University of Missouri - Columbia
Sinclair Farm Phase 2
Final Status Survey Report

Sinclair Farm
South Sinclair Rd
Columbia, MO 65201

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

January 12, 2012

Prepared by:

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

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APPENDICES

ACRONYM LIST

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
CRSO	Corporate Radiation Safety Officer
$DCGL_{EMC}$	Derived Concentration Guideline Level – Elevated Measurement Comparison
$DCGL_W$	Derived Concentration Guideline Level – Wilcoxon Rank Sum
DQA	Data Quality Assessment
DQO	Data Quality Objective
DSV	Default Screening Value
FSS	Final Status Survey
HASP	Health and Safety Plan
HSA	Historical Site Assessment
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
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 13617, 13618, 13620, 13630, and 13663 located at the Sinclair Farm Site in Columbia, Missouri. Because most of these buildings were historically used for activities involving radioactive materials under the MU US Nuclear Regulatory Commission (NRC) Broad Scope Type A radioactive materials license No. 24-00513-32, MU must demonstrate that they meet the criteria for unrestricted use prior to demolition. A map of the site is provided in Appendix A. Isotopes of concern consisted of C-14, Cl-36, and H-3. Other short-lived beta/gamma emitters may have been utilized, but due to their short half-lives, do not need to be considered in this report.

MU procured Chase Environmental Group, Inc. (Chase) to perform MARSSIM-based surveys at the Sinclair Farm Site. These independent, third party surveys are statistically sound and support that the buildings in question 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 2, Radiological Survey Plan"* (Plan) dated December 5, 2011. On site activities were performed from December 13-16, 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/100cm^2 total surface contamination (averaged over 1m^2)
- 15,000 dpm/100cm^2 maximum total surface contamination (limited to 100 cm^2)
- 1,000 dpm/100cm^2 removable surface contamination

Facility radiological surveys did not identify residual radioactivity above ALARA goals. Therefore, no remediation was necessary and no radioactive waste was generated as a result of decommissioning activities.

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 default screening values (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 < 0.025 mrem/year (<0.1% of the release criterion of 25 mrem/yr)** using the results of the survey unit with the highest average activity.

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, and operational history obtained from personnel interviews.

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

2.2.1 Ownership

The site is owned by MU.

2.2.2 Potential Contaminants

Based on information provided by MU, the nuclides of concern are C-14, Cl-36 and H-3. Other short-lived (half-life <120 days) beta-gamma emitters and low activity sealed sources may have also been used at the facility, but are not of concern for decommissioning.

2.2.3 Impacted Building Descriptions

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. During Phase 1 of the Sinclair Farm project, Chase completed surveys of five barns (buildings 13646, 13648, 13650, 13667, and 13641) and a small clinic (building 13661). For Phase 2, five buildings (13617, 13618, 13620, 13630, and 13663) located on the

east side of South Sinclair Road are considered impacted. Building 13663 consists of two double wide trailers. Buildings 13617, 13618, 13620, and 13630 are metal shell buildings sitting on poured concrete pads. Impacted buildings were broom clean and consisted of primarily floor and wall area.

2.2.4 Impacted Systems

All building floor drains are directed into a lagoon near the barns. All buildings contained inoperable general exhaust ventilation systems. None of the Sinclair Farm facilities contain vacuum 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 surface 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
Cl-36	3.0E+05	NO	Beta	5.0E+05
H-3	1.2E+01	NO	Weak Beta	1.2E+08

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, Cl-36 and H-3 were the nuclides of concern for all areas. Dose calculations are conservatively based on the limiting nuclide, Cl-36.

Because H-3 cannot be efficiently detected by direct methods, it was evaluated by removable contamination measurements only. Considering the extremely conservative ALARA goals, we can ensure the H-3 dose contribution is an insignificant component of the total calculated 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/100cm^2 total surface contamination (averaged over 1m^2)
- 15,000 dpm/100cm^2 maximum total surface contamination (limited to 100 cm^2)
- 1,000 dpm/100cm^2 removable surface contamination

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.

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. 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 865-481-8801.

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.

Mike Culp was the Project Manager and can be reached at 865-850-2767.

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

Dave Culp was the Radiation Control Supervisor and can be reached at 865-207-3664.

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

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 Project 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.

9 RADIATION PROTECTION

Radiological work was performed according to the Chase radioactive materials license Radiation Protection Program (RPP).

10 HEALTH AND SAFETY PROGRAM

The project was performed under a Chase project-specific Health and Safety Plan (HASP), and in accordance with the MU Safety Program requirements.

11 ENVIRONMENTAL MONITORING PROGRAM

Due to the small quantities of materials present at the facility, an environmental monitoring program was not required.

12 RADIOACTIVE WASTE MANAGEMENT

There was no radioactive waste generated from project activities.

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 are 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 met the Data Quality Objectives (DQOs) specified in the plan. MARSSIM equations relative to building

surfaces have been modified to convert to units of dpm/100cm^2. 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/100cm^2)
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 (cm^2)

A typical static MDC calculation for the Ludlum Model 43-37 gas flow proportional detector is shown below:

$$MDC_{STATIC} = \frac{3 + 3.29\sqrt{(1500)(0.1)\left(1 + \frac{0.1}{0.1}\right)}}{(0.1)(0.16)\frac{582}{100}} = 644 \text{ dpm/100cm}^2$$

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/100cm^2)
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 (cm^2)

A typical MDC_{scan} calculation for the Ludlum 43-37 gas flow proportional detector is shown below:

$$i = 13.3\,\text{cm} \cdot \frac{\text{inch}}{2.54\,\text{cm}} \cdot \frac{\text{sec}}{20\,\text{inch}} \cdot = 0.26\,\text{sec}$$

$$b_i = 0.26\,\text{sec} \cdot \frac{1{,}500\,\text{counts}}{\text{minute}} \cdot \frac{\text{minute}}{60\,\text{sec}} = 6.5\,\text{counts}$$

$$MDC_{SCAN} = \frac{1.38\sqrt{6.5}\left(\frac{60}{0.26}\right)}{\left(\sqrt{0.5}\right)(0.16)\left(\frac{582}{100}\right)} = 1233\,\text{dpm/100cm}^2$$

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/100cm^2)
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.)

Uncertainties presented with total surface activity results are additionally corrected for detection efficiency and probe area for presentation in the same units as total surface activity results.

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 Efficiency
Ludlum 43-68	Gas Flow Proportional	126	Ludlum 2241-3	0.8	16% (C-14)
Ludlum 43-37 Floor Monitor	Gas Flow Proportional	582	Ludlum 2241-3	0.8	16% (C-14)
Packard TriCarb (or Equivalent)	Liquid Scintillation	N/A	N/A	N/A	60% (H-3) 80% (C-14) 90% (CH3, >256 keV)

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	2,849 (C-14)
Surface Scans	Ludlum 43-37	20	N/A	1,500	1,233 (C-14)
Total Surface Activity	Ludlum 43-68	N/A	6	500	1,781 (C-14)
Total Surface Activity	Ludlum 43-37	N/A	6	1,500	644 (C-14)
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 uses ISO-7503-1 methodology that takes into account the texture of the surface and the 2π detector efficiency. Instrument efficiencies are conservatively based on C-14 because it was the most commonly used nuclide at the facility. 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. This methodology was chosen because:

- Application of the ISO-7503-1 surface efficiency would significantly impact 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 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 extreme over-conservatism for low energy beta emitters.
- Dose calculations are conservatively based on the limiting nuclide (Cl-36) that had limited, if any usage at the site. Cl-36 has a higher ISO-7503-1 detection efficiency than the 4-pi C-14 detection efficiency, so this method is conservative.

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. No areas of elevated activity were identified during characterization surveys.

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. 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 16.8. Even though not part of MARSSIM, characterization included large area wipes of all surfaces.

The purpose of scanning was to identify locations of elevated activity. Ten 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. No elevated activity was detected during scans, judgmental static measurements, or removable activity measurements.

Buildings 13620 and 13618 contained attic areas that were accessible by stairs. A small portion of each attic area was finished, and the finished area in Building 13618 was used for storage. Because these small areas were not used for licensed activities, they received a preliminary classification of non-impacted. 100% scans and large area wipes of the stairwells, finished floor areas, and shelving was conducted during characterization to confirm the non-impacted classification.

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. 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.

16 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.

16.1 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.

The liquid scintillation counter was set up to report results in gross dpm in each channel (no background subtraction).

16.2 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/100cm^2
- Scanning of structural surfaces was conducted at a rate to achieve an MDC_{scan} of less than the ALARA goal of 5,000 dpm/100cm^2
- Removable contamination measurements were counted to achieve an MDC_{smear} of less than 200 dpm/100cm^2 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.

16.3 Area Classifications

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

16.3.1 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
- Attic spaces in Buildings 13618 and 13620

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.

16.3.2 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 conservatively 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.

16.4 Survey Units

A survey unit is a geographical area of specified size and shape for which a separate decision was made whether or not that area met the release criteria. 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 m^2 , Class 2: 100 m^2 to 1000 m^2 and Class 3: no limit.

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:

Survey Unit Designations
Building Number[1] – Elevation/Classification/Numerical Identifier
The default numeric identifier is 01

Elevations:
1=1st Floor

Example:
617-1201 is Barn 13617, first floor, class 2
630-1201 is Barn 13630, first floor, class 2

Survey units are presented in the table below.

Table 16-1: Building Structural Survey Units

Building	Class	Survey Unit Number	Floor Area (GSF)
617	2	1201	6,589
618	2	1201	6,404
620	2	1201	6,480
630	2	1201	8,368
	2	1202	2,160
663	2	1201	2,737

Building systems survey units were arranged by building and system type. There were two types of systems, ventilation and drains. Each system survey unit encompassed all of a certain type within a particular building i.e., all drains in building 13617 are grouped into survey unit 617-DR01. The four digit identifier for systems surveys consisted of the first digit for the system code, and the fourth digit as a numerical identifier.

Survey Unit Designations
System codes are DR=Drain, VE=Ventilation.
The default numeric identifier is 01.

[1] Because all the building numbers are five digits long and start with 13, only last three digits were used as the building number.

Example:

617-VE01 is Building 13617, ventilation
The building system survey units are presented in Table 16-2.

Table 16-2: Building Systems Survey Units

Building	Systems Survey Unit	
	Drain	Ventilation
617	617-DR01	617-VE01
618	618-DR01	618-VE01
620	620-DR01	620-VE01
630	630-DR01	630-VE01
663	N/A	663-VE01

16.5 Surface Scans

Scanning was used to identify locations that exceed the investigation level listed in the table below. Scan surveys were conducted by moving the detector probe at a distance of about $^1/_8$ 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. Table 16-3 summarizes the percentage of accessible structural surfaces scanned based on classification.

Table 16-3: 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. Surveys provided no indication of the migration of residual contamination.

No elevated activity was detected during the scan surveys.

16.6 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:

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

Where:

cpm_{sample} = sample count rate in counts per minute
$cpm_{background}$ = 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. Due to small geometry, system internals were inaccessible and no direct measurements were performed.

16.7 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 conservative estimate of the standard deviation of total surface activity measurements (1,000 dpm/100cm^2) was used for calculations. The Lower Bound Gray Region was set at one half of the DCGL. The calculation performed to determine the required number of samples in accessible areas is provided below.

16.7.1 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:

$$\Delta/\sigma_S = \frac{DCGL - LBGR}{\sigma_S}$$

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 calculation is provided below:

$$\Delta/\sigma_S = \frac{5.0E5\ \text{dpm}/100\text{cm}^2 - 2.5E5\ \text{dpm}/100\text{cm}^2}{1{,}000\ \text{dpm}/100\text{cm}^2} = 250$$

Since MARRSIM 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.

16.7.2 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.

16.7.3 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 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):

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

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**.

16.8 Determination of Sample Locations

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.

Ten 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 C.

16.9 Removable Contamination Measurements

Removable contamination measurements were collected by wiping an area of approximately 100 cm^2 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 triple channel counting as follows:

Channel 1 (^3H):	2 – 18.6 keV
Channel 2 (^{14}C):	18.6 – 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 100cm^2 was wiped. LSC results are reported in gross dpm/100cm^2 without subtraction of background.

16.10 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 the table below.

Table 16-4: System Survey Coverage for Final Site Survey

System	Class 2
General Ventilation Exhaust Ducts and Fans	100%
Drains	100%

16.11 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. Investigation levels are summarized in the table below.

Table 16-5: 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

17 SURVEY DOCUMENTATION AND DATA MANAGEMENT

17.1 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

17.2 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 the table below.

Table 17-1: 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) B1 = Benchtop, D2 = Floor Drains, E1 = Hood Ventilation F1 = Floor, D3 = Sink Drains, E2 = General Ventilation S1 = Sink, D4 = Other Drains
M:	=	Structural Material Code. This field represents the type of structural material on which a particular measurement is taken. (1 character) C = Concrete M = Miscellaneous (wood, plastic, metal) W = Wood
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 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.

18.1 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 E and F, respectively.

18.2 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.

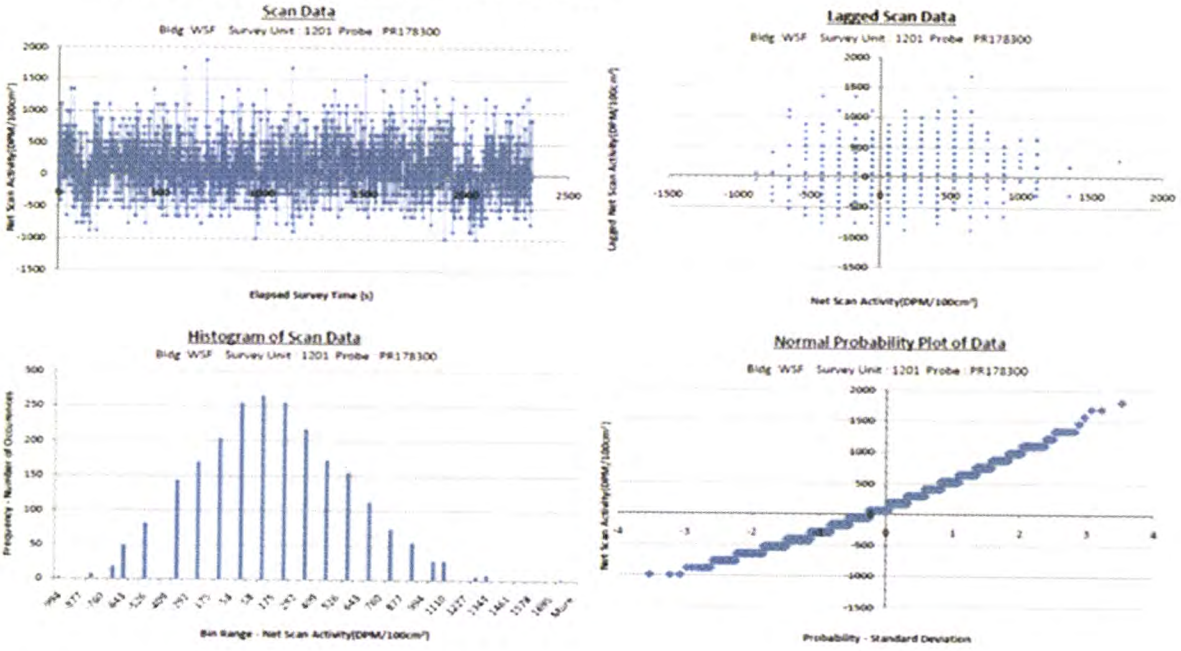
The following preliminary data reviews were performed for each survey unit:

- 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 to ensure a sufficient number of samples was 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.



18.3 Review of 4 Plots

A 4-Plot was produced for each survey instrument used within each survey unit (i.e., survey unit 618-1201 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 unit 4-Plot graphs can be found in Appendix D.

