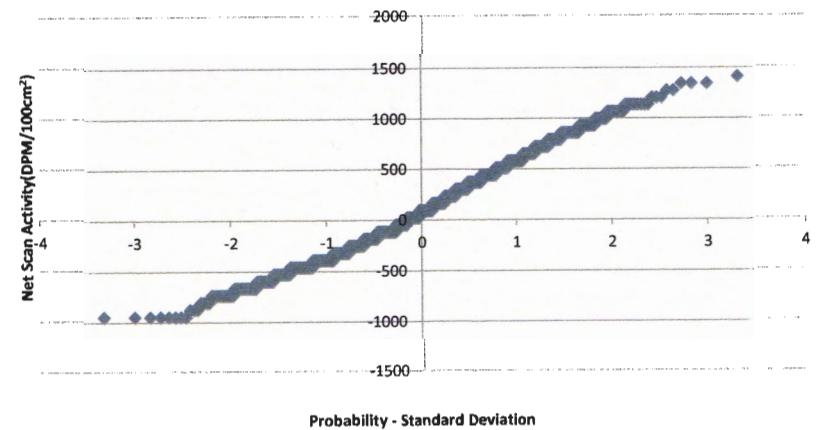
Histogram of Scan Data

Bldg :61 Survey Unit : 1201 Probe : PR178300



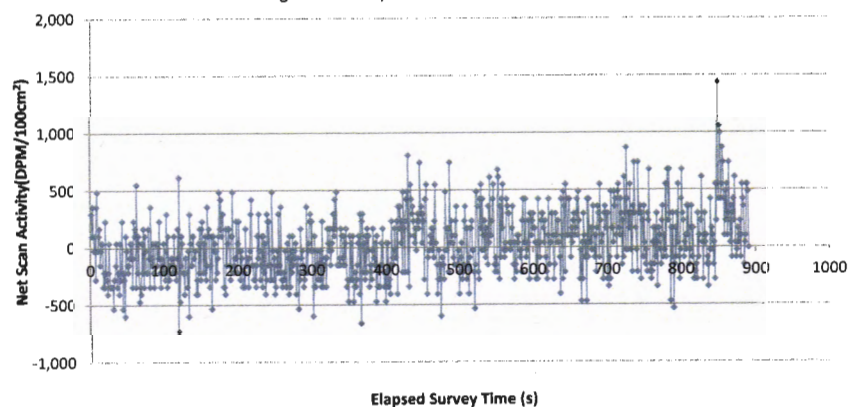
Normal Probability Plot of Data

Bldg :61 Survey Unit : 1201 Probe : PR178300



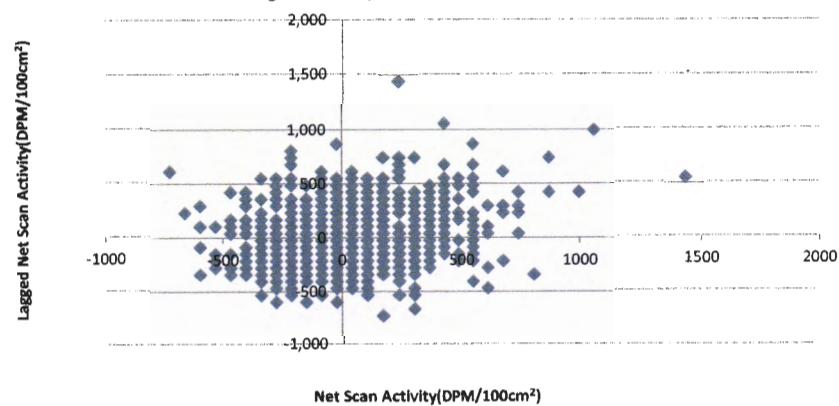
Scan Data

Bldg :67 Survey Unit : 1201 Probe : PR259902



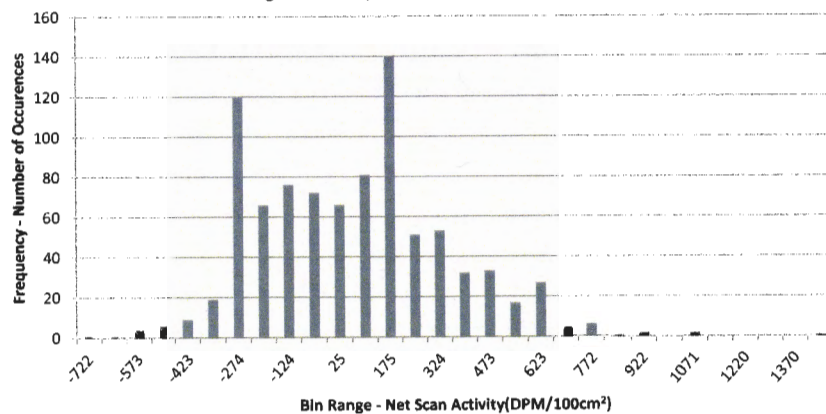
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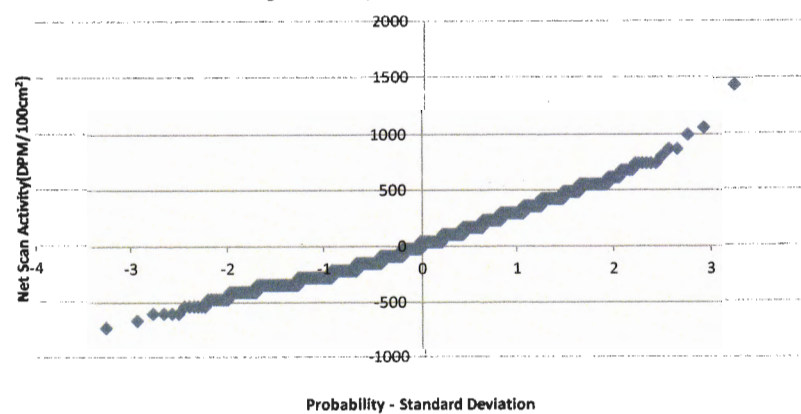
Histogram of Scan Data