18.4 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 18-1: 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)					
617-1201	15	432	470	110	271	598	NO
618-1201	15	495	476	91	294	610	NO
620-1201	15	223	394	82	85	392	NO
630-1201	16	-20	394	169	-297	328	NO
630-1202	16	68	394	105	-117	265	NO
663-1201	12	-197	549	206	-361	316	NO

Table 18-2: Building Structural Surfaces Removable ^{3}H Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
617-1201	15	36	11	17	57	NO
618-1201	15	31	11	12	47	NO
620-1201	15	21	8	5	34	NO
630-1201	16	23	9	11	38	NO
630-1202	16	23	6	14	34	NO
663-1201	12	39	9	22	51	NO

Table 18-3: Building Structural Surfaces Removable ^{14}C Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
617-1201	15	16	7	7	34	NO
618-1201	15	19	5	8	29	NO
620-1201	15	21	5	8	26	NO
630-1201	16	16	3	12	22	NO
630-1202	16	18	6	5	30	NO
663-1201	12	22	5	13	30	NO

Table 18-4: Building Structural Surfaces Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
617-1201	15	13	7	2	30	NO
618-1201	15	12	3	7	16	NO
620-1201	15	12	3	7	16	NO
630-1201	16	11	3	5	16	NO
630-1202	16	13	5	3	18	NO
663-1201	12	11	6	2	21	NO

Table 18-5: Building Systems Removable ^{3}H Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
617-DR01	21	29	11	9	54	NO
617-VE01	11	32	11	19	48	NO
618-DR01	10	35	14	11	59	NO
618-VE01	11	26	8	17	42	NO
620-DR01	20	29	9	13	49	NO
620-VE01	21	30	9	13	49	NO
630-DR01	40	30	13	11	79	NO
630-VE01	31	33	11	12	52	NO
663-VE01	1	27	0	27	27	NO

Table 18-6: Building Systems Removable ^{14}C Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
617-DR01	21	18	5	9	25	NO
617-VE01	11	17	4	11	24	NO
618-DR01	10	16	5	8	24	NO
618-VE01	11	18	7	7	30	NO
620-DR01	20	18	6	7	29	NO
620-VE01	21	17	5	9	27	NO
630-DR01	40	19	5	11	33	NO
630-VE01	31	19	6	8	30	NO
663-VE01	1	20	0	20	20	NO

Table 18-7: Building Systems Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
617-DR01	21	12	5	5	21	NO
617-VE01	11	14	8	5	36	NO
618-DR01	10	9	3	3	13	NO
618-VE01	11	10	4	5	18	NO
620-DR01	20	15	5	7	25	NO
620-VE01	21	13	4	5	24	NO
630-DR01	40	13	5	5	25	NO
630-VE01	31	13	6	3	28	NO
663-VE01	1	16	0	16	16	NO

18.5 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 DCGL and investigation levels to determine if an area required further surveillance. All total surface activity measurement collected at MARSSIM-calculated locations were less than the investigation levels and significantly less than the DCGL.

The Sign test is not performed in this survey design because the total activity DCGL is used as a maximum. If all measurements are less than the DCGL, performance of the Sign test is not necessary because the survey units will pass the Sign test. Therefore, the null hypothesis can be rejected and the survey units meet the release criteria and are suitable for release for unrestricted use.

The standard deviation for each survey unit was less than the standard deviation used for preliminary calculation of the minimum number of samples required for the Sign test. Therefore, 11 measurements are required for each survey unit.

The results of the data quality assessment and calculations of the dose from each structural surface survey unit are presented in the table below.

Table 18-8: 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[2] (mrem/yr)
617-1201	110	15	432	0.022
618-1201	91	15	495	0.025
620-1201	82	15	223	0.011
630-1201	169	16	-20	-0.001
630-1202	105	16	68	0.003
663-1201	206	12	-197	-0.010
			Maximum:	**0.025**

18.6 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.

19 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. This was accomplished by re-surveying survey unit 663-1201.

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

[2] The TEDE shown is calculated by multiplying 25 mrem/yr by the ratio of the mean total surface activity to the Cl-36 DCGL of 5.0E5 dpm/100cm^2.

Table 19-1: QA Survey Building Structural Surfaces Total Activity Summary

Survey Unit	# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 5,000?
		(dpm/100 cm^2)					
663-QA01	12	25	455	216	-146	483	NO

Table 19-2: QA Survey Building Structural Surfaces Removable ^3H Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
663-QA01	12	21	13	2	43	NO

Table 19-3: QA Survey Building Structural Surfaces Removable ^{14}C Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Any Result Exceeding Investigation Level of 200?
		(dpm/100 cm^2)				
663-QA01	12	19	5	13	28	NO

Table 19-4: 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?
		(dpm/100 cm^2)				
663-QA01	12	13	4	7	20	NO

20 REFERENCES

- NRC Regulations
- Chase Commonwealth of Kentucky Radioactive Materials License Number 201-605-90
- Chase Environmental Group 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

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GRIFFIN INSTRUMENTS

CALIBRATION CERTIFICATE FOR 2241-3 SERIAL# 253363

Owner: CHASE ENV

DATE: 06/09/11 LOCATION: Griffin Inst

TECH: E.M. Glenn DATE LAST CAL EXPIRES: 04/06/12

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 #: 134715 CAL. DUE: 04/13/12

MODEL: SERIAL #: CAL DUE:

☑ Fast/Slow Switch working properly ☑ Audio Response ☑ Geotropism CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ○ Yes ◉ No BATTERY CHECK: Sat

AF HV (V) #1:	1575	AL HV (V) #1:	1625	AF I.S. (mV) #1:	4	AL I.S. (mV) #1:	A.F.
AF HV (V) #2:	1700	AL HV (V) #2:	1725	AF I.S. (mV) #2:	4	AL I.S. (mV) #2:	A.F.
AF HV (V) #3:	1125	AL HV (V) #3:	1150	AF I.S. (mV) #3:	4	AL I.S. (mV) #3:	A.F.
AF HV (V) #4:	1150	AL HV (V) #4:	1250	AF I.S. (mV) #4:	4	AL I.S. (mV) #4:	A.F.

RATE CPM	AS FOUND		% ERROR	AS LEFT	% ERROR
250	251		0.4%	A.F.	
2500	2509		0.4%	A.F.	
25K	25.090	K	0.4%	A.F.	
250K	250.935	K	0.4%	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: Re-calibrated due to probe repairs.

Does Instrument Meet Final Acceptance Criteria?: ◉ Yes ○ No

Calibration Sticker Attached?: ◉ Yes ○ No

Date Instrument is Due For Next Calibration: 06/09/12

INSTRUMENT MARRIED WITH #

Performed/Reviewed by: E.M. Glenn EG Date: 6/9/2011 Entered by: EG Initials

Calibrations performed to ANSI N323A-1997 standards.

GRIFFIN INSTRUMENTS

CALIBRATION CERTIFICATE FOR 43-37 PROBE # PR265548

Owner: CHASE ENV

DATE: 06/09/11 LOCATION: Griffin Inst
TECH: E.M. Glenn DATE LAST CAL EXPIRES: 04/06/12

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 #: 253363 CAL. DUE: 06/09/12

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

Condition: ◉ Sat ○ Unsat

Efficiencies from last cal.:

Pu: 23.49% Th: 21.71% Sr: 42.52%

Tc ss: 28.77% C14: 16.40% 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.
1200 a / 1650 b											

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

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
AF CPM:						
AF 4 pi eff:						
AF 2 pi eff:						

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 #: PR265548
Date: 06/09/11

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				3252		17.6%	1			
1150				4230		22.8%	9			
1200				4696		25.4%	2			
1250				4710		25.4%	5			
1300				4841		26.1%	4			

Alpha / Beta Bkg (cpm) 4

HV / Vernier		Pu-239	Tc-99 Ni	Tc-99 SS	Th-230	C-14	Sr-90
1250 a / N/A	CPM:	4789			3831		
4 pi AL Efficiencies:		**25.86%**			**22.92%**		
2 pi AL Efficiencies:		***50.96%***			***46.84%***		

PROBE #: PR265548
Date: 06/09/11

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.		
1600		2954	15.9%					198		
1650		4667	24.5%					428		
1700		5486	26.9%					836		
1750		5919	27.3%					1196		
1800								1475		

Alpha / Beta Bkg (cpm) 1028

HV / Vernier		Pu-239	Tc-99 Ni	Tc-99 SS	Th-230	C-14	Sr-90
1725 b	CPM:			5935		8942	4943
4 pi AL Efficiencies:				**28.36%**		**16.22%**	**42.07%**
2 pi AL Efficiencies:				***45.44%***		***42.41%***	***60.18%***

GRIFFIN INSTRUMENTS

REMARKS: Replaced broken wire. Replaced torn mylar. Det.2 - b; Det.4 - a.

Does Instrument Meet Final Acceptance Criteria?: (•) Yes ( ) No

Calibration Sticker Attached?: (•) Yes ( ) No

Date Instrument is Due For Next Calibration: **06/09/12**

INSTRUMENT MARRIED WITH **2241-3** **# 253363**

Performed/Reviewed by: *E. M. Glenn* **Date:** 6/9/2011 **Entered by:** ____ **Initials**

2 pi efficiencies denoted in italics.

Calibrations performed to ANSI N323A-1997 standards.

GRIFFIN INSTRUMENTS

CALIBRATION CERTIFICATE FOR 2241-3 SERIAL# 267138

Owner: CHASE ENV

DATE: 05/02/11 LOCATION: Griffin Inst

TECH: E.M. Glenn DATE LAST CAL EXPIRES: 07/14/11

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 #: 134715 CAL. DUE: 04/13/12

MODEL: SERIAL #: CAL DUE:

☑ Fast/Slow Switch working properly ☑ Audio Response ☐ Geotropism CABLE LENGTH 5'

CONDITION: Sat

NEW BATTERIES: ( ) Yes (●) No BATTERY CHECK: Sat

AF HV (V) #1:	1675	AL HV (V) #1:	A.F.	AF I.S. (mV) #1:	4	AL I.S. (mV) #1:	A.F.
AF HV (V) #2:	1850	AL HV (V) #2:	1800	AF I.S. (mV) #2:	4	AL I.S. (mV) #2 :	A.F.
AF HV (V) #3:	1250	AL HV (V) #3:	A.F.	AF I.S. (mV) #3:	4	AL I.S. (mV) #3:	A.F.
AF HV (V) #4:	1250	AL HV (V) #4:	A.F.	AF I.S. (mV) #4:	4	AL I.S. (mV) #4:	A.F.

RATE CPM	AS FOUND		% ERROR	AS LEFT	% ERROR
250	250		0.0%	A.F.	
2500	2502		0.1%	A.F.	
25K	25.020	K	0.1%	A.F.	
250K	250.193	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.	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: 05/02/12

INSTRUMENT MARRIED WITH #

Performed/Reviewed by: E.M. Glenn E.G. Date: 5/2/2011 Entered by: E.G. Initials

Calibrations performed to ANSI N323A-1997 standards.

GRIFFIN INSTRUMENTS

CALIBRATION CERTIFICATE FOR 43-37 PROBE # PR286832

Owner: CHASE ENV

DATE: 05/02/11 **LOCATION:** Griffin Inst
TECH: E.M. Glenn **DATE LAST CAL EXPIRES:** 07/14/11

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 #:** 267138 **CAL. DUE:** 05/02/12

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

Condition: ◉ Sat ○ Unsat

Efficiencies from last cal.:

Pu:	23.70%	Th:	22.51%	Sr:	43.05%
Tc ss:	27.97%	C14:	15.52%	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 / 1850 b				4321		23.34%	3	1385		6264	28.20%

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

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
AF CPM:	4321		6264	3726	5340	9075
AF 4 pi eff:	23.34%		28.20%	22.29%	42.42%	15.76%
AF 2 pi eff:	*46.08%*		*45.18%*	*45.57%*	*60.67%*	*41.21%*

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 #: PR286832
Date: 05/02/11

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.		
1750		5608	26.8%					971		
1800		5745	26.6%					1137		
1850		6029	27.8%					1219		
1900								18654		

Alpha / Beta Bkg (cpm) 3 1169

HV / Vernier		Pu-239	Tc-99 Ni	Tc-99 SS	Th-230	C-14	Sr-90
1250 a /1800 b	CPM:	4321		5935	3726	8637	5007
4 pi AL Efficiencies:		**23.34%**		**27.55%**	**22.29%**	**15.31%**	**41.16%**
2 pi AL Efficiencies:		***45.99%***		***44.13%***	***45.57%***	***40.02%***	***58.88%***

REMARKS: Repleced mylar due to multiple white-out spots and pinholes.

Does Instrument Meet Final Acceptance Criteria?: (●) Yes ( ) No

Calibration Sticker Attached?: (●) Yes ( ) No

Date Instrument Is Due For Next Calibration: **05/02/12**

INSTRUMENT MARRIED WITH **2241-3** **# 267138**

Performed/Reviewed by: E.M. Glenn **Date:** 5/2/2011 **Entered by:**_____**Initials**

2 pi efficiencies denoted in italics. **Calibrations performed to ANSI N323A-1997 standards.**

GRIFFIN INSTRUMENTS

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:**

[x] Fast/Slow Switch working properly [x] 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:	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: Joanne Glenn **Date:** 4/6/2011 **Entered by:** ____ **Initials**

Calibrations performed to ANSI N323A-1997 standards.

GRIFFIN INSTRUMENTS

CALIBRATION CERTIFICATE FOR 43-37 PROBE # PR281040

Owner: CHASE ENV

DATE: 04/06/11 **LOCATION:** Griffin Inst
TECH: E.M. Glenn **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	18,660 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: 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%

	Pu239	Tc99 Ni	Tc99 ss	Th-230	Sr90	C-14
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 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 #: 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

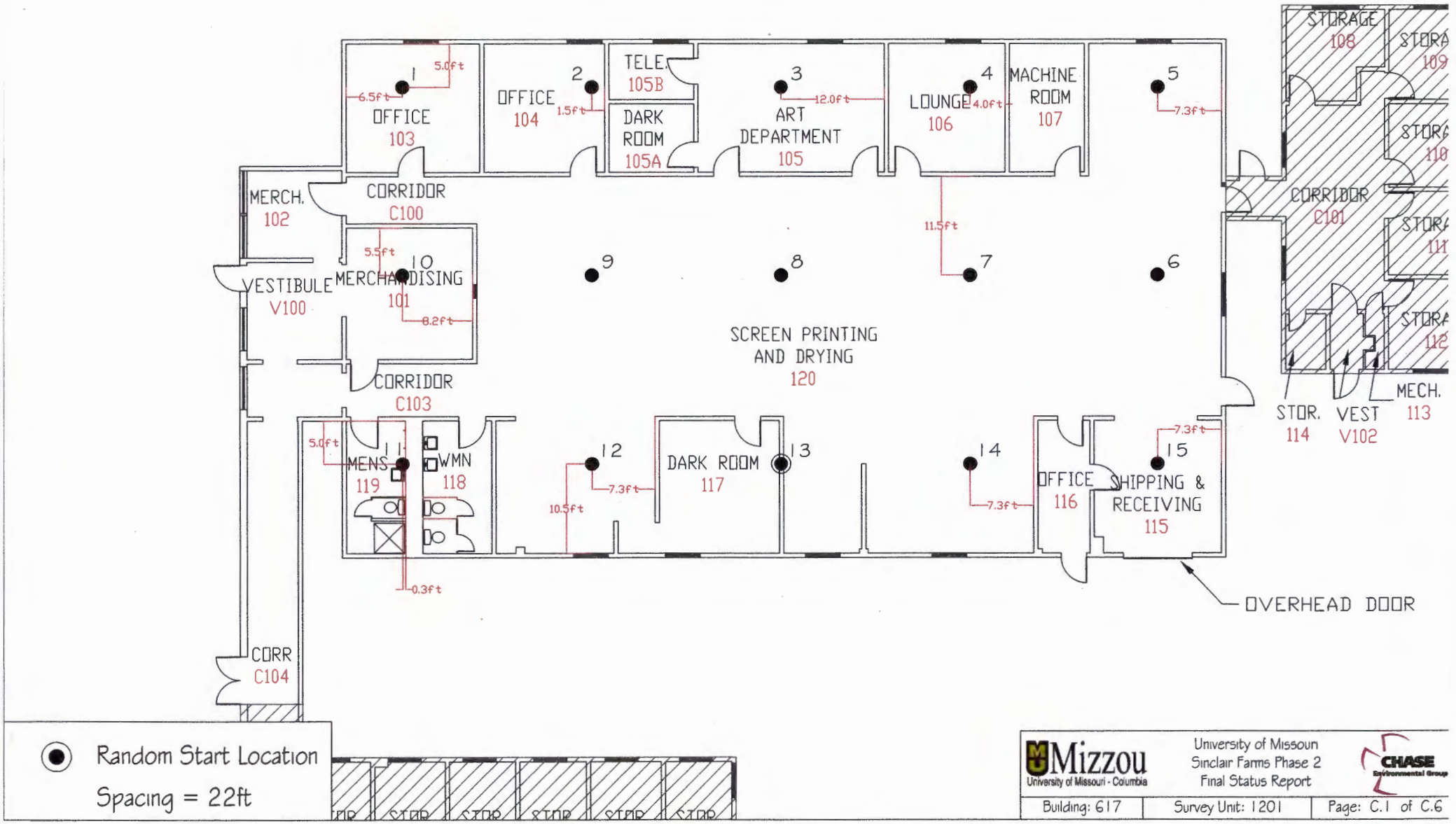
Calibration Sticker Attached?: (•) Yes ( ) No