Bldg :67 Survey Unit : 1201 Probe : PR259902



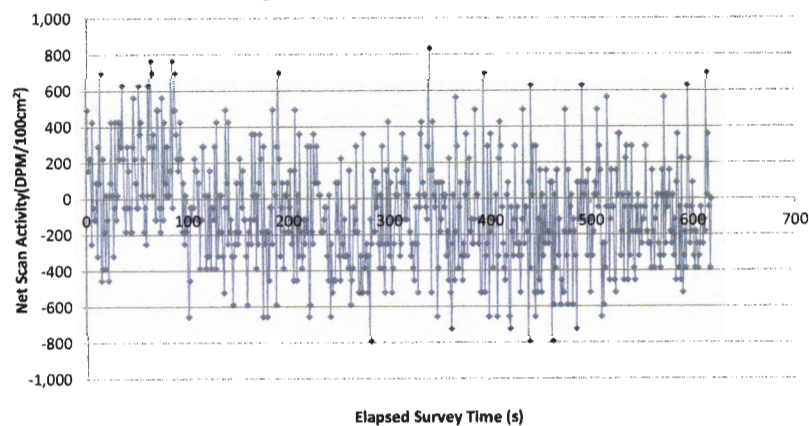
Normal Probability Plot of Data

Bldg :67 Survey Unit : 1201 Probe : PR259902



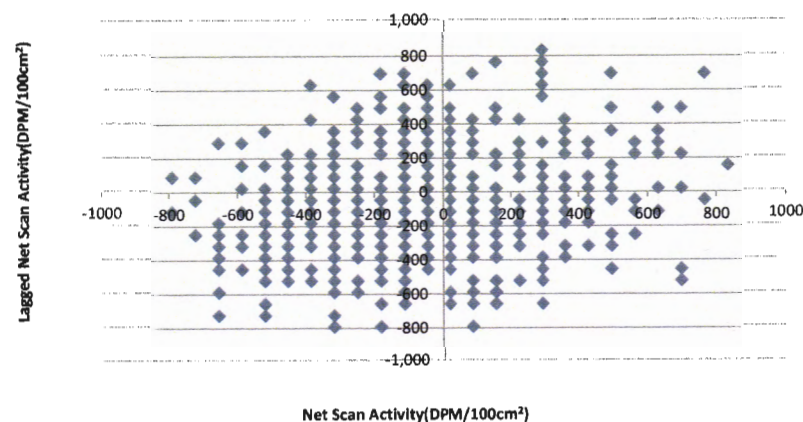
Scan Data

Bldg :67 Survey Unit : 1201 Probe : PR281040



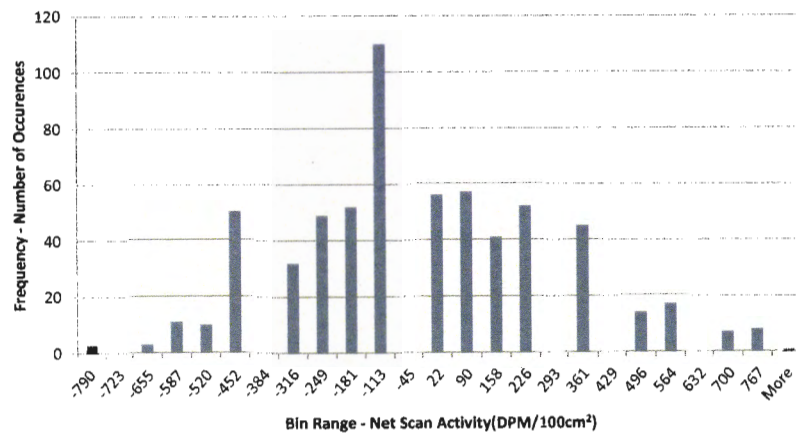
Lagged Scan Data

Bldg :67 Survey Unit : 1201 Probe : PR281040



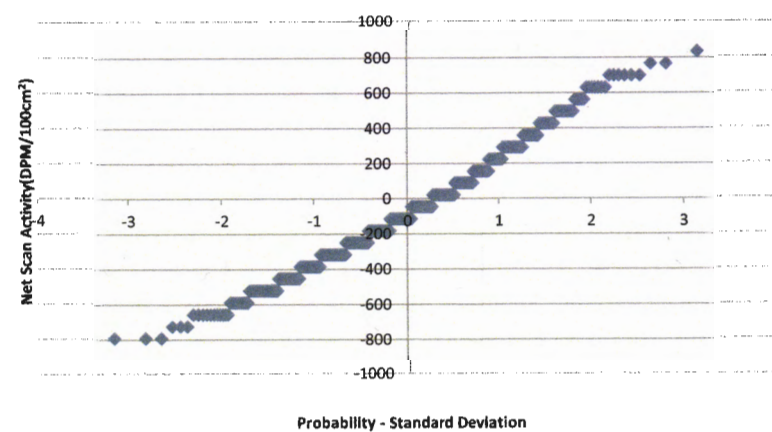
Histogram of Scan Data

Bldg :67 Survey Unit : 1201 Probe : PR281040



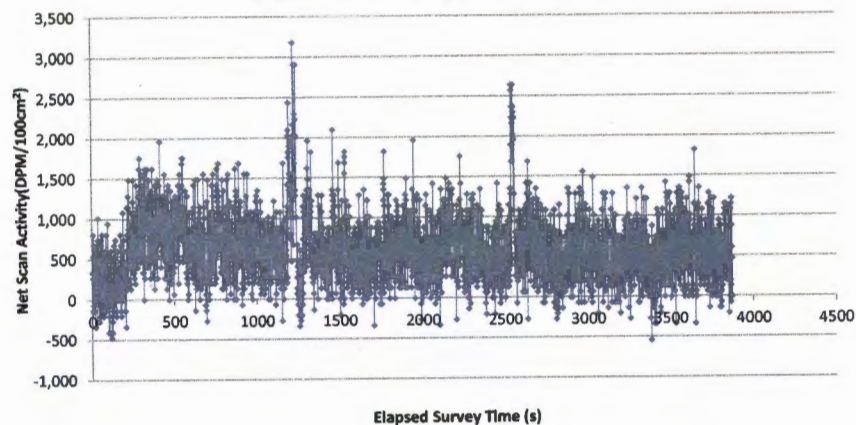
Normal Probability Plot of Data

Bldg :67 Survey Unit : 1201 Probe : PR281040



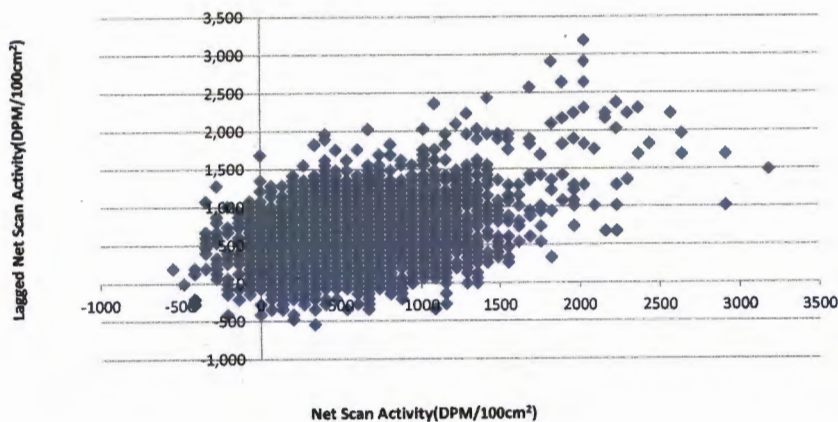
Scan Data

Bldg :41 Survey Unit : QA01 Probe : PR281040



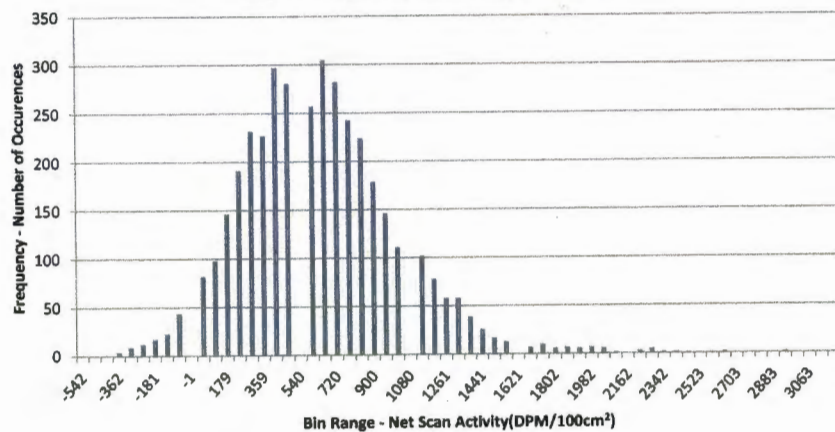
Lagged Scan Data

Bldg :41 Survey Unit : QA01 Probe : PR281040



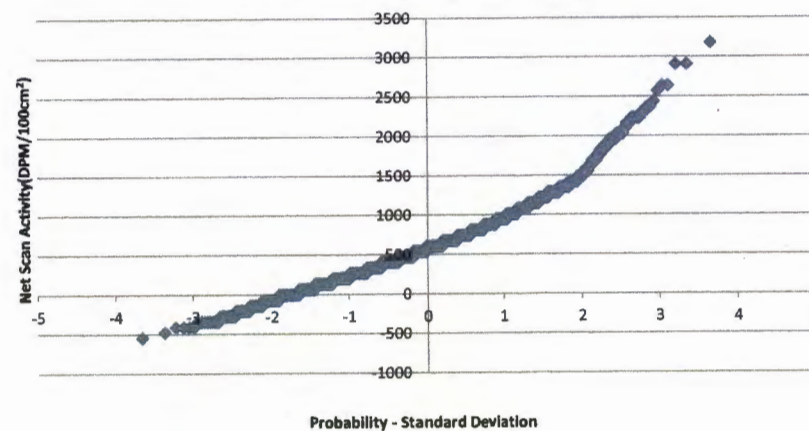
Histogram of Scan Data

Bldg :41 Survey Unit : QA01 Probe : PR281040



Normal Probability Plot of Data

Bldg :41 Survey Unit : QA01 Probe : PR281040



Structural Surfaces Survey Results

Building 041

Survey Unit 1201

Class 2

Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>					
	Activity	MDC	<u>Channel 1</u>		<u>Channel 2</u>		<u>Channel 3</u>	
			Activity	MDC	Activity	MDC	Activity	MDC
041-1201-F1-C-001	294 ± 500	912	36 ± 12	44	9 ± 6	26	0 ± 0	24
041-1201-F1-C-002	110 ± 457	912	13 ± 7	44	2 ± 3	26	0 ± 0	24
041-1201-F1-C-003	331 ± 508	912	18 ± 8	44	20 ± 9	26	0 ± 0	24
041-1201-F1-C-004	441 ± 532	912	29 ± 11	44	23 ± 9	26	0 ± 0	24
041-1201-F1-C-005	367 ± 516	912	41 ± 13	44	10 ± 6	26	0 ± 0	24
041-1201-F1-C-006	-110 ± 399	912	18 ± 8	44	5 ± 4	26	0 ± 0	24
041-1201-F1-C-007	294 ± 500	912	19 ± 9	44	7 ± 5	26	0 ± 0	24
041-1201-F1-C-008	-184 ± 378	912	19 ± 9	44	7 ± 5	26	10 ± 6	24
041-1201-F1-C-009	73 ± 448	912	24 ± 10	44	1 ± 2	26	0 ± 0	24
041-1201-F1-C-010	478 ± 540	912	25 ± 10	44	16 ± 8	26	0 ± 0	24
041-1201-F1-C-011	-37 ± 419	912	36 ± 12	44	2 ± 3	26	4 ± 4	24
041-1201-F1-C-012	-147 ± 389	912	18 ± 8	44	0 ± 0	26	8 ± 6	24
041-1201-F1-C-013	551 ± 555	912	41 ± 13	44	4 ± 4	26	0 ± 0	24
041-1201-F1-C-014	0 ± 429	912	29 ± 11	44	13 ± 7	26	0 ± 0	24
041-1201-F1-C-015	0 ± 429	912	11 ± 7	44	1 ± 2	26	0 ± 0	24
041-1201-F1-C-016	294 ± 500	912	23 ± 9	44	11 ± 7	26	0 ± 0	24
041-1201-F1-C-017	588 ± 562	912	23 ± 9	44	6 ± 5	26	0 ± 0	24
041-1201-F1-C-018	294 ± 500	912	49 ± 14	44	4 ± 4	26	0 ± 0	24
Summary for Survey Unit # 1201 (18 detail records)								
Average	202		26		8		1	
Minimum	-184		11		0		0	
Maximum	588		49		23		10	
Standard Deviation	244		11		7		3	
Summary for Building # 041 (18 detail records)								
Avg	202		26		8		1	
Min	-184		11		0		0	
Max	588		49		23		10	