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.**



Random Start Location

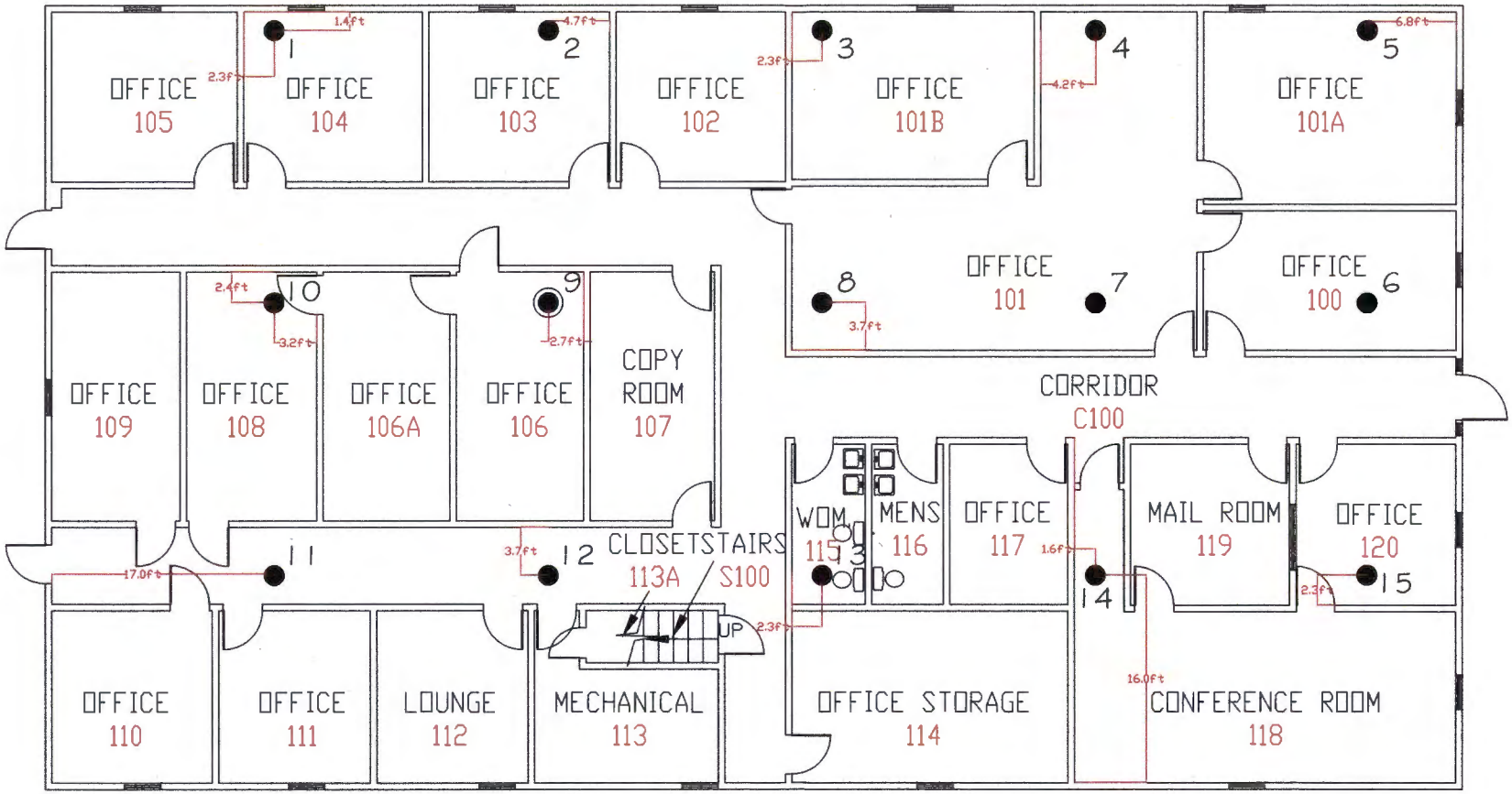
Spacing = 22ft

Mizzou
University of Missouri - Columbia

University of Missoun
Sinclair Farms Phase 2
Final Status Report

CHASE Environmental Group

Building: 617	Survey Unit: 1201	Page: C.1 of C.6



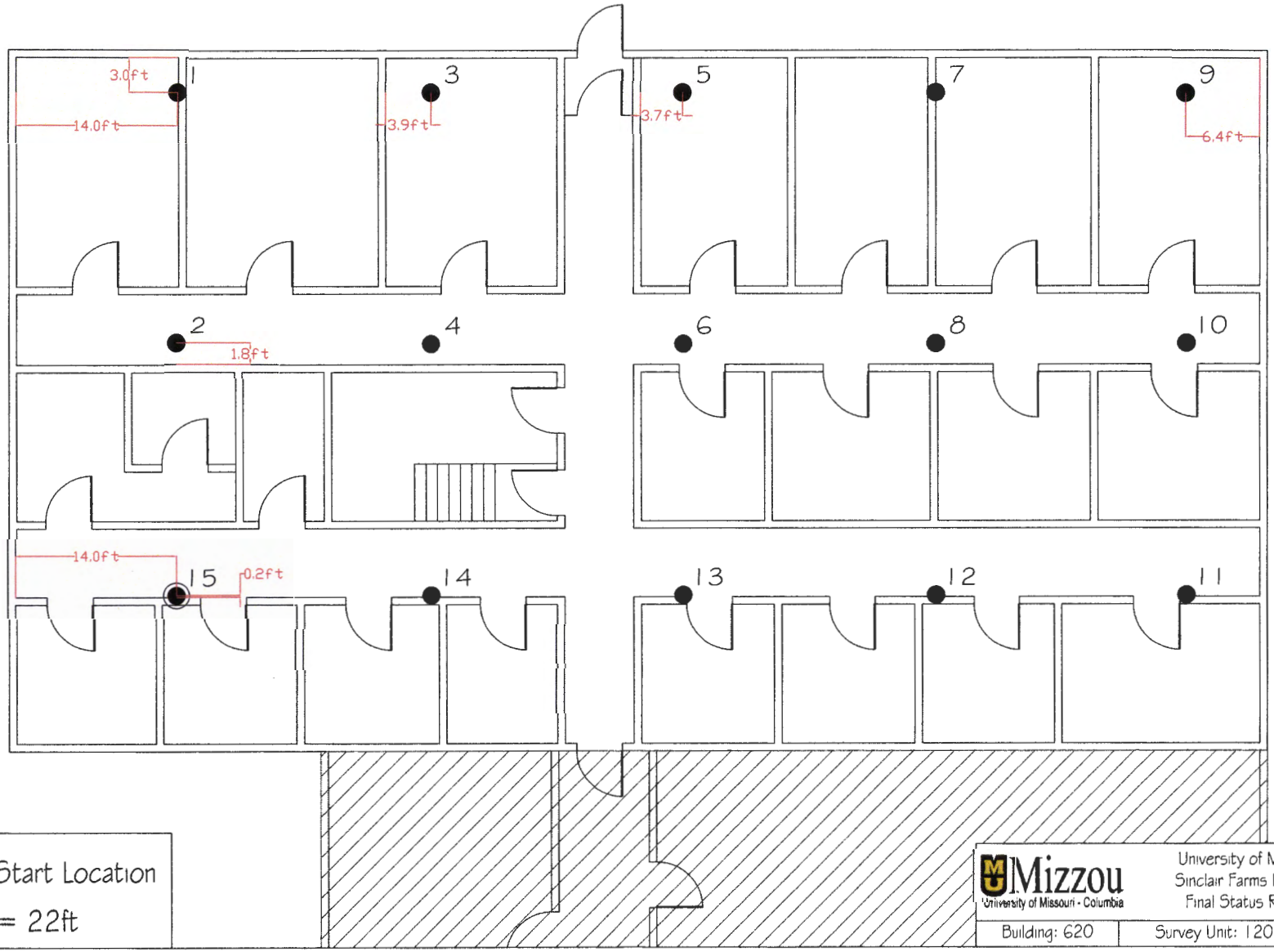
Random Start Location

Spacing = 21ft

N

University of Missouri
Sinclair Farms Phase 2
Final Status Report

Building: 618	Survey Unit: 1201	Page: C.2 of C.6



Random Start Location

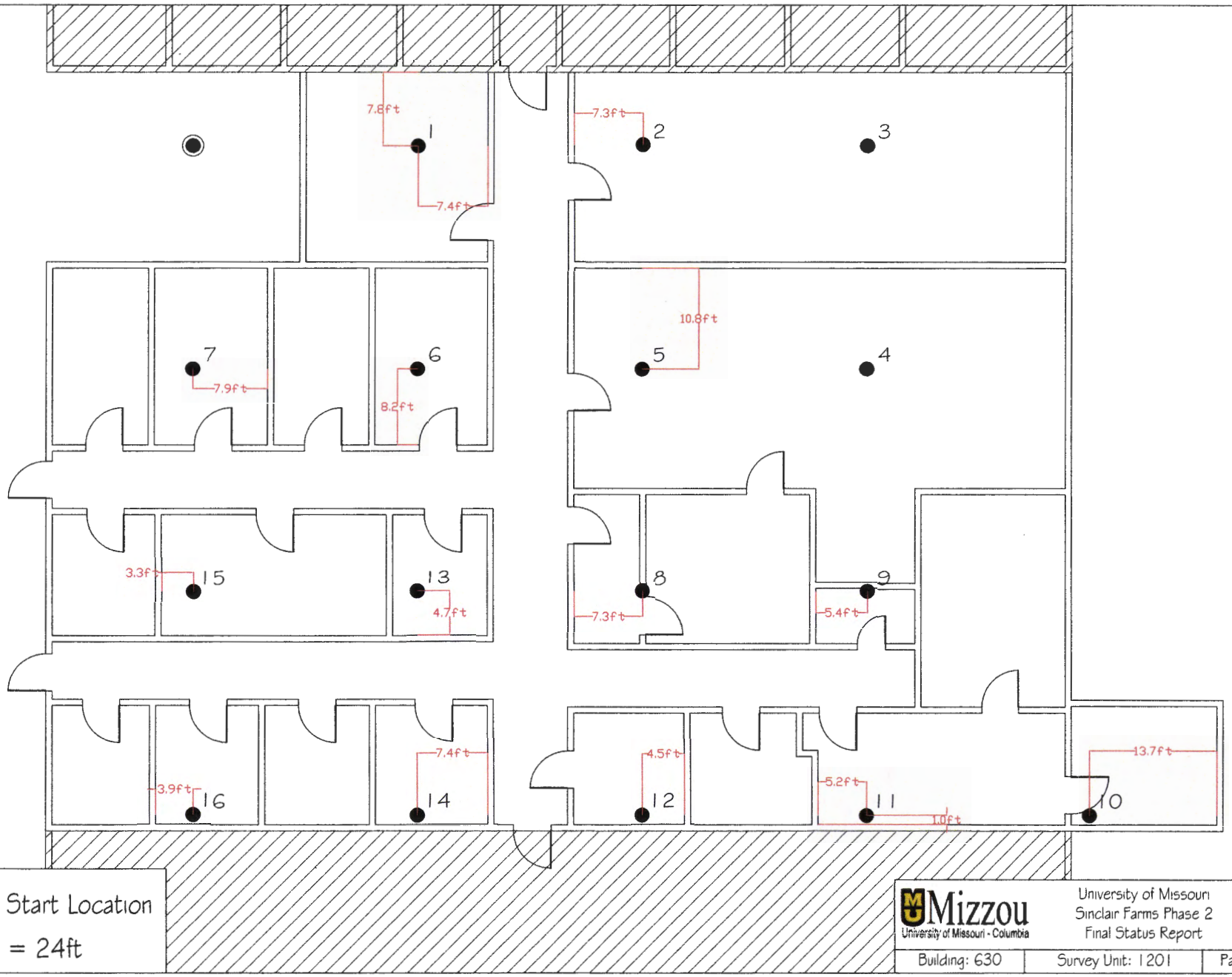
Spacing = 22ft

University of Missouri - Columbia

University of Missouri
Sinclair Farms Phase 2
Final Status Report

CHASE Environmental Group

Building: 620	Survey Unit: 1201	Page: C.3 of C.6

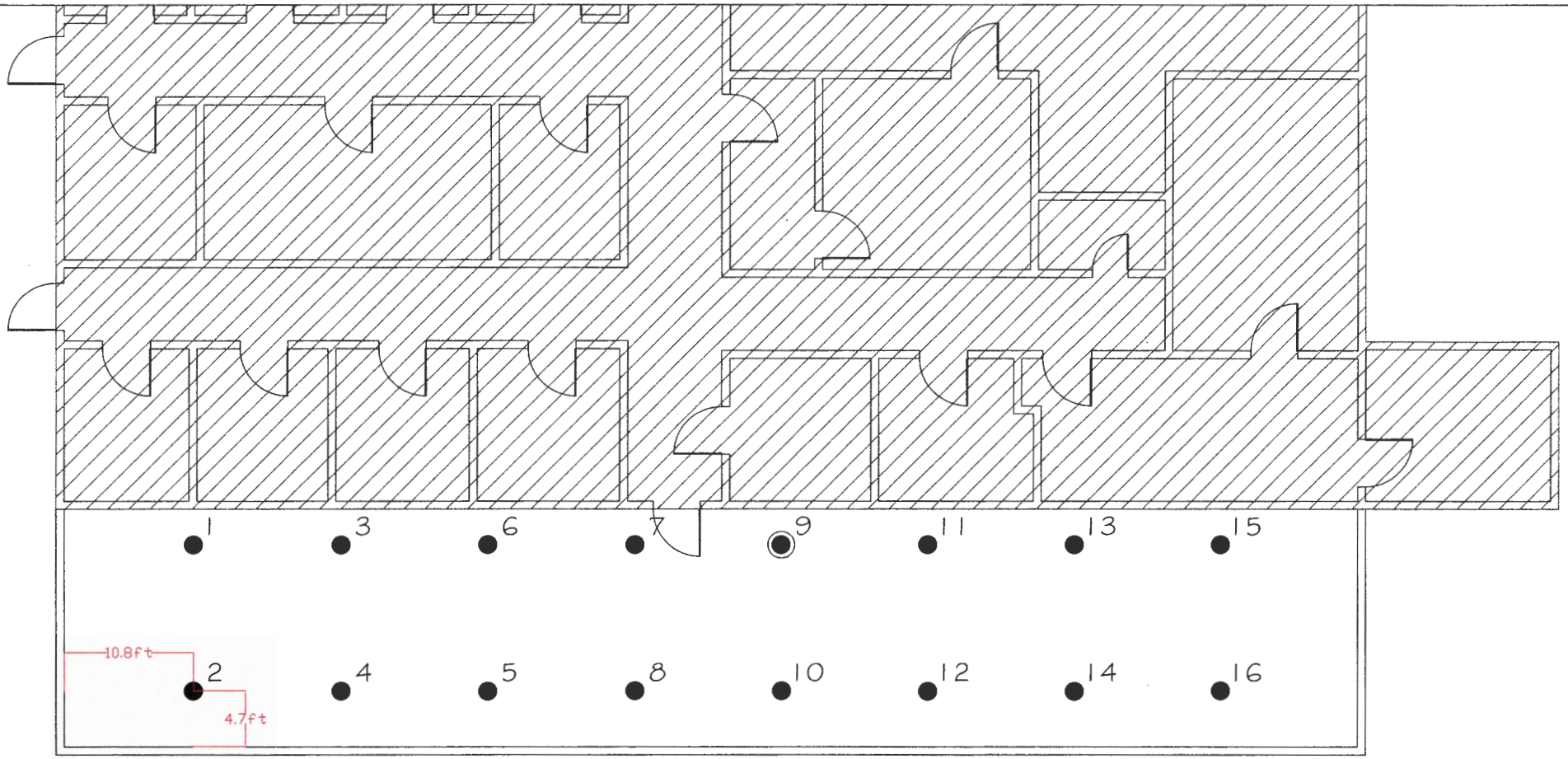


Random Start Location

Spacing = 24ft

University of Missouri
Sinclair Farms Phase 2
Final Status Report

Building: 630	Survey Unit: 1201	Page: C.4 of C.6

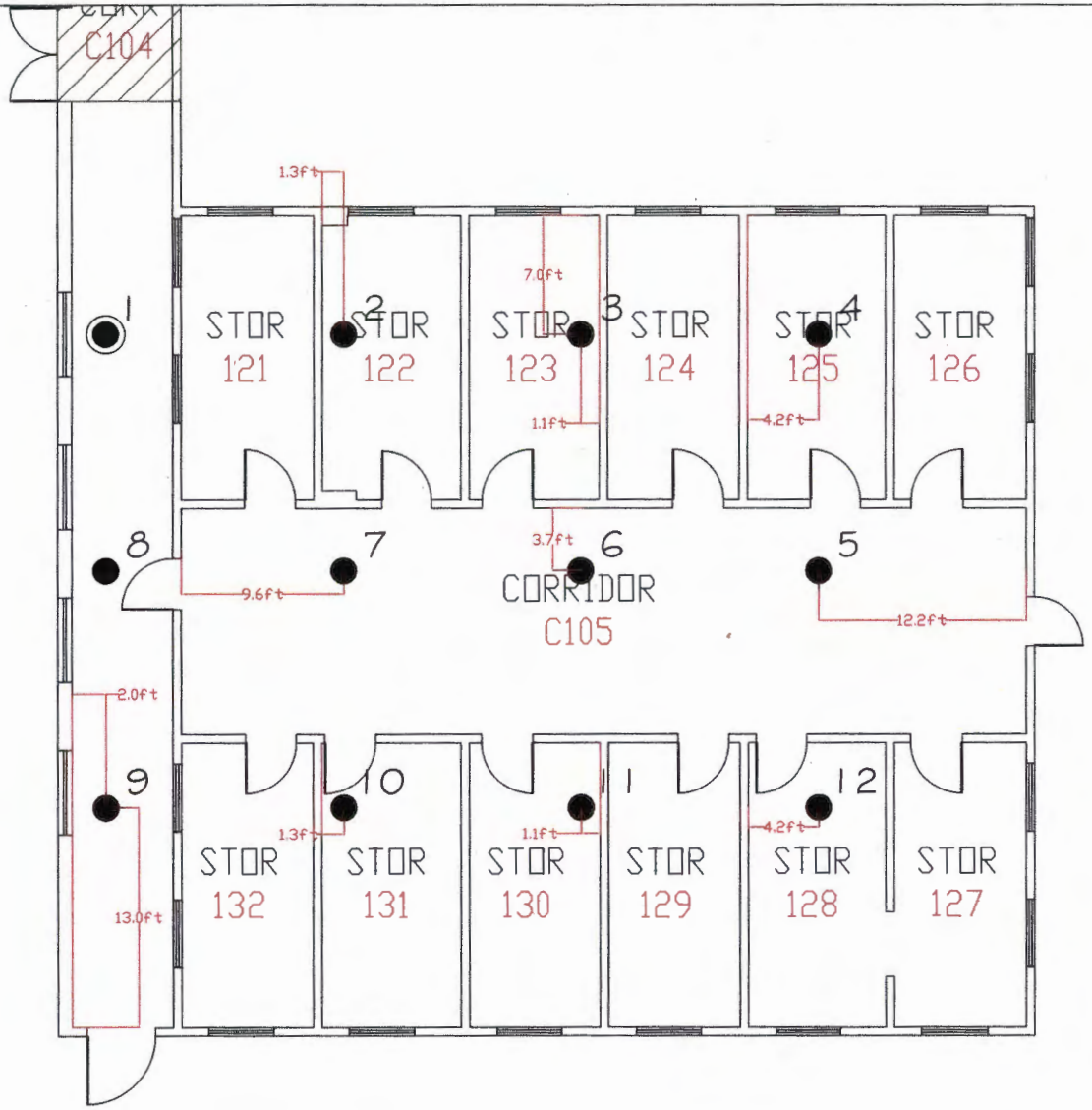


Random Start Location

Spacing = 12ft

University of Missouri
Sinclair Farms Phase 2
Final Status Report

Building: 630	Survey Unit: 1202	Page: C.5 of C.6

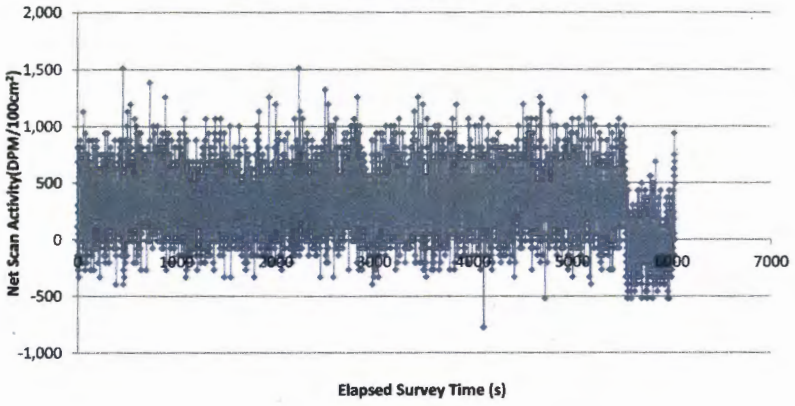


Random Start Location

Spacing = 14ft

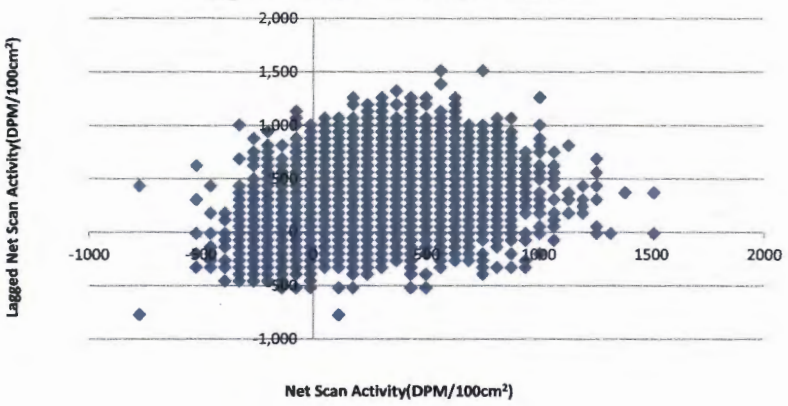
Scan Data

Bldg :617 Survey Unit : 1201 Probe : PR265548



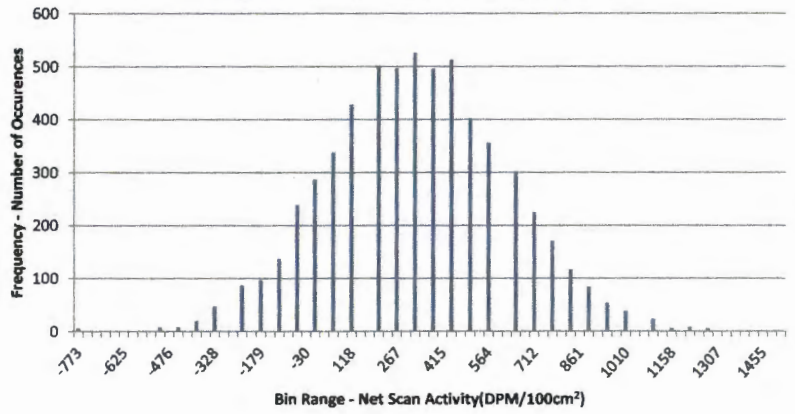
Lagged Scan Data

Bldg :617 Survey Unit : 1201 Probe : PR265548



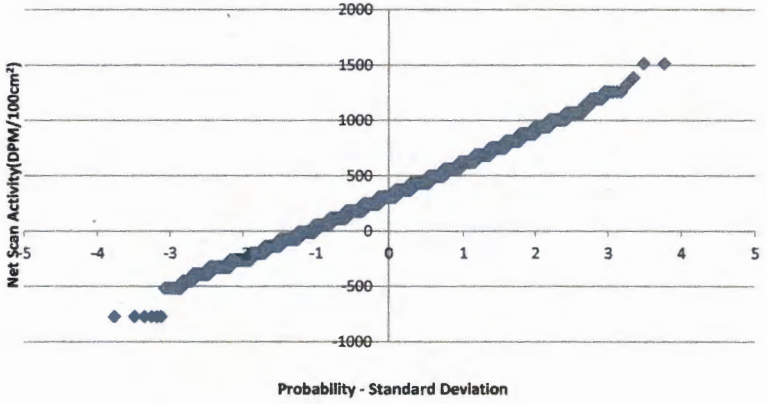
Histogram of Scan Data

Bldg :617 Survey Unit : 1201 Probe : PR265548



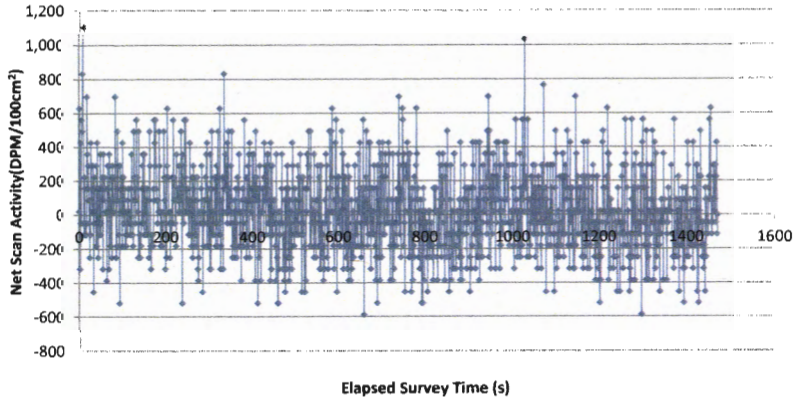
Normal Probability Plot of Data