Note: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 046		Survey Unit 1201		Class 2		
Location Code	Total Activity Measurements		Removable Activity Measurements			
	Activity	MDC	Channel 1		Channel 2	
			Activity	MDC	Activity	MDC
046-1201-F1-C-001	1,084 ± 892	1,053	53 ± 26	44	14 ± 7	26
046-1201-F1-C-002	413 ± 765	1,053	17 ± 15	44	13 ± 7	26
046-1201-F1-C-003	206 ± 721	1,053	22 ± 17	44	15 ± 8	26
046-1201-F1-C-004	258 ± 732	1,053	22 ± 17	44	7 ± 5	26
046-1201-F1-C-005	516 ± 786	1,053	20 ± 16	44	10 ± 6	26
046-1201-F1-C-006	516 ± 786	1,053	23 ± 17	44	5 ± 4	26
046-1201-F1-C-007	413 ± 765	1,053	33 ± 21	44	7 ± 5	26
046-1201-F1-C-008	568 ± 796	1,053	33 ± 21	44	9 ± 6	26
046-1201-F1-C-009	464 ± 775	1,053	33 ± 21	44	9 ± 6	26
046-1201-F1-C-010	877 ± 855	1,053	25 ± 18	44	18 ± 8	26
046-1201-F1-C-011	619 ± 806	1,053	55 ± 27	44	14 ± 7	26
046-1201-F1-C-012	310 ± 743	1,053	43 ± 23	44	1 ± 2	26
046-1201-F1-C-013	413 ± 765	1,053	39 ± 22	44	2 ± 3	26
046-1201-F1-C-014	103 ± 698	1,053	30 ± 20	44	7 ± 5	26
Summary for Survey Unit # 1201 (14 detail records)						
Average	483		32		9	
Minimum	103		17		1	
Maximum	1,084		55		18	
Standard Deviation	257		12		5	
Summary for Building # 046 (14 detail records)						
Avg	483		32		9	
Min	103		17		1	
Max	1,084		55		18	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 048

Survey Unit 1201

Class 2

Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>			
	Activity	MDC	<u>Channel 1</u>		<u>Channel 2</u>	
			Activity	MDC	Activity	MDC
048-1201-F1-C-001	606 ± 1,027	1,394	99 ± 36	44	14 ± 7	26
048-1201-F1-C-002	771 ± 1,054	1,394	65 ± 29	44	17 ± 8	26
048-1201-F1-C-003	606 ± 1,027	1,394	36 ± 21	44	9 ± 6	26
048-1201-F1-C-004	551 ± 1,018	1,394	65 ± 29	44	20 ± 9	26
048-1201-F1-C-005	386 ± 990	1,394	44 ± 24	44	4 ± 4	26
048-1201-F1-C-006	826 ± 1,062	1,394	27 ± 19	44	5 ± 4	26
048-1201-F1-C-007	936 ± 1,080	1,394	53 ± 26	44	9 ± 6	26
048-1201-F1-C-008	991 ± 1,088	1,394	25 ± 18	44	0 ± 0	26
048-1201-F1-C-009	661 ± 1,036	1,394	72 ± 30	44	12 ± 7	26
048-1201-F1-C-010	881 ± 1,071	1,394	47 ± 25	44	4 ± 4	26
048-1201-F1-C-011	551 ± 1,018	1,394	70 ± 30	44	13 ± 7	26
048-1201-F1-C-012	441 ± 1,000	1,394	59 ± 27	44	4 ± 4	26
048-1201-F1-C-013	661 ± 1,036	1,394	34 ± 21	44	1 ± 2	26
048-1201-F1-C-014	441 ± 1,000	1,394	47 ± 25	44	12 ± 7	26
048-1201-F1-C-015	551 ± 1,018	1,394	33 ± 21	44	8 ± 6	26
048-1201-F1-C-016	661 ± 1,036	1,394	36 ± 21	44	4 ± 4	26
Summary for Survey Unit # 1201 (16 detail records)						
Average	657		51		9	
Minimum	386		25		0	
Maximum	991		99		20	
Standard Deviation	180		20		6	
Summary for Building # 048 (16 detail records)						
Avg	657		51		9	
Min	386		25		0	
Max	991		99		20	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 050

Survey Unit 1201

Class 2

Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>			
	Activity	MDC	<u>Channel 1</u>		<u>Channel 2</u>	
			Activity	MDC	Activity	MDC
050-1201-F1-C-001	551 ± 1,122	1,545	41 ± 23	44	0 ± 0	26
050-1201-F1-C-002	0 ± 1,036	1,545	31 ± 20	44	5 ± 4	26
050-1201-F1-C-003	110 ± 1,054	1,545	36 ± 21	44	10 ± 6	26
050-1201-F1-C-004	275 ± 1,080	1,545	51 ± 26	44	5 ± 4	26
050-1201-F1-C-005	606 ± 1,130	1,545	59 ± 27	44	10 ± 6	26
050-1201-F1-C-006	551 ± 1,122	1,545	56 ± 27	44	9 ± 6	26
050-1201-F1-C-007	771 ± 1,154	1,545	38 ± 22	44	12 ± 7	26
050-1201-F1-C-008	330 ± 1,088	1,545	43 ± 23	44	9 ± 6	26
050-1201-F1-C-009	110 ± 1,054	1,545	44 ± 24	44	17 ± 8	26
050-1201-F1-C-010	220 ± 1,071	1,545	43 ± 23	44	15 ± 8	26
050-1201-F1-C-011	220 ± 1,071	1,545	44 ± 24	44	19 ± 9	26
050-1201-F1-C-012	551 ± 1,122	1,545	62 ± 28	44	0 ± 0	26
050-1201-F1-C-013	991 ± 1,186	1,545	51 ± 26	44	0 ± 0	26
050-1201-F1-C-014	551 ± 1,122	1,545	43 ± 23	44	1 ± 2	26
050-1201-F1-C-015	165 ± 1,062	1,545	58 ± 27	44	3 ± 3	26
050-1201-F1-C-016	1,377 ± 1,239	1,545	52 ± 26	44	14 ± 7	26

Summary for Survey Unit # 1201 (16 detail records)

Average	461	47	8
Minimum	0	31	0
Maximum	1,377	62	19
Standard Deviation	364	9	6

Summary for Building # 050 (16 detail records)

Avg	461	47	8
Min	0	31	0
Max	1,377	62	19

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm². Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 061		Survey Unit 1201				Class 2	
Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>				
	Activity	MDC	<u>Channel 1</u>		<u>Channel 2</u>		
			Activity	MDC	Activity	MDC	
061-1201-F1-C-001	441 ± 1,154	1,615	41 ± 23	44	16 ± 8	26	
061-1201-F1-C-002	661 ± 1,186	1,615	37 ± 22	44	6 ± 5	26	
061-1201-F1-C-003	0 ± 1,088	1,615	39 ± 22	44	13 ± 7	26	
061-1201-F1-C-004	551 ± 1,170	1,615	45 ± 24	44	9 ± 6	26	
061-1201-F1-C-005	991 ± 1,232	1,615	21 ± 16	44	0 ± 0	26	
061-1201-F1-C-006	441 ± 1,154	1,615	41 ± 23	44	0 ± 0	26	
061-1201-F1-R-007	-275 ± 1,045	1,615	26 ± 18	44	9 ± 6	26	
061-1201-F1-R-008	991 ± 1,232	1,615	37 ± 22	44	24 ± 10	26	
061-1201-F1-R-009	330 ± 1,138	1,615	24 ± 18	44	10 ± 6	26	
061-1201-F1-R-010	110 ± 1,105	1,615	28 ± 19	44	17 ± 8	26	
061-1201-F1-R-011	220 ± 1,122	1,615	39 ± 22	44	0 ± 0	26	
061-1201-F1-R-012	275 ± 1,130	1,615	41 ± 23	44	6 ± 5	26	
061-1201-F1-R-013	551 ± 1,170	1,615	23 ± 17	44	7 ± 5	26	
061-1201-F1-R-014	330 ± 1,138	1,615	22 ± 17	44	4 ± 4	26	
061-1201-F1-R-015	-496 ± 1,009	1,615	26 ± 18	44	4 ± 4	26	
061-1201-F1-R-016	661 ± 1,186	1,615	28 ± 19	44	8 ± 6	26	
061-1201-F1-R-017	-496 ± 1,009	1,615	39 ± 22	44	6 ± 5	26	
061-1201-F1-R-018	-110 ± 1,071	1,615	29 ± 19	44	0 ± 0	26	
061-1201-F1-R-019	-771 ± 962	1,615	24 ± 18	44	6 ± 5	26	
061-1201-F1-C-020	441 ± 1,154	1,615	29 ± 19	44	13 ± 7	26	
Summary for Survey Unit # 1201 (20 detail records)							
Average	242		32		8		
Minimum	-771		21		0		
Maximum	991		45		24		
Standard Deviation	480		8		6		

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Summary for Building # 061 (20 detail records)

Avg	242	32	8
Min	-771	21	0
Max	991	45	24

Structural Surfaces Survey Results

Building 067

Survey Unit 1201

Class 2

Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>			
	Activity	MDC	<u>Channel 1</u>		<u>Channel 2</u>	
			Activity	MDC	Activity	MDC
067-1201-F1-C-001	110 ± 1,036	1,521	55 ± 27	44	13 ± 7	26
067-1201-F1-C-002	386 ± 1,080	1,521	28 ± 19	44	0 ± 0	26
067-1201-F1-C-003	496 ± 1,097	1,521	39 ± 22	44	0 ± 0	26
067-1201-F1-C-004	330 ± 1,071	1,521	4 ± 7	44	17 ± 8	26
067-1201-F1-C-005	55 ± 1,027	1,521	28 ± 19	44	2 ± 3	26
067-1201-F1-C-006	-165 ± 990	1,521	33 ± 21	44	17 ± 8	26
067-1201-F1-C-007	771 ± 1,138	1,521	39 ± 22	44	10 ± 6	26
067-1201-F1-C-008	496 ± 1,097	1,521	35 ± 21	44	13 ± 7	26
067-1201-F1-C-009	-55 ± 1,009	1,521	47 ± 25	44	4 ± 4	26
067-1201-F1-C-010	-275 ± 971	1,521	25 ± 18	44	13 ± 7	26
067-1201-F1-C-011	330 ± 1,071	1,521	57 ± 27	44	9 ± 6	26
067-1201-F1-C-012	0 ± 1,018	1,521	56 ± 27	44	12 ± 7	26
067-1201-F1-C-013	-275 ± 971	1,521	36 ± 21	44	7 ± 5	26
067-1201-F1-C-014	55 ± 1,027	1,521	46 ± 24	44	7 ± 5	26
067-1201-F1-C-015	165 ± 1,045	1,521	53 ± 26	44	9 ± 6	26
067-1201-F1-C-016	0 ± 1,018	1,521	30 ± 20	44	12 ± 7	26
067-1201-F1-C-017	606 ± 1,113	1,521	30 ± 20	44	7 ± 5	26
067-1201-F1-C-018	275 ± 1,062	1,521	63 ± 28	44	12 ± 7	26
067-1201-F1-C-019	661 ± 1,122	1,521	70 ± 30	44	5 ± 4	26
067-1201-F1-C-020	-110 ± 1,000	1,521	47 ± 25	44	23 ± 9	26
067-1201-F1-C-021	220 ± 1,054	1,521	49 ± 25	44	2 ± 3	26
Summary for Survey Unit # 1201 (21 detail records)						
Average	194		41		9	
Minimum	-275		4		0	
Maximum	771		70		23	
Standard Deviation	302		15		6	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Summary for Building # 067 (21 detail records)