Bldg :617 Survey Unit : 1201 Probe : PR265548



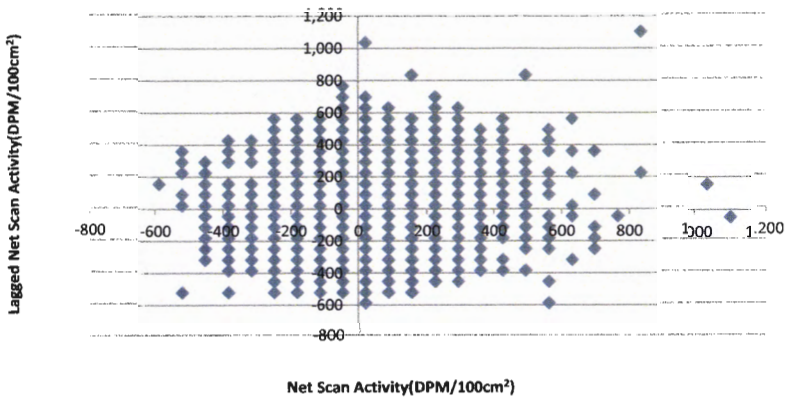
Scan Data

Bldg :618 Survey Unit : 1201 Probe : PR281040



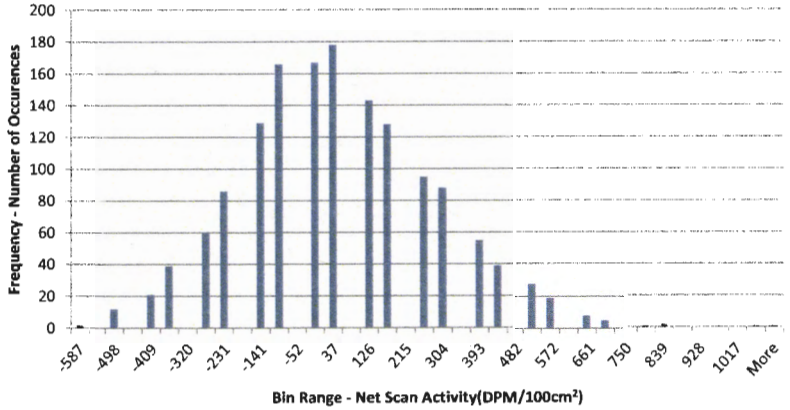
Lagged Scan Data

Bldg :618 Survey Unit : 1201 Probe : PR281040



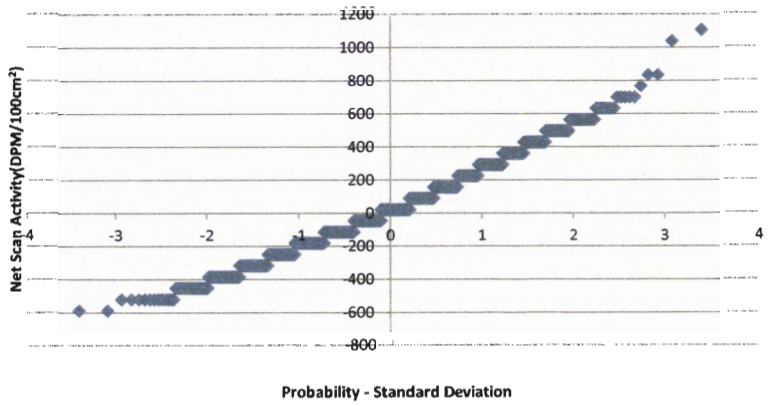
Histogram of Scan Data

Bldg :618 Survey Unit : 1201 Probe : PR281040



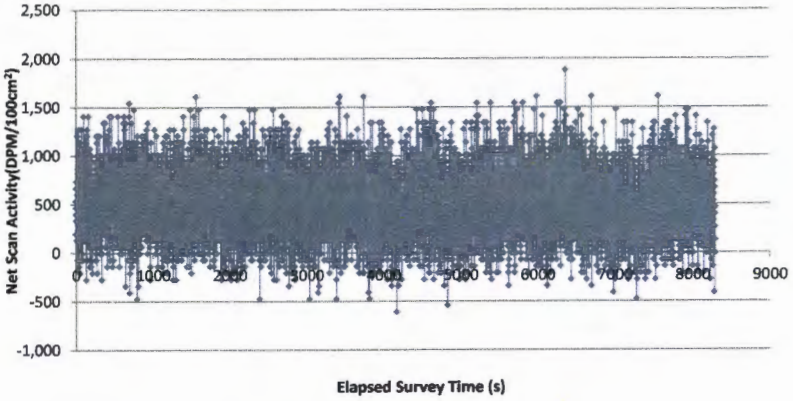
Normal Probability Plot of Data

Bldg :618 Survey Unit : 1201 Probe : PR281040



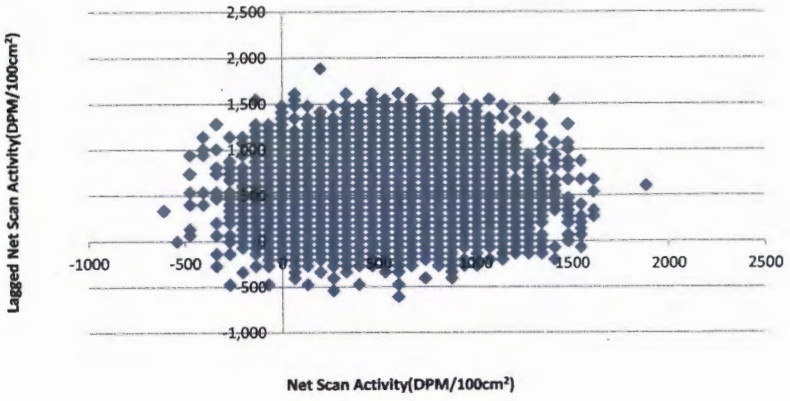
Scan Data

Bldg :618 Survey Unit : 1201 Probe : PR286832



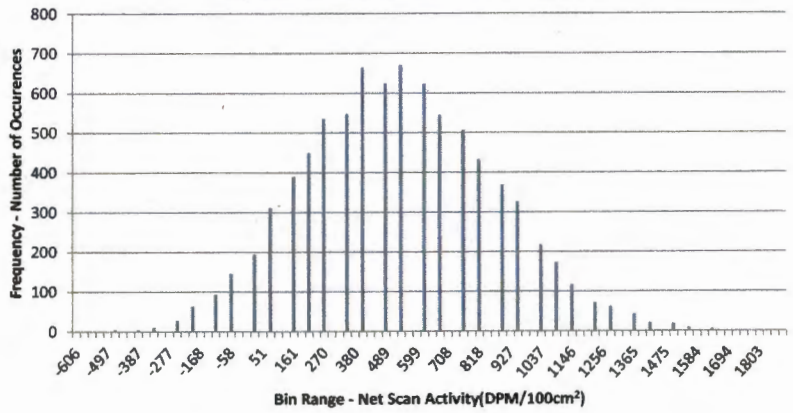
Lagged Scan Data

Bldg :618 Survey Unit : 1201 Probe : PR286832



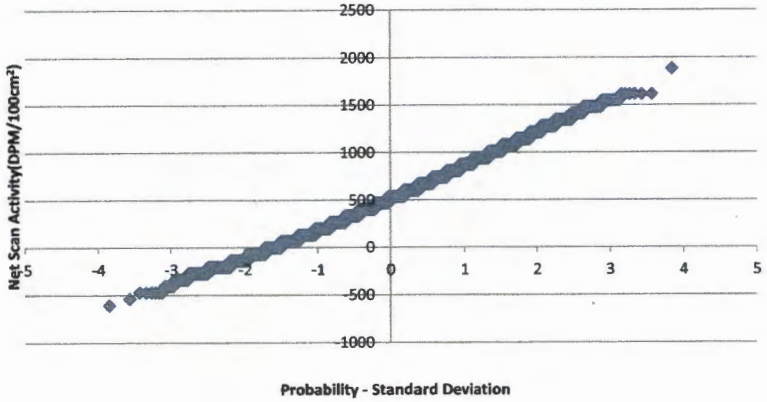
Histogram of Scan Data

Bldg :618 Survey Unit : 1201 Probe : PR286832



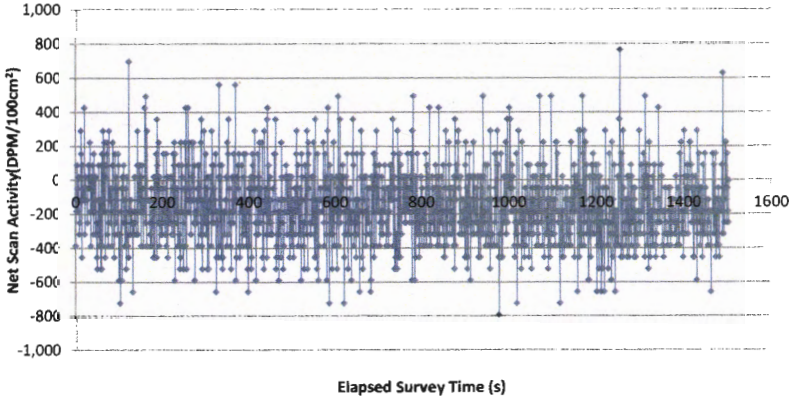
Normal Probability Plot of Data

Bldg :618 Survey Unit : 1201 Probe : PR286832



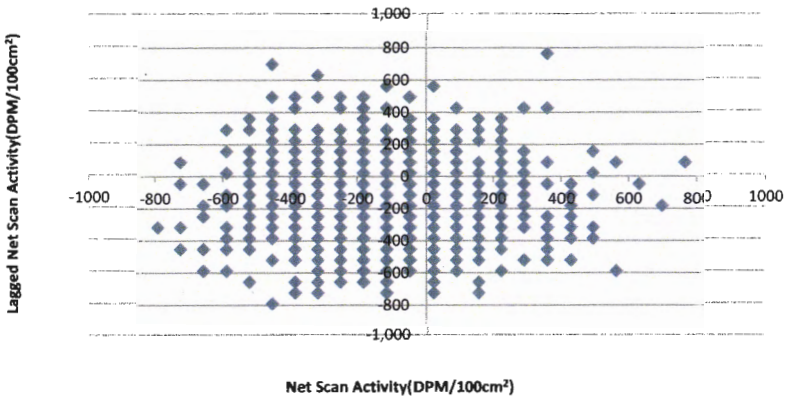
Scan Data

Bldg :620 Survey Unit : 1201 Probe : PR281040



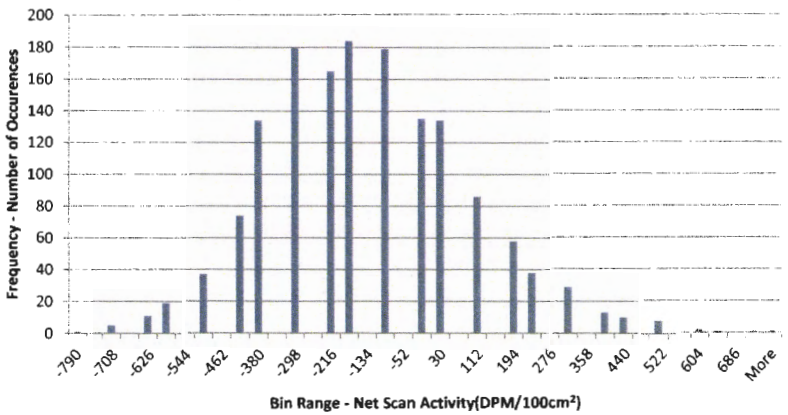
Lagged Scan Data

Bldg :620 Survey Unit : 1201 Probe : PR281040



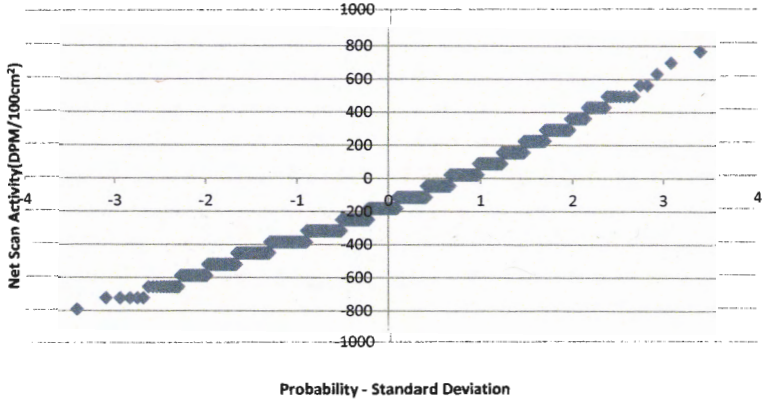
Histogram of Scan Data

Bldg :620 Survey Unit : 1201 Probe : PR281040



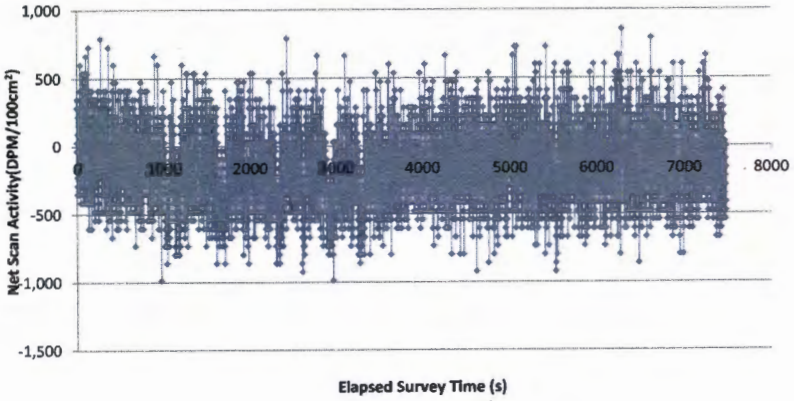
Normal Probability Plot of Data

Bldg :620 Survey Unit : 1201 Probe : PR281040



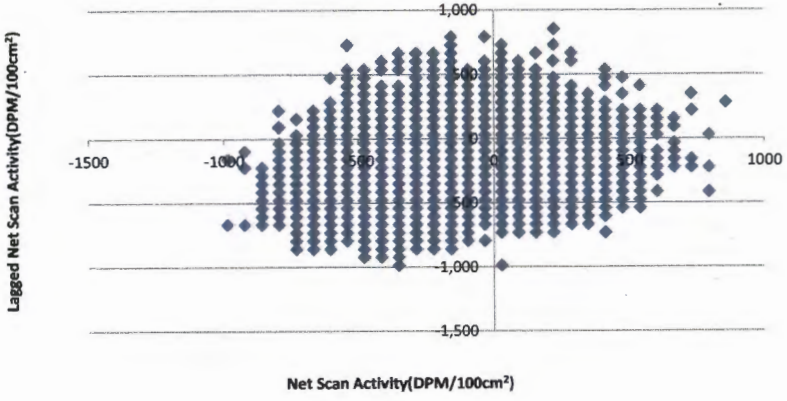
Scan Data

Bldg :620 Survey Unit : 1201 Probe : PR265548



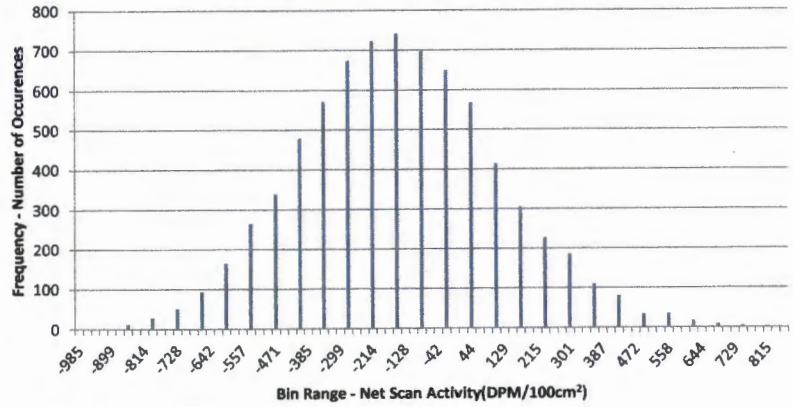
Lagged Scan Data

Bldg :620 Survey Unit : 1201 Probe : PR265548



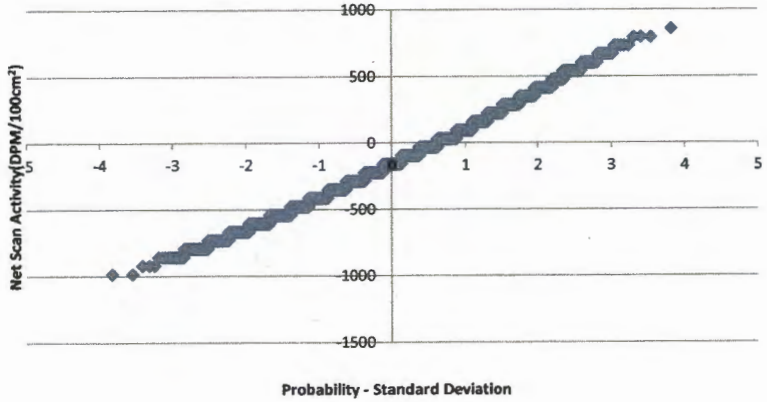
Histogram of Scan Data