Avg	194	41	9
Min	-275	4	0
Max	771	70	23

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 046		Survey Unit 1DR1		Class	
Location Code	Total Activity Measurements		Removable Activity Measurements		
	Activity	MDC	Channel 1 Activity MDC	Channel 2 Activity MDC	
046-1DR1-D2-M-001	±		54±26 44	8 ±6	26
046-1DR1-D2-M-002	±		52±26 44	5 ±4	26
046-1DR1-D2-M-003	±		62±28 44	18 ±8	26
046-1DR1-D2-M-004	±		44±24 44	13 ±7	26
046-1DR1-D2-M-005	±		66±29 44	16 ±8	26
046-1DR1-D2-M-006	±		50±25 44	11 ±7	26
046-1DR1-D2-M-007	±		43±23 44	11 ±7	26
046-1DR1-D2-M-008	±		68±30 44	10 ±6	26
046-1DR1-D2-M-009	±		76±31 44	14 ±7	26
046-1DR1-D2-M-010	±		77±31 44	10 ±6	26
046-1DR1-D2-M-011	±		69±30 44	13 ±7	26
046-1DR1-D2-M-012	±		93±35 44	8 ±6	26
046-1DR1-D2-M-013	±		44±24 44	0 ±0	26
046-1DR1-D2-M-014	±		59±27 44	0 ±0	26
046-1DR1-D2-M-015	±		52±26 44	14 ±7	26
046-1DR1-D2-M-016	±		39±22 44	0 ±0	26
046-1DR1-D2-M-017	±		54±26 44	25 ±10	26
046-1DR1-D2-M-018	±		43±23 44	3 ±3	26
046-1DR1-D2-M-019	±		44±24 44	11 ±7	26
Summary for Survey Unit # 1DR1 (19 detail records)					
Average			57	10	
Minimum			39	0	
Maximum			93	25	
Standard Deviation			14	6	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 046		Survey Unit 1VE1		Class	
Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>		
	Activity	MDC	<u>Channel 1</u> Activity MDC	<u>Channel 2</u> Activity MDC	
046-1VE1-E2-M-001	±		92±34	44	11 ±7 26
046-1VE1-E2-M-002	±		61±28	44	4 ±4 26
046-1VE1-E3-M-003	±		77±31	44	0 ±0 26
046-1VE1-E3-M-004	±		68±30	44	10 ±6 26
046-1VE1-E3-M-005	±		80±32	44	4 ±4 26
046-1VE1-E3-M-006	±		80±32	44	3 ±3 26
046-1VE1-E3-M-007	±		58±27	44	9 ±6 26
Summary for Survey Unit # 1VE1 (7 detail records)					
Average			74		6
Minimum			58		0
Maximum			92		11
Standard Deviation			12		4
Summary for Building # 046 (26 detail records)					
Avg			62		9
Min			39		0
Max			93		25

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 048		Survey Unit 1DR1		Class		
Location Code	Total Activity Measurements		Removable Activity Measurements			
	Activity	MDC	Channel 1 Activity MDC		Channel 2 Activity MDC	
048-1DR1-D2-M-001	±		34±21	44	0 ±0	26
048-1DR1-D2-M-002	±		24±18	44	8 ±6	26
048-1DR1-D2-M-003	±		36±21	44	0 ±0	26
048-1DR1-D2-M-004	±		46±24	44	8 ±6	26
048-1DR1-D2-M-005	±		29±19	44	3 ±3	26
048-1DR1-D2-M-006	±		36±21	44	0 ±0	26
048-1DR1-D2-M-007	±		40±23	44	5 ±4	26
048-1DR1-D2-M-008	±		49±25	44	8 ±6	26
048-1DR1-D2-M-009	±		36±21	44	4 ±4	26
048-1DR1-D2-M-010	±		28±19	44	0 ±0	26
048-1DR1-D2-M-011	±		45±24	44	15 ±8	26
048-1DR1-D2-M-012	±		21±16	44	13 ±7	26
048-1DR1-D2-M-013	±		80±32	44	9 ±6	26
048-1DR1-D2-M-014	±		44±24	44	12 ±7	26
048-1DR1-D2-M-015	±		33±21	44	18 ±8	26
048-1DR1-D2-M-016	±		46±24	44	7 ±5	26
Summary for Survey Unit # 1DR1 (16 detail records)						
Average			39		7	
Minimum			21		0	
Maximum			80		18	
Standard Deviation			14		6	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.
Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 048		Survey Unit 1VE1		Class		
Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>			
	Activity	MDC	<u>Channel 1</u> Activity MDC		<u>Channel 2</u> Activity MDC	
048-1VE1-E3-M-001	±		38±22	44	13 ±7	26
048-1VE1-E3-M-002	±		71±30	44	8 ±6	26
048-1VE1-E3-M-003	±		59±27	44	19 ±9	26
048-1VE1-E2-M-004	±		76±31	44	8 ±6	26
048-1VE1-E2-M-005	±		65±29	44	18 ±8	26
Summary for Survey Unit # 1VE1 (5 detail records)						
Average			62		13	
Minimum			38		8	
Maximum			76		19	
Standard Deviation			15		5	
Summary for Building # 048 (21 detail records)						
Avg			45		8	
Min			21		0	
Max			80		19	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 050		Survey Unit 1DR1		Class		
Location Code	Total Activity Measurements		Removable Activity Measurements			
	Activty	MDC	Channel 1 Activity MDC		Channel 2 Activity MDC	
050-1DR1-D2-M-001	±		86±33	44	11 ±7	26
050-1DR1-D2-M-002	±		49±25	44	13 ±7	26
050-1DR1-D2-M-003	±		57±27	44	7 ±5	26
050-1DR1-D2-M-004	±		59±27	44	3 ±3	26
050-1DR1-D2-M-005	±		75±31	44	8 ±6	26
050-1DR1-D2-M-006	±		74±31	44	16 ±8	26
050-1DR1-D2-M-007	±		36±21	44	19 ±9	26
050-1DR1-D2-M-008	±		74±31	44	4 ±4	26
050-1DR1-D2-M-009	±		75±31	44	1 ±2	26
050-1DR1-D2-M-010	±		60±28	44	12 ±7	26
050-1DR1-D2-M-011	±		61±28	44	14 ±7	26
050-1DR1-D2-M-012	±		61±28	44	0 ±0	26
050-1DR1-D2-M-013	±		52±26	44	19 ±9	26
Summary for Survey Unit # 1DR1 (13 detail records)						
Average			63		10	
Minimum			36		0	
Maximum			86		19	
Standard Deviation			13		6	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 050		Survey Unit 1VE1		Class	
Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>		
	Activity	MDC	<u>Channel 1</u> Activity MDC	<u>Channel 2</u> Activity MDC	
050-1VE1-E2-M-001	±		58±27	44	17 ±8 26
050-1VE1-E2-M-002	±		98±35	44	6 ±5 26
050-1VE1-E2-M-003	±		65±29	44	24 ±10 26
050-1VE1-E2-M-004	±		89±34	44	6 ±5 26
050-1VE1-E3-M-005	±		62±28	44	6 ±5 26
050-1VE1-E3-M-006	±		64±29	44	0 ±0 26
050-1VE1-E2-M-007	±		81±32	44	1 ±2 26
050-1VE1-E2-M-008	±		68±30	44	5 ±4 26
Summary for Survey Unit # 1VE1 (8 detail records)					
Average			73		8
Minimum			58		0
Maximum			98		24
Standard Deviation			14		8
Summary for Building # 050 (21 detail records)					
Avg			67		9
Min			36		0
Max			98		24