Bldg :620 Survey Unit : 1201 Probe : PR265548



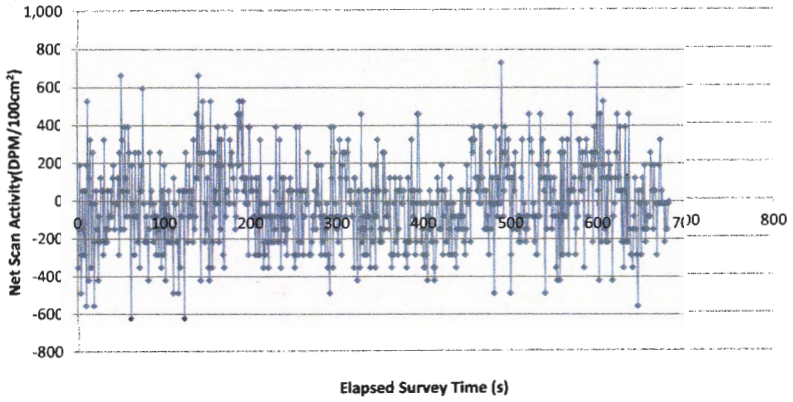
Normal Probability Plot of Data

Bldg :620 Survey Unit : 1201 Probe : PR265548



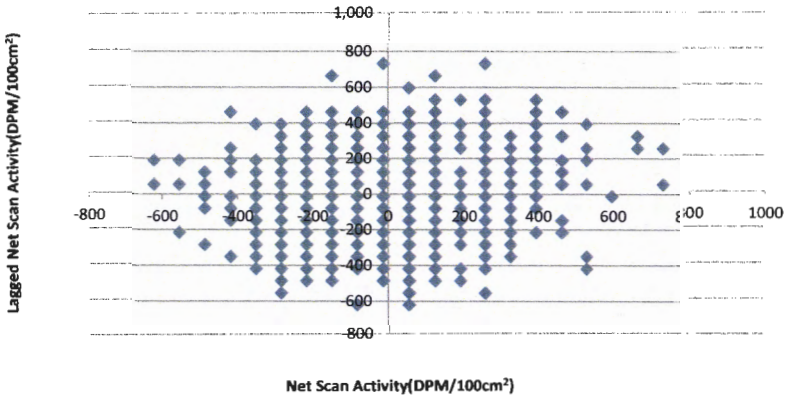
Scan Data

Bldg :630 Survey Unit : 1201 Probe : PR281040



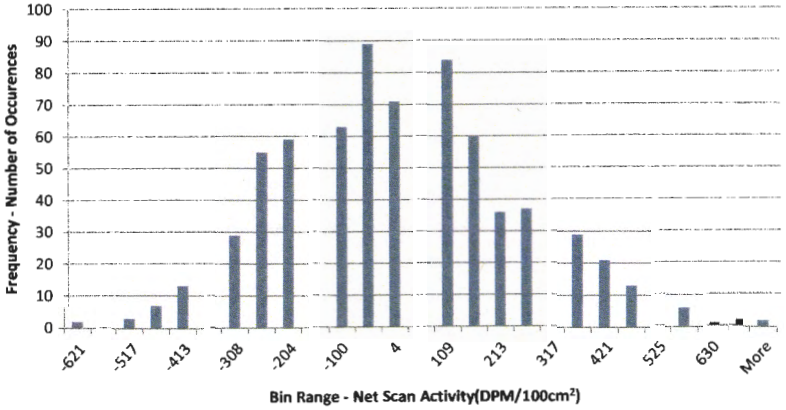
Lagged Scan Data

Bldg :630 Survey Unit : 1201 Probe : PR281040



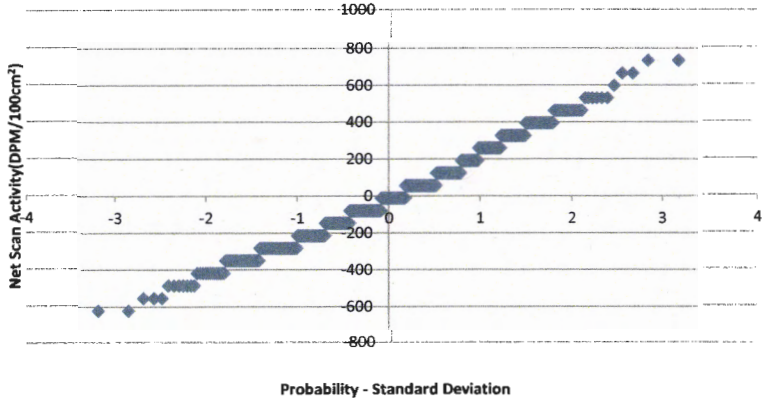
Histogram of Scan Data

Bldg :630 Survey Unit : 1201 Probe : PR281040



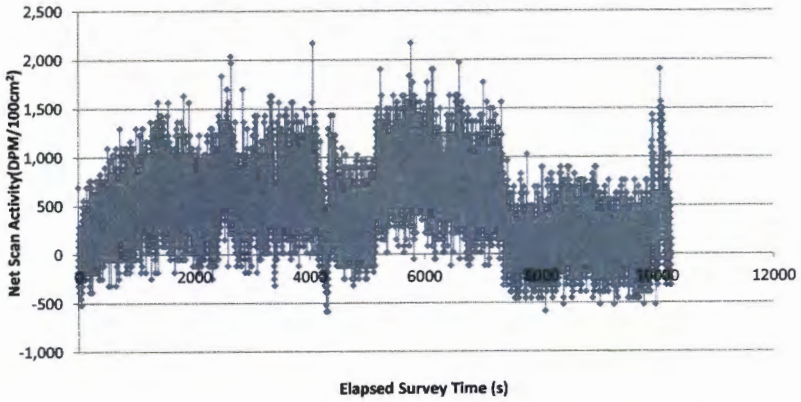
Normal Probability Plot of Data

Bldg :630 Survey Unit : 1201 Probe : PR281040



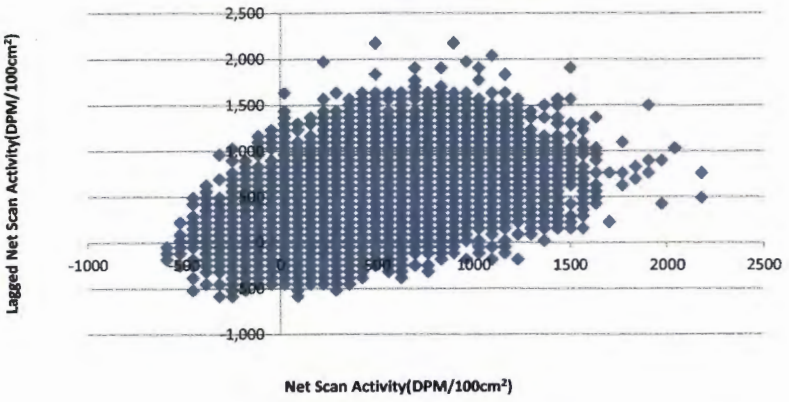
Scan Data

Bldg :630 Survey Unit : 1201 Probe : PR286832



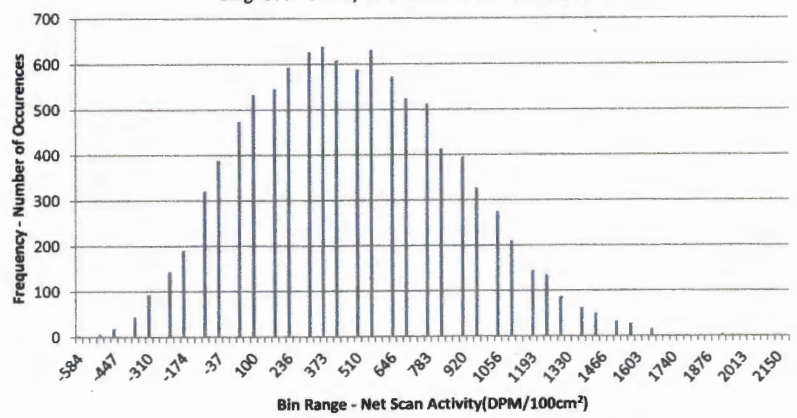
Lagged Scan Data

Bldg :630 Survey Unit : 1201 Probe : PR286832



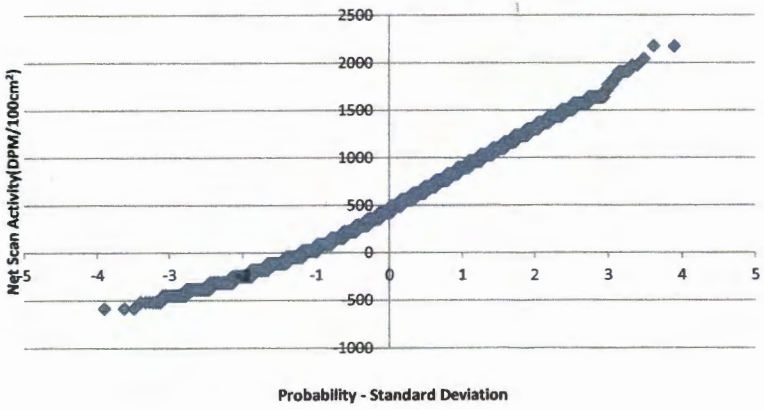
Histogram of Scan Data

Bldg :630 Survey Unit : 1201 Probe : PR286832



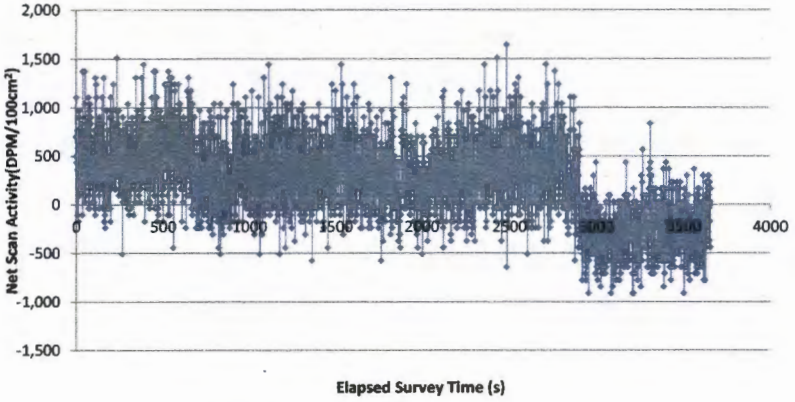
Normal Probability Plot of Data

Bldg :630 Survey Unit : 1201 Probe : PR286832



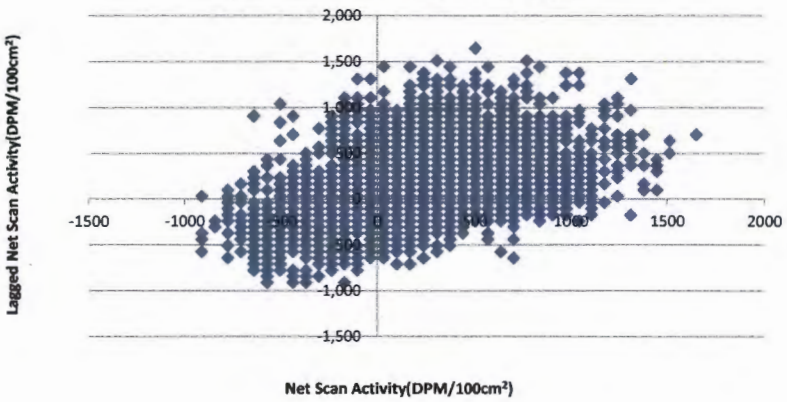
Scan Data

Bldg :630 Survey Unit : 1202 Probe : PR286832



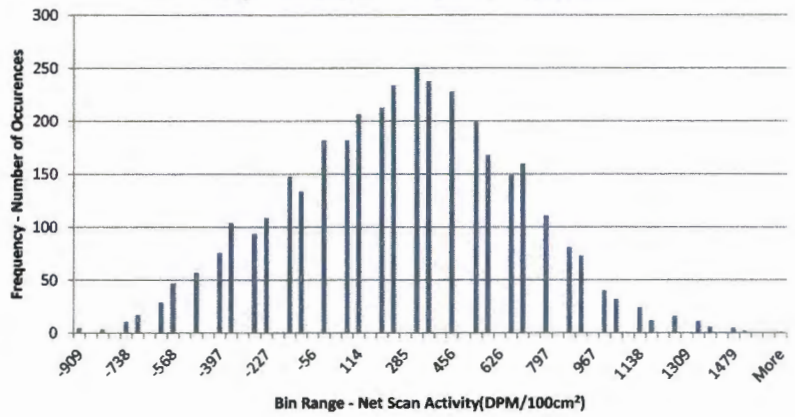
Lagged Scan Data

Bldg :630 Survey Unit : 1202 Probe : PR286832



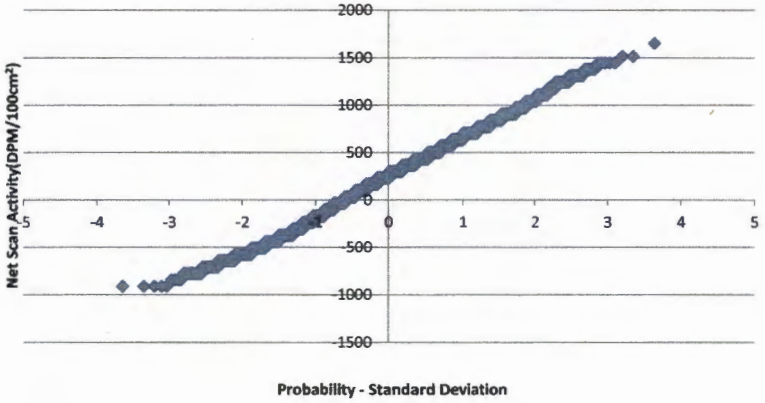
Histogram of Scan Data

Bldg :630 Survey Unit : 1202 Probe : PR286832



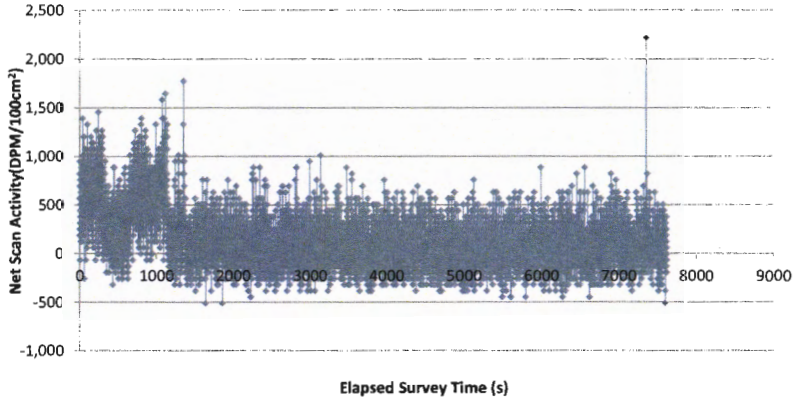
Normal Probability Plot of Data

Bldg :630 Survey Unit : 1202 Probe : PR286832



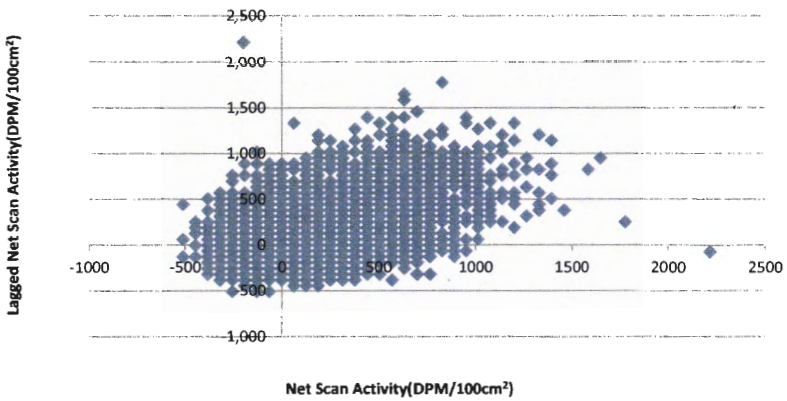
Scan Data

Bldg :663 Survey Unit : 1201 Probe : PR265548



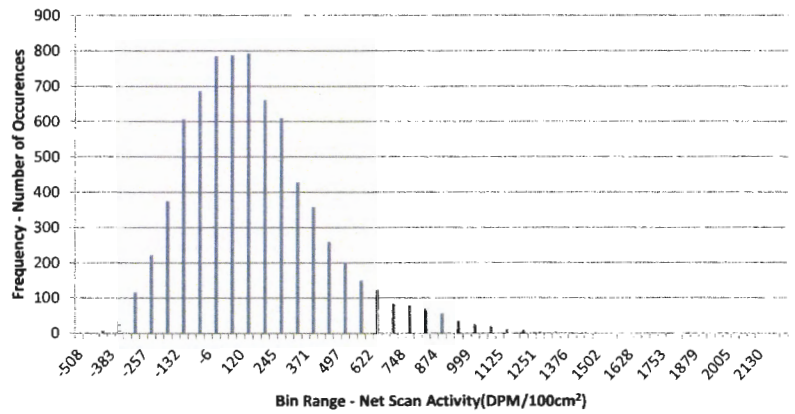
Lagged Scan Data

Bldg :663 Survey Unit : 1201 Probe : PR265548



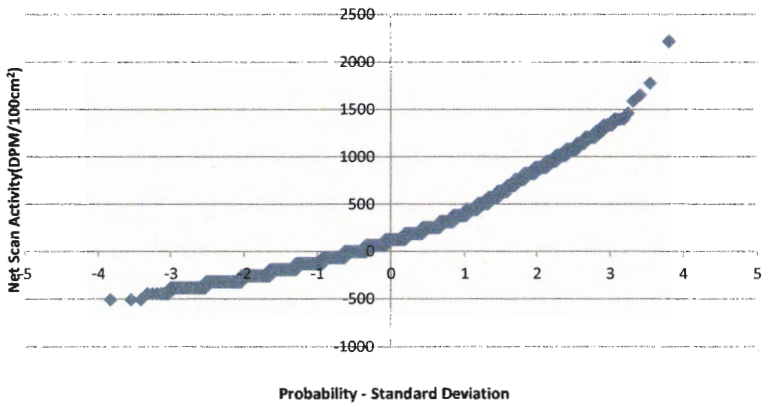
Histogram of Scan Data

Bldg :663 Survey Unit : 1201 Probe : PR265548



Normal Probability Plot of Data

Bldg :663 Survey Unit : 1201 Probe : PR265548



Structural Surfaces Survey Results

Building 617 Survey Unit 1201 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
617-1201-F1-C-001	271 ± 282	470	17 ± 10	44	23 ± 11	26	20 ± 9	24
617-1201-F1-C-002	**497** ± 299	470	24 ± 12	44	18 ± 9	26	10 ± 6	24
617-1201-F1-C-003	339 ± 287	470	37 ± 15	44	23 ± 11	26	11 ± 7	24
617-1201-F1-C-004	440 ± 294	470	**45** ± 17	44	11 ± 7	26	13 ± 7	24
617-1201-F1-C-005	440 ± 294	470	23 ± 12	44	**34** ± 13	26	**30** ± 11	24
617-1201-F1-C-006	294 ± 283	470	29 ± 14	44	7 ± 6	26	8 ± 6	24
617-1201-F1-C-007	429 ± 294	470	**57** ± 19	44	18 ± 9	26	2 ± 3	24
617-1201-F1-C-008	**598** ± 306	470	34 ± 15	44	17 ± 9	26	16 ± 8	24
617-1201-F1-C-009	282 ± 282	470	**45** ± 17	44	11 ± 7	26	20 ± 9	24
617-1201-F1-C-010	327 ± 286	470	42 ± 16	44	16 ± 9	26	11 ± 7	24
617-1201-F1-C-011	**497** ± 299	470	**49** ± 18	44	9 ± 7	26	13 ± 7	24
617-1201-F1-C-012	463 ± 296	470	24 ± 12	44	17 ± 9	26	15 ± 8	24
617-1201-F1-C-013	**564** ± 303	470	**45** ± 17	44	15 ± 8	26	8 ± 6	24
617-1201-F1-C-014	**598** ± 306	470	34 ± 15	44	17 ± 9	26	11 ± 7	24
617-1201-F1-C-015	440 ± 294	470	41 ± 16	44	11 ± 7	26	7 ± 5	24
Summary for Survey Unit # 1201 (15 detail records)								
Average	432		36		16		13	
Minimum	271		17		7		2	
Maximum	598		57		34		30	
Standard Deviation	110		11		7		7	
Summary for Building # 617 (15 detail records)								
Avg	432		36		16		13	
Min	271		17		7		2	
Max	598		57		34		30	