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 061		Survey Unit 1DR1		Class		
Location Code	Total Activity Measurements		Removable Activity Measurements			
	Activity	MDC	Channel 1 Activity MDC		Channel 2 Activity MDC	
061-1DR1-D2-M-001	±		64±29	44	12 ±7	26
061-1DR1-D3-M-002	±		73±31	44	3 ±3	26
061-1DR1-D2-M-003	±		94±35	44	11 ±7	26
061-1DR1-D3-M-004	±		89±34	44	11 ±7	26
061-1DR1-D2-M-005	±		70±30	44	14 ±7	26
061-1DR1-D2-M-006	±		102±36	44	11 ±7	26
061-1DR1-D2-M-007	±		95±35	44	13 ±7	26
061-1DR1-D2-M-008	±		79±32	44	9 ±6	26
061-1DR1-D2-M-009	±		65±29	44	0 ±0	26
061-1DR1-D2-M-010	±		116±39	44	8 ±6	26
Summary for Survey Unit # 1DR1 (10 detail records)						
Average			85		9	
Minimum			64		0	
Maximum			116		14	
Standard Deviation			17		4	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in red print. Results above investigation levels are in red print.
Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 061		Survey Unit 1VE1		Class	
Location Code	Total Activity Measurements		Removable Activity Measurements		
	Activity	MDC	Channel 1 Activity MDC	Channel 2 Activity MDC	
061-1VE1-E2-M-001	±		65±29 44	14 ±7	26
061-1VE1-E2-M-002	±		67±29 44	11 ±7	26
061-1VE1-E2-M-003	±		64±29 44	20 ±9	26
061-1VE1-E2-M-004	±		74±31 44	3 ±3	26
061-1VE1-E2-M-005	±		74±31 44	11 ±7	26
061-1VE1-E2-M-006	±		78±32 44	11 ±7	26
061-1VE1-E3-M-007	±		85±33 44	8 ±6	26
061-1VE1-E3-M-008	±		110±38 44	0 ±0	26
061-1VE1-E2-M-009	±		64±29 44	3 ±3	26
Summary for Survey Unit # 1VE1 (9 detail records)					
Average			76	9	
Minimum			64	0	
Maximum			110	20	
Standard Deviation			15	6	
Summary for Building # 061 (19 detail records)					
Avg			80	9	
Min			64	0	
Max			116	20	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 067		Survey Unit 1DR1		Class		
Location Code	Total Activity Measurements		Removable Activity Measurements			
	Activity	MDC	Channel 1 Activity MDC		Channel 2 Activity MDC	
067-1DR1-D2-M-001	±		69±30	44	6 ±5	26
067-1DR1-D2-M-002	±		62±28	44	6 ±5	26
067-1DR1-D2-M-003	±		48±25	44	4 ±4	26
067-1DR1-D2-M-004	±		49±25	44	12 ±7	26
067-1DR1-D2-M-005	±		48±25	44	10 ±6	26
067-1DR1-D2-M-006	±		76±31	44	5 ±4	26
067-1DR1-D2-M-007	±		57±27	44	4 ±4	26
067-1DR1-D2-M-008	±		64±29	44	4 ±4	26
067-1DR1-D2-M-009	±		74±31	44	7 ±5	26
067-1DR1-D2-M-010	±		56±27	44	10 ±6	26
067-1DR1-D2-M-011	±		74±31	44	6 ±5	26
067-1DR1-D2-M-012	±		82±32	44	10 ±6	26
067-1DR1-D2-M-013	±		85±33	44	2 ±3	26
067-1DR1-D2-M-014	±		79±32	44	3 ±3	26
067-1DR1-D2-M-015	±		105±37	44	10 ±6	26
067-1DR1-D2-M-016	±		68±30	44	1 ±2	26
067-1DR1-D2-M-017	±		96±35	44	4 ±4	26
Summary for Survey Unit # 1DR1 (17 detail records)						
Average			70		6	
Minimum			48		1	
Maximum			105		12	
Standard Deviation			16		3	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.
Total activity measurements not possible in all locations due to geometry.

Systems Survey Results

Building 067		Survey Unit 1VE1		Class		
Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>			
	Activity	MDC	<u>Channel 1</u> Activity MDC		<u>Channel 2</u> Activity MDC	
067-1VE1-E2-M-001	±		79±32	44	0 ±0	26
067-1VE1-E2-M-002	±		75±31	44	2 ±3	26
067-1VE1-E3-M-003	±		90±34	44	16 ±8	26
067-1VE1-E3-M-004	±		48±25	44	15 ±8	26
067-1VE1-E3-M-005	±		62±28	44	0 ±0	26
Summary for Survey Unit # 1VE1 (5 detail records)						
Average			71		7	
Minimum			48		0	
Maximum			90		16	
Standard Deviation			16		8	
Summary for Building # 067 (22 detail records)						
Avg			70		6	
Min			48		0	
Max			105		16	

Notes: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
 Results above MDC are in bold print. Results above investigation levels are in red print.
 Total activity measurements not possible in all locations due to geometry.