Notes: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 618 Survey Unit 1201 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
618-1201-F1-C-001	294 ± 287	476	**45** ± 17	44	8 ± 6	26	15 ± 8	24
618-1201-F1-C-002	**610** ± 310	476	27 ± 13	44	17 ± 9	26	16 ± 8	24
618-1201-F1-C-003	**485** ± 301	476	42 ± 16	44	15 ± 8	26	15 ± 8	24
618-1201-F1-C-004	**587** ± 308	476	31 ± 14	44	19 ± 10	26	8 ± 6	24
618-1201-F1-C-005	452 ± 299	476	24 ± 12	44	24 ± 11	26	15 ± 8	24
618-1201-F1-C-006	**519** ± 303	476	23 ± 12	44	21 ± 10	26	11 ± 7	24
618-1201-F1-C-007	**564** ± 307	476	17 ± 10	44	12 ± 8	26	10 ± 6	24
618-1201-F1-C-008	**553** ± 306	476	22 ± 12	44	15 ± 8	26	13 ± 7	24
618-1201-F1-C-009	**553** ± 306	476	28 ± 13	44	17 ± 9	26	11 ± 7	24
618-1201-F1-C-010	418 ± 296	476	42 ± 16	44	24 ± 11	26	13 ± 7	24
618-1201-F1-C-011	**576** ± 307	476	**47** ± 17	44	25 ± 11	26	7 ± 5	24
618-1201-F1-C-012	**576** ± 307	476	38 ± 16	44	22 ± 10	26	11 ± 7	24
618-1201-F1-C-013	418 ± 296	476	33 ± 15	44	**29** ± 12	26	13 ± 7	24
618-1201-F1-C-014	440 ± 298	476	12 ± 9	44	16 ± 9	26	10 ± 6	24
618-1201-F1-C-015	384 ± 294	476	38 ± 16	44	21 ± 10	26	16 ± 8	24
Summary for Survey Unit # 1201 (15 detail records)								
Average	495		31		19		12	
Minimum	294		12		8		7	
Maximum	610		47		29		16	
Standard Deviation	91		11		5		3	
Summary for Building # 618 (15 detail records)								
Avg	495		31		19		12	
Min	294		12		8		7	
Max	610		47		29		16	

Notes: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 620 Survey Unit 1201 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
620-1201-F1-C-001	275 ± 240	394	32 ± 14	44	8 ± 6	26	8 ± 6	24
620-1201-F1-C-002	222 ± 236	394	33 ± 15	44	16 ± 9	26	15 ± 8	24
620-1201-F1-C-003	180 ± 232	394	12 ± 9	44	23 ± 11	26	13 ± 7	24
620-1201-F1-C-004	169 ± 231	394	24 ± 12	44	26 ± 11	26	8 ± 6	24
620-1201-F1-C-005	275 ± 240	394	5 ± 6	44	26 ± 11	26	16 ± 8	24
620-1201-F1-C-006	392 ± 250	394	13 ± 9	44	26 ± 11	26	10 ± 6	24
620-1201-F1-C-007	106 ± 226	394	34 ± 15	44	23 ± 11	26	16 ± 8	24
620-1201-F1-C-008	212 ± 235	394	23 ± 12	44	20 ± 10	26	11 ± 7	24
620-1201-F1-C-009	244 ± 238	394	22 ± 12	44	18 ± 9	26	13 ± 7	24
620-1201-F1-C-010	254 ± 239	394	24 ± 12	44	19 ± 10	26	15 ± 8	24
620-1201-F1-C-011	328 ± 245	394	14 ± 9	44	26 ± 11	26	10 ± 6	24
620-1201-F1-C-012	85 ± 224	394	23 ± 12	44	22 ± 10	26	11 ± 7	24
620-1201-F1-C-013	254 ± 239	394	22 ± 12	44	20 ± 10	26	13 ± 7	24
620-1201-F1-C-014	222 ± 236	394	16 ± 10	44	22 ± 10	26	11 ± 7	24
620-1201-F1-C-015	127 ± 227	394	17 ± 10	44	20 ± 10	26	7 ± 5	24
Summary for Survey Unit # 1201 (15 detail records)								
Average	223		21		21		12	
Minimum	85		5		8		7	
Maximum	392		34		26		16	
Standard Deviation	82		8		5		3	
Summary for Building # 620 (15 detail records)								
Avg	223		21		21		12	
Min	85		5		8		7	
Max	392		34		26		16	

Notes: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 630 Survey Unit 1201 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
630-1201-F1-M-001	-32 ± 213	394	11 ± 8	44	16 ± 9	26	10 ± 6	24
630-1201-F1-C-002	222 ± 236	394	18 ± 11	44	16 ± 9	26	10 ± 6	24
630-1201-F1-C-003	328 ± 245	394	35 ± 15	44	15 ± 8	26	10 ± 6	24
630-1201-F1-C-004	-148 ± 201	394	32 ± 14	44	15 ± 8	26	13 ± 7	24
630-1201-F1-C-005	-275 ± 188	394	11 ± 8	44	12 ± 8	26	11 ± 7	24
630-1201-F1-C-006	159 ± 230	394	21 ± 12	44	18 ± 9	26	16 ± 8	24
630-1201-F1-C-007	64 ± 222	394	38 ± 16	44	13 ± 8	26	5 ± 4	24
630-1201-F1-C-008	-106 ± 206	394	21 ± 12	44	20 ± 10	26	15 ± 8	24
630-1201-F1-C-009	-53 ± 211	394	28 ± 13	44	14 ± 8	26	11 ± 7	24
630-1201-F1-C-010	85 ± 224	394	22 ± 12	44	16 ± 9	26	10 ± 6	24
630-1201-B1-M-011	-180 ± 198	394	13 ± 9	44	22 ± 10	26	7 ± 5	24
630-1201-F1-C-012	-53 ± 211	394	25 ± 13	44	16 ± 9	26	13 ± 7	24
630-1201-F1-C-013	-11 ± 215	394	36 ± 15	44	18 ± 9	26	10 ± 6	24
630-1201-F1-C-014	-64 ± 210	394	20 ± 11	44	19 ± 10	26	13 ± 7	24
630-1201-F1-C-015	42 ± 220	394	27 ± 13	44	16 ± 9	26	13 ± 7	24
630-1201-B1-M-016	-297 ± 186	394	12 ± 9	44	15 ± 8	26	15 ± 8	24
Summary for Survey Unit # 1201 (16 detail records)								
Average	-20		23		16		11	
Minimum	-297		11		12		5	
Maximum	328		38		22		16	
Standard Deviation	169		9		3		3	

Notes: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 630 Survey Unit 1202 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
630-1202-F1-C-001	265 ± 239	394	23 ± 12	44	19 ± 10	26	3 ± 3	24
630-1202-F1-C-002	180 ± 232	394	31 ± 14	44	19 ± 10	26	13 ± 7	24
630-1202-F1-C-003	95 ± 225	394	22 ± 12	44	13 ± 8	26	16 ± 8	24
630-1202-F1-C-004	53 ± 221	394	23 ± 12	44	5 ± 5	26	16 ± 8	24
630-1202-F1-C-005	-21 ± 214	394	26 ± 13	44	**28** ± 12	26	15 ± 8	24
630-1202-F1-C-006	117 ± 226	394	16 ± 10	44	**30** ± 12	26	15 ± 8	24
630-1202-F1-C-007	-85 ± 208	394	34 ± 15	44	11 ± 7	26	10 ± 6	24
630-1202-F1-C-008	64 ± 222	394	14 ± 9	44	19 ± 10	26	15 ± 8	24
630-1202-F1-C-009	53 ± 221	394	16 ± 10	44	15 ± 8	26	18 ± 8	24
630-1202-F1-C-010	201 ± 234	394	14 ± 9	44	13 ± 8	26	10 ± 6	24
630-1202-F1-C-011	127 ± 227	394	29 ± 14	44	19 ± 10	26	15 ± 8	24
630-1202-F1-C-012	-117 ± 204	394	18 ± 11	44	20 ± 10	26	3 ± 3	24
630-1202-F1-C-013	42 ± 220	394	30 ± 14	44	14 ± 8	26	18 ± 8	24
630-1202-F1-C-014	-64 ± 210	394	23 ± 12	44	24 ± 11	26	15 ± 8	24
630-1202-F1-C-015	138 ± 228	394	27 ± 13	44	19 ± 10	26	10 ± 6	24
630-1202-F1-C-016	32 ± 219	394	19 ± 11	44	20 ± 10	26	10 ± 6	24
Summary for Survey Unit # 1202 (16 detail records)								
Average	68		23		18		13	
Minimum	-117		14		5		3	
Maximum	265		34		30		18	
Standard Deviation	105		6		6		5	
Summary for Building # 630 (32 detail records)								
Avg	24		23		17		12	
Min	-297		11		5		3	
Max	328		38		30		18	

Notes: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Structural Surfaces Survey Results

Building 663 Survey Unit 1201 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
663-1201-F1-C-001	316 ± 328	549	38 ± 16	44	26 ± 11	26	18 ± 8	24
663-1201-F1-W-002	-361 ± 280	549	22 ± 12	44	24 ± 11	26	16 ± 8	24
663-1201-F1-C-003	-260 ± 288	549	41 ± 16	44	15 ± 8	26	2 ± 3	24
663-1201-F1-C-004	-327 ± 282	549	44 ± 17	44	24 ± 11	26	7 ± 5	24
663-1201-F1-C-005	-361 ± 280	549	23 ± 12	44	20 ± 10	26	18 ± 8	24
663-1201-F1-C-006	-271 ± 287	549	38 ± 16	44	26 ± 11	26	21 ± 9	24
663-1201-F1-C-007	-260 ± 288	549	**50** ± 18	44	23 ± 11	26	8 ± 6	24
663-1201-F1-C-008	56 ± 311	549	44 ± 17	44	25 ± 11	26	11 ± 7	24
663-1201-F1-C-009	-45 ± 303	549	**51** ± 18	44	23 ± 11	26	8 ± 6	24
663-1201-F1-C-010	-350 ± 281	549	40 ± 16	44	20 ± 10	26	8 ± 6	24
663-1201-F1-C-011	-282 ± 286	549	43 ± 17	44	13 ± 8	26	8 ± 6	24
663-1201-F1-C-012	-214 ± 291	549	29 ± 14	44	**30** ± 12	26	11 ± 7	24
Summary for Survey Unit # 1201 (12 detail records)								
Average	-197		39		22		11	
Minimum	-361		22		13		2	
Maximum	316		51		30		21	
Standard Deviation	206		9		5		6	
Summary for Building # 663 (12 detail records)								
Avg	-197		39		22		11	
Min	-361		22		13		2	
Max	316		51		30		21	

Notes: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 617 Survey Unit DR01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
617-DR01-D2-M-001	±		27 ± 13	44	20 ± 10	26	10 ± 6	24
617-DR01-D2-M-002	±		33 ± 15	44	12 ± 8	26	7 ± 5	24
617-DR01-D3-M-003	±		24 ± 12	44	13 ± 8	26	21 ± 9	24
617-DR01-D3-M-004	±		25 ± 13	44	19 ± 10	26	13 ± 7	24
617-DR01-D3-M-005	±		25 ± 13	44	19 ± 10	26	8 ± 6	24
617-DR01-D2-M-006	±		32 ± 14	44	23 ± 11	26	20 ± 9	24
617-DR01-D3-M-007	±		**54** ± 19	44	20 ± 10	26	13 ± 7	24
617-DR01-D3-M-008	±		26 ± 13	44	17 ± 9	26	5 ± 4	24
617-DR01-D3-M-009	±		9 ± 8	44	23 ± 11	26	18 ± 9	24
617-DR01-D2-M-010	±		12 ± 9	44	20 ± 10	26	7 ± 5	24
617-DR01-D3-M-011	±		23 ± 12	44	9 ± 7	26	8 ± 6	24
617-DR01-D3-M-012	±		27 ± 13	44	13 ± 8	26	11 ± 7	24
617-DR01-D3-M-013	±		17 ± 10	44	25 ± 11	26	16 ± 8	24
617-DR01-D3-M-014	±		39 ± 16	44	20 ± 10	26	8 ± 6	24
617-DR01-D3-M-015	±		27 ± 13	44	18 ± 9	26	10 ± 6	24
617-DR01-D2-M-016	±		37 ± 15	44	20 ± 10	26	10 ± 6	24
617-DR01-D4-M-017	±		20 ± 11	44	12 ± 8	26	18 ± 9	24
617-DR01-D3-M-018	±		37 ± 15	44	13 ± 8	26	18 ± 9	24
617-DR01-D2-M-019	±		25 ± 13	44	25 ± 11	26	11 ± 7	24
617-DR01-D2-M-020	±		**49** ± 18	44	25 ± 11	26	18 ± 9	24
617-DR01-D3-M-021	±		39 ± 16	44	9 ± 7	26	8 ± 6	24
Summary for Survey Unit # DR01 (21 detail records)								
Average			29		18		12	
Minimum			9		9		5	
Maximum			54		25		21	
Standard Deviation			11		5		5	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 617 Survey Unit VE01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
617-VE01-E2-M-001	±		**45** ± 17	44	22 ± 10	26	**36** ± 12	24
617-VE01-E2-M-002	±		32 ± 14	44	24 ± 11	26	13 ± 7	24
617-VE01-E3-M-003	±		25 ± 13	44	18 ± 9	26	11 ± 7	24
617-VE01-E3-M-004	±		25 ± 13	44	16 ± 9	26	10 ± 6	24
617-VE01-E3-M-005	±		29 ± 14	44	20 ± 10	26	18 ± 9	24
617-VE01-E3-M-006	±		28 ± 13	44	11 ± 7	26	5 ± 4	24
617-VE01-E3-M-007	±		22 ± 12	44	15 ± 8	26	10 ± 6	24
617-VE01-E2-M-008	±		19 ± 11	44	13 ± 8	26	11 ± 7	24
617-VE01-E2-M-009	±		26 ± 13	44	19 ± 10	26	18 ± 9	24
617-VE01-E3-M-010	±		**48** ± 18	44	15 ± 8	26	10 ± 6	24
617-VE01-E3-M-011	±		**48** ± 18	44	13 ± 8	26	11 ± 7	24
Summary for Survey Unit # VE01 (11 detail records)								
Average			32		17		14	
Minimum			19		11		5	
Maximum			48		24		36	
Standard Deviation			11		4		8	
Summary for Building # 617 (32 detail records)								
Avg			30		18		13	
Min			9		9		5	
Max			54		25		36	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 618 Survey Unit DR01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
618-DR01-D3-M-001	±		44 ± 17	44	14 ± 8	26	13 ± 7	24
618-DR01-D3-M-002	±		11 ± 8	44	20 ± 10	26	8 ± 6	24
618-DR01-D3-M-003	±		24 ± 12	44	8 ± 6	26	8 ± 6	24
618-DR01-D3-M-004	±		34 ± 15	44	20 ± 10	26	10 ± 6	24
618-DR01-D2-M-005	±		**47** ± 17	44	14 ± 8	26	10 ± 6	24
618-DR01-D3-M-006	±		**45** ± 17	44	11 ± 7	26	7 ± 5	24
618-DR01-D3-M-007	±		20 ± 11	44	24 ± 11	26	11 ± 7	24
618-DR01-D3-M-008	±		34 ± 15	44	19 ± 10	26	10 ± 6	24
618-DR01-D3-M-009	±		28 ± 13	44	19 ± 10	26	7 ± 5	24
618-DR01-D3-M-010	±		**59** ± 19	44	11 ± 7	26	3 ± 3	24
Summary for Survey Unit # DR01 (10 detail records)								
Average			35		16		9	
Minimum			11		8		3	
Maximum			59		24		13	
Standard Deviation			14		5		3	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 618 Survey Unit VE01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
618-VE01-E2-M-001	±		17 ± 10	44	**30** ± 12	26	8 ± 6	24
618-VE01-E2-M-002	±		23 ± 12	44	9 ± 7	26	7 ± 5	24
618-VE01-E2-M-003	±		29 ± 14	44	7 ± 6	26	5 ± 4	24
618-VE01-E2-M-004	±		25 ± 13	44	20 ± 10	26	8 ± 6	24
618-VE01-E2-M-005	±		17 ± 10	44	22 ± 10	26	8 ± 6	24
618-VE01-E2-M-006	±		21 ± 12	44	16 ± 9	26	10 ± 6	24
618-VE01-E2-M-007	±		36 ± 15	44	18 ± 9	26	10 ± 6	24
618-VE01-E2-M-008	±		42 ± 16	44	24 ± 11	26	18 ± 9	24
618-VE01-E2-M-009	±		36 ± 15	44	26 ± 11	26	11 ± 7	24
618-VE01-E2-M-010	±		20 ± 11	44	11 ± 7	26	11 ± 7	24
618-VE01-E3-M-011	±		25 ± 13	44	12 ± 8	26	15 ± 8	24
Summary for Survey Unit # VE01 (11 detail records)								
Average			26		18		10	
Minimum			17		7		5	
Maximum			42		30		18	
Standard Deviation			8		7		4	
Summary for Building # 618 (21 detail records)								
Avg			30		17		9	
Min			11		7		3	
Max			59		30		18	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 620 Survey Unit DR01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
620-DR01-D3-M-001	±		14 ± 9	44	**29** ± 12	26	18 ± 9	24
620-DR01-D3-M-002	±		25 ± 13	44	26 ± 11	26	13 ± 7	24
620-DR01-D3-M-003	±		26 ± 13	44	12 ± 8	26	**25** ± 10	24
620-DR01-D3-M-004	±		13 ± 9	44	16 ± 9	26	21 ± 9	24
620-DR01-D3-M-005	±		34 ± 15	44	**27** ± 11	26	16 ± 8	24
620-DR01-D3-M-006	±		20 ± 11	44	18 ± 9	26	10 ± 6	24
620-DR01-D3-M-007	±		19 ± 11	44	18 ± 9	26	18 ± 9	24
620-DR01-D2-M-008	±		20 ± 11	44	15 ± 8	26	15 ± 8	24
620-DR01-D3-M-009	±		28 ± 13	44	15 ± 8	26	18 ± 9	24
620-DR01-D3-M-010	±		42 ± 16	44	7 ± 6	26	21 ± 9	24
620-DR01-D3-M-011	±		37 ± 15	44	17 ± 9	26	11 ± 7	24
620-DR01-D3-M-012	±		34 ± 15	44	9 ± 7	26	18 ± 9	24
620-DR01-D3-M-013	±		39 ± 16	44	19 ± 10	26	11 ± 7	24
620-DR01-D3-M-014	±		**49** ± 18	44	11 ± 7	26	11 ± 7	24
620-DR01-D3-M-015	±		24 ± 12	44	22 ± 10	26	15 ± 8	24
620-DR01-D3-M-016	±		27 ± 13	44	13 ± 8	26	10 ± 6	24
620-DR01-D3-M-017	±		28 ± 13	44	17 ± 9	26	16 ± 8	24
620-DR01-D3-M-018	±		23 ± 12	44	16 ± 9	26	7 ± 5	24
620-DR01-D3-M-019	±		33 ± 15	44	25 ± 11	26	10 ± 6	24
620-DR01-D3-M-020	±		35 ± 15	44	18 ± 9	26	11 ± 7	24
Summary for Survey Unit # DR01 (20 detail records)								
Average			29		18		15	
Minimum			13		7		7	
Maximum			49		29		25	
Standard Deviation			9		6		5	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 620 Survey Unit VE01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
620-VE01-E2-M-001	±		**46** ± 17	44	14 ± 8	26	13 ± 7	24
620-VE01-E2-M-002	±		25 ± 13	44	13 ± 8	26	13 ± 7	24
620-VE01-E2-M-003	±		35 ± 15	44	9 ± 7	26	15 ± 8	24
620-VE01-E2-M-004	±		29 ± 14	44	15 ± 8	26	5 ± 4	24
620-VE01-E2-M-005	±		33 ± 15	44	22 ± 10	26	18 ± 9	24
620-VE01-E2-M-006	±		25 ± 13	44	12 ± 8	26	13 ± 7	24
620-VE01-E2-M-007	±		22 ± 12	44	14 ± 8	26	7 ± 5	24
620-VE01-E2-M-008	±		27 ± 13	44	20 ± 10	26	13 ± 7	24
620-VE01-E2-M-009	±		23 ± 12	44	11 ± 7	26	16 ± 8	24
620-VE01-E2-M-010	±		34 ± 15	44	16 ± 9	26	10 ± 6	24
620-VE01-E2-M-011	±		30 ± 14	44	11 ± 7	26	15 ± 8	24
620-VE01-E3-M-012	±		31 ± 14	44	18 ± 9	26	15 ± 8	24
620-VE01-E2-M-013	±		21 ± 12	44	17 ± 9	26	20 ± 9	24
620-VE01-E2-M-014	±		**49** ± 18	44	**27** ± 11	26	13 ± 7	24
620-VE01-E2-M-015	±		36 ± 15	44	25 ± 11	26	13 ± 7	24
620-VE01-E2-M-016	±		13 ± 9	44	18 ± 9	26	5 ± 4	24
620-VE01-E2-M-017	±		18 ± 11	44	19 ± 10	26	24 ± 10	24
620-VE01-E2-M-018	±		40 ± 16	44	22 ± 10	26	11 ± 7	24
620-VE01-E2-M-019	±		25 ± 13	44	**27** ± 11	26	13 ± 7	24
620-VE01-E2-M-020	±		33 ± 15	44	16 ± 9	26	13 ± 7	24
620-VE01-E2-M-021	±		25 ± 13	44	17 ± 9	26	16 ± 8	24
Summary for Survey Unit # VE01 (21 detail records)								
Average			30		17		13	
Minimum			13		9		5	
Maximum			49		27		24	
Standard Deviation			9		5		4	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Summary for Building # 620 (41 detail records)			
Avg	29	17	14
Min	13	7	5
Max	49	29	25

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 630 Survey Unit DR01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
630-DR01-D2-M-001	±		26 ± 13	44	19 ± 10	26	16 ± 8	24
630-DR01-D2-M-002	±		27 ± 13	44	**27** ± 11	26	16 ± 8	24
630-DR01-D2-M-003	±		12 ± 9	44	22 ± 10	26	16 ± 8	24
630-DR01-D2-M-004	±		37 ± 15	44	16 ± 9	26	11 ± 7	24
630-DR01-D2-M-005	±		11 ± 8	44	26 ± 11	26	11 ± 7	24
630-DR01-D2-M-006	±		38 ± 16	44	18 ± 9	26	10 ± 6	24
630-DR01-D3-M-007	±		40 ± 16	44	19 ± 10	26	20 ± 9	24
630-DR01-D3-M-008	±		35 ± 15	44	**33** ± 13	26	13 ± 7	24
630-DR01-D3-M-009	±		37 ± 15	44	15 ± 8	26	10 ± 6	24
630-DR01-D2-M-010	±		14 ± 9	44	**29** ± 12	26	11 ± 7	24
630-DR01-D2-M-011	±		35 ± 15	44	18 ± 9	26	10 ± 6	24
630-DR01-D2-M-012	±		32 ± 14	44	16 ± 9	26	8 ± 6	24
630-DR01-D2-M-013	±		19 ± 11	44	19 ± 10	26	13 ± 7	24
630-DR01-D2-M-014	±		33 ± 15	44	23 ± 11	26	15 ± 8	24
630-DR01-D2-M-015	±		30 ± 14	44	19 ± 10	26	14 ± 8	24
630-DR01-D3-M-016	±		18 ± 11	44	**29** ± 12	26	18 ± 9	24
630-DR01-D2-M-017	±		13 ± 9	44	15 ± 8	26	5 ± 4	24
630-DR01-D3-M-018	±		34 ± 15	44	18 ± 9	26	8 ± 6	24
630-DR01-D2-M-019	±		44 ± 17	44	16 ± 9	26	13 ± 7	24
630-DR01-D2-M-020	±		17 ± 10	44	21 ± 10	26	15 ± 8	24
630-DR01-D4-M-021	±		28 ± 13	44	15 ± 8	26	13 ± 7	24
630-DR01-D2-M-022	±		**49** ± 18	44	18 ± 9	26	11 ± 7	24
630-DR01-D3-M-023	±		**49** ± 18	44	15 ± 8	26	11 ± 7	24
630-DR01-D3-M-024	±		19 ± 11	44	16 ± 9	26	11 ± 7	24

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 630 Survey Unit DR01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
630-DR01-D3-M-025	±		27 ± 13	44	19 ± 10	26	7 ± 5	24
630-DR01-D3-M-026	±		**47** ± 17	44	18 ± 9	26	5 ± 4	24
630-DR01-D3-M-027	±		20 ± 11	44	25 ± 11	26	20 ± 9	24
630-DR01-D3-M-028	±		31 ± 14	44	**27** ± 11	26	11 ± 7	24
630-DR01-D2-M-029	±		27 ± 13	44	15 ± 8	26	8 ± 6	24
630-DR01-D3-M-030	±		22 ± 12	44	24 ± 11	26	11 ± 7	24
630-DR01-D3-M-031	±		19 ± 11	44	14 ± 8	26	10 ± 6	24
630-DR01-D3-M-032	±		34 ± 15	44	11 ± 7	26	18 ± 9	24
630-DR01-D3-M-033	±		**79** ± 22	44	12 ± 8	26	**25** ± 10	24
630-DR01-D3-M-034	±		36 ± 15	44	16 ± 9	26	20 ± 9	24
630-DR01-D3-M-035	±		27 ± 13	44	20 ± 10	26	8 ± 6	24
630-DR01-D2-M-036	±		22 ± 12	44	11 ± 7	26	11 ± 7	24
630-DR01-D3-M-037	±		15 ± 10	44	25 ± 11	26	20 ± 9	24
630-DR01-D2-M-038	±		28 ± 13	44	11 ± 7	26	5 ± 4	24
630-DR01-D2-M-039	±		35 ± 15	44	20 ± 10	26	10 ± 6	24
630-DR01-D2-M-040	±		35 ± 15	44	15 ± 8	26	15 ± 8	24
Summary for Survey Unit # DR01 (40 detail records)								
Average			30		19		13	
Minimum			11		11		5	
Maximum			79		33		25	
Standard Deviation			13		5		5	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 630 Survey Unit VE01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
630-VE01-E2-M-001	±		35 ± 15	44	20 ± 10	26	8 ± 6	24
630-VE01-E2-M-002	±		39 ± 16	44	14 ± 8	26	7 ± 5	24
630-VE01-E2-M-003	±		41 ± 16	44	19 ± 10	26	11 ± 7	24
630-VE01-E2-M-004	±		12 ± 9	44	24 ± 11	26	18 ± 9	24
630-VE01-E2-M-005	±		42 ± 16	44	18 ± 9	26	15 ± 8	24
630-VE01-E2-M-006	±		24 ± 12	44	19 ± 10	26	18 ± 9	24
630-VE01-E2-M-007	±		39 ± 16	44	15 ± 8	26	21 ± 9	24
630-VE01-E2-M-008	±		44 ± 17	44	11 ± 7	26	13 ± 7	24
630-VE01-E2-M-009	±		40 ± 16	44	17 ± 9	26	7 ± 5	24
630-VE01-E2-M-010	±		37 ± 15	44	**28** ± 12	26	20 ± 9	24
630-VE01-E2-M-011	±		33 ± 15	44	**30** ± 12	26	15 ± 8	24
630-VE01-E2-M-012	±		41 ± 16	44	8 ± 6	26	15 ± 8	24
630-VE01-E2-M-013	±		24 ± 12	44	26 ± 11	26	15 ± 8	24
630-VE01-E2-M-014	±		**52** ± 18	44	19 ± 10	26	8 ± 6	24
630-VE01-E2-M-015	±		**52** ± 18	44	11 ± 7	26	8 ± 6	24
630-VE01-E2-M-016	±		27 ± 13	44	12 ± 8	26	8 ± 6	24
630-VE01-E2-M-017	±		20 ± 11	44	23 ± 11	26	8 ± 6	24
630-VE01-E2-M-018	±		33 ± 15	44	23 ± 11	26	7 ± 5	24
630-VE01-E2-M-019	±		17 ± 10	44	17 ± 9	26	8 ± 6	24
630-VE01-E2-M-020	±		30 ± 14	44	**28** ± 12	26	10 ± 6	24
630-VE01-E2-M-021	±		22 ± 12	44	20 ± 10	26	11 ± 7	24
630-VE01-E2-M-022	±		37 ± 15	44	26 ± 11	26	16 ± 8	24
630-VE01-E2-M-023	±		21 ± 12	44	22 ± 10	26	3 ± 3	24
630-VE01-E2-M-024	±		20 ± 11	44	17 ± 9	26	16 ± 8	24

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Systems Survey Results

Building 630 Survey Unit VE01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
630-VE01-E2-M-025	±		43 ± 17	44	9 ± 7	26	16 ± 8	24
630-VE01-E2-M-026	±		43 ± 17	44	**30** ± 12	26	20 ± 9	24
630-VE01-E2-M-027	±		31 ± 14	44	18 ± 9	26	**28** ± 11	24
630-VE01-E3-M-028	±		42 ± 16	44	19 ± 10	26	12 ± 7	24
630-VE01-E2-M-029	±		16 ± 10	44	14 ± 8	26	20 ± 9	24
630-VE01-E2-M-030	±		19 ± 11	44	16 ± 9	26	13 ± 7	24
630-VE01-E3-M-031	±		**48** ± 18	44	**28** ± 12	26	11 ± 7	24
Summary for Survey Unit # VE01 (31 detail records)								
Average			33		19		13	
Minimum			12		8		3	
Maximum			52		30		28	
Standard Deviation			11		6		6	
Summary for Building # 630 (71 detail records)								
Avg			31		19		13	
Min			11		8		3	
Max			79		33		28	

Building 663 Survey Unit VE01 Class

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
663-VE01-E3-M-001	±		27 ± 13	44	20 ± 10	26	16 ± 8	24
Summary for Survey Unit # VE01 (1 detail record)								
Average			27		20		16	
Minimum			27		20		16	
Maximum			27		20		16	
Standard Deviation								
Summary for Building # 663 (1 detail record)								
Avg			27		20		16	
Min			27		20		16	
Max			27		20		16	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.

Quality Assurance Survey Results

Building 663 Survey Unit QA01 Class 2

Location Code	Total Activity Measurements		Removable Activity Measurements					
			Channel 1		Channel 2		Channel 3	
	Activty	MDC	Activity	MDC	Activity	MDC	Activity	MDC
663-QA01-F1-C-001	**483** ± 289	455	32 ± 14	44	13 ± 8	26	8 ± 6	24
663-QA01-F1-W-002	-67 ± 245	455	7 ± 7	44	20 ± 10	26	20 ± 9	24
663-QA01-F1-W-003	-146 ± 238	455	11 ± 8	44	22 ± 10	26	16 ± 8	24
663-QA01-F1-W-004	-79 ± 244	455	10 ± 8	44	**28** ± 12	26	7 ± 5	24
663-QA01-F1-W-005	34 ± 254	455	39 ± 16	44	14 ± 8	26	10 ± 6	24
663-QA01-F1-W-006	-45 ± 247	455	27 ± 13	44	15 ± 8	26	15 ± 8	24
663-QA01-F1-W-007	-101 ± 242	455	17 ± 10	44	16 ± 9	26	16 ± 8	24
663-QA01-F1-C-008	-11 ± 250	455	19 ± 11	44	26 ± 11	26	20 ± 9	24
663-QA01-F1-C-009	**471** ± 288	455	18 ± 11	44	20 ± 10	26	13 ± 7	24
663-QA01-F1-W-010	-79 ± 244	455	43 ± 17	44	17 ± 9	26	11 ± 7	24
663-QA01-F1-W-011	-34 ± 248	455	2 ± 4	44	20 ± 10	26	8 ± 6	24
663-QA01-F1-W-012	-123 ± 240	455	25 ± 13	44	16 ± 9	26	13 ± 7	24
Summary for Survey Unit # QA01 (12 detail records)								
Average	25		21		19		13	
Minimum	-146		2		13		7	
Maximum	483		43		28		20	
Standard Deviation	216		13		5		4	
Summary for Building # 663 (12 detail records)								
Avg	25		21		19		13	
Min	-146		2		13		7	
Max	483		43		28		20	

Note: All total activity results reported in net dpm/100cm^2. All removable activity results reported in dpm/100cm^2. Results above MDC are in bold print. Results above investigation levels are in red print.