Quality Assurance Survey Results

Building 041

Survey Unit QA01

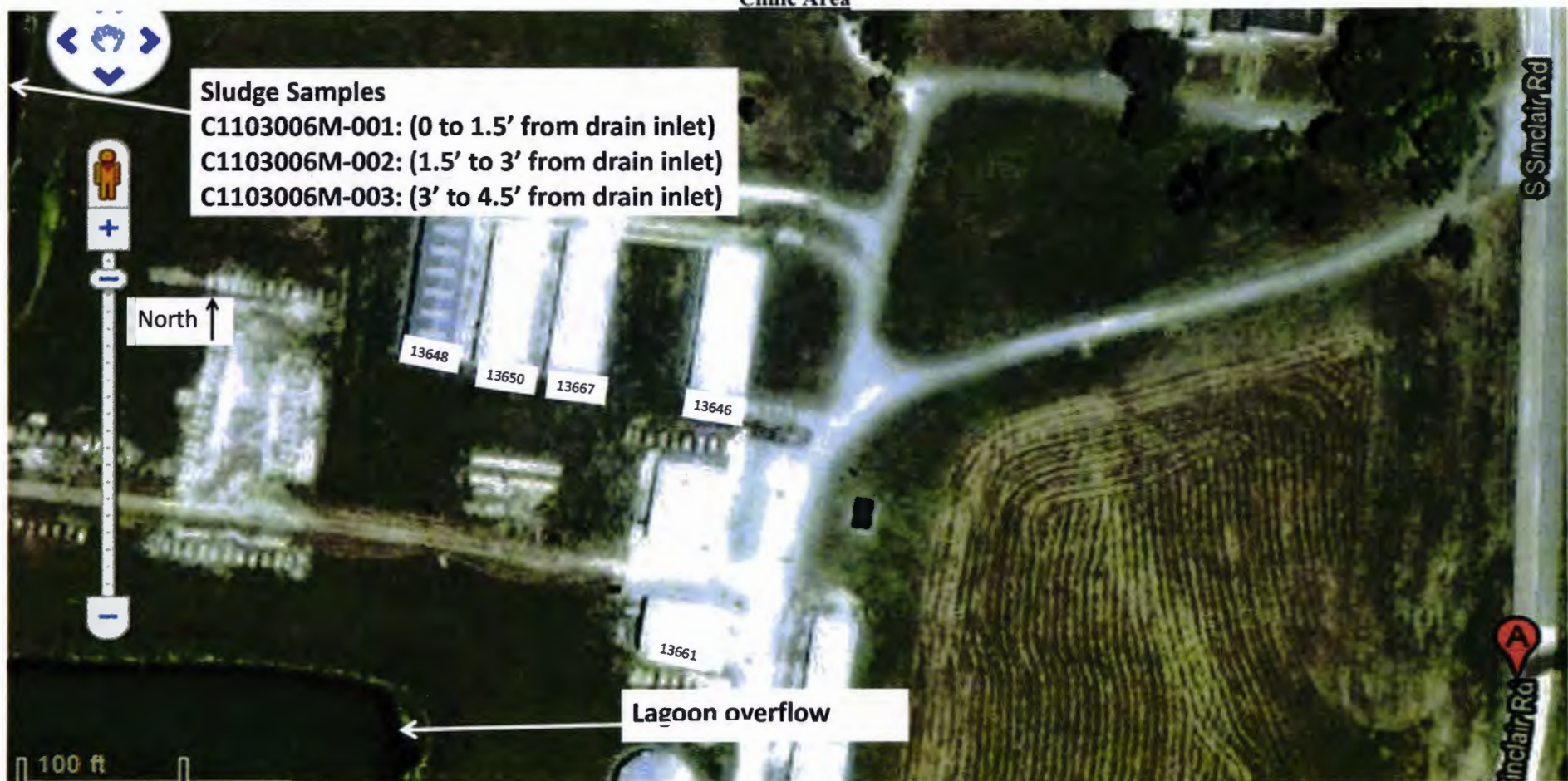
Class 2

Location Code	<u>Total Activity Measurements</u>		<u>Removable Activity Measurements</u>					
	Activity	MDC	<u>Channel 1</u>		<u>Channel 2</u>		<u>Channel 3</u>	
			Activity	MDC	Activity	MDC	Activity	MDC
041-QA01-F1-C-001	671 ± 588	944	59 ± 15	44	4 ± 4	26	0 ± 0	24
041-QA01-F1-C-002	565 ± 568	944	36 ± 12	44	4 ± 4	26	2 ± 3	24
041-QA01-F1-C-003	530 ± 562	944	39 ± 12	44	0 ± 0	26	0 ± 0	24
041-QA01-F1-C-004	707 ± 595	944	50 ± 14	44	0 ± 0	26	2 ± 3	24
041-QA01-F1-C-005	495 ± 555	944	36 ± 12	44	5 ± 4	26	0 ± 0	24
041-QA01-F1-C-006	671 ± 588	944	44 ± 13	44	20 ± 9	26	0 ± 0	24
041-QA01-F1-C-007	495 ± 555	944	28 ± 10	44	4 ± 4	26	0 ± 0	24
041-QA01-F1-C-008	424 ± 541	944	27 ± 10	44	13 ± 7	26	0 ± 0	24
041-QA01-F1-C-009	318 ± 519	944	52 ± 14	44	8 ± 6	26	8 ± 6	24
041-QA01-F1-C-010	424 ± 541	944	48 ± 14	44	12 ± 7	26	2 ± 3	24
041-QA01-F1-C-011	919 ± 632	944	49 ± 14	44	4 ± 4	26	0 ± 0	24
041-QA01-F1-C-012	636 ± 582	944	36 ± 12	44	13 ± 7	26	0 ± 0	24
041-QA01-F1-C-013	565 ± 568	944	31 ± 11	44	12 ± 7	26	0 ± 0	24
041-QA01-F1-C-014	777 ± 607	944	30 ± 11	44	0 ± 0	26	0 ± 0	24
041-QA01-F1-C-015	1,095 ± 661	944	38 ± 12	44	0 ± 0	26	2 ± 3	24
041-QA01-F1-C-016	530 ± 562	944	58 ± 15	44	17 ± 8	26	0 ± 0	24
041-QA01-F1-C-017	601 ± 575	944	36 ± 12	44	17 ± 8	26	0 ± 0	24
041-QA01-F1-C-018	813 ± 614	944	48 ± 14	44	11 ± 7	26	0 ± 0	24
Summary for Survey Unit # QA01 (18 detail records)								
Average	624		41		8		1	
Minimum	318		27		0		0	
Maximum	1,095		59		20		8	
Standard Deviation	190		10		7		2	
Summary for Building # 041 (18 detail records)								
Avg	624		41		8		1	
Min	318		27		0		0	
Max	1,095		59		20		8	

Note: All total activity results reported in net dpm/100cm². All removable activity results reported in net dpm/100cm².
Results above MDC are in bold print. Results above investigation levels are in red print.

APPENDIX I – LAGOON SAMPLES

West Side of S. Sinclair Road Clinic Area



East Side of S. Sinclair Road
MURR Barn Area



APPENDIX J – SOIL SAMPLE LOCATIONS

East Side of Sinclair Road
MURR Barn Area

