NRC FORM 313 (06-2016)
10 CFR 30, 32, 33, 34 35, 36, 37, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS LICENSE

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1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- ☐ A. NEW LICENSE
- ☑ B. AMENDMENT TO LICENSE NUMBER 21-01432-02
- ☐ C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

Central Michigan University
Office of Research and Graduate Studies
Foust Hall 251
Mount Pleasant, MI 48859

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Brooks Hall, Dow Science Complex, CART Building (102, 111), Health Professions Building (2303, 2305, 2309, 2307, 2307A, 2302, 2302A, 2302B, 1320A, 1320B), Research Laboratory Facility (126, 127, 131, 132, 133, 142), Biosciences Building (1038A, 4327, 4327A)

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Jennifer Walton

BUSINESS TELEPHONE NUMBER	BUSINESS CELLULAR TELEPHONE NUMBER
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BUSINESS EMAIL ADDRESS
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SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES (Fees required only for new applications, with few exceptions*) *(See 10 CFR 170 and Section 170.31)*
***Amendments/Renewals that increase the scope of the existing license to a new or higher fee category will require a fee.**

FEE CATEGORY: exempt AMOUNT ENCLOSED: $ 0.00

13. CERTIFICATION. *(Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.*

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35 , 36, 37, 39, AND 40, AND THAT ALL INFORMATION CONTANED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.
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CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
David Ash, Ph.D., Interim Vice President for Research and Dean of Graduate Studies	David Ash	2/10/17

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NRC FORM 313 (06-2016)

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CMU Amendment Request

Section 9. Facilities and Equipment.

CMU requests the removal of the following buildings from the NRC license (located in line 10 of the license):

1. **Brooks Hall**
2. **CART Building (Rooms 102 and 111)**

The close out radiological surveys for both buildings are attached.

Central Michigan University
CART Building
Final Status Report

NRC License Number 21-01432-02

January 17, 2017

Prepared:	Mike Culp	Project Manager	Date:	1-17-17
Approved:	Dave Culp	Field Services Manager	Date:	1-31-17
Approved:	Jennifer Walton	Central Michigan University Radiation Safety Officer	Date:	2-2-17

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APPENDICES

Appendix A – Site Satellite Photo
Appendix B – Building Floor Plans
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Appendix F – Structural Surfaces Final Status Survey Results
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ACRONYMS

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
CMU	Central Michigan University
DCGL	Derived Concentration Guideline Level
$DCGL_{EMC}$	Derived Concentration Guideline Level – Elevated Measurement Comparison
$DCGL_W$	Derived Concentration Guideline Level – Wilcoxon Rank Sum
DQO	Data Quality Objective
DSV	Default Screening Value
FSS	Final Status Survey
FSSR	Final Status Survey Report
LBGR	Lower Bound of the Gray Region
LSC	Liquid Scintillation Counter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NRC	U.S. Nuclear Regulatory Commission
NIST	National Institute of Standards and Technology
QA	Quality Assurance
TEDE	Total Effective Dose Equivalent

1.0 INTRODUCTION

Central Michigan University (CMU) has decided to permanently cease licensed activities within the CART building located at 2625 Denison Drive on the CMU campus in Mount Pleasant, MI 48859. CMU will decommission the CART building, listed as an authorized usage area under NRC license number 21-01432-02, and release for unrestricted use. A site satellite photo is presented in Appendix A.

Radioactive materials used at the facility consisted of beta emitting radionuclides for research. Based on an analysis of the default screening values (DSVs), quantities used, physical forms, half-lives, and receipt and distribution records, only C-14 and H-3 are of concern for decommissioning.

CMU contracted Chase Environmental Group, Inc. (Chase) to perform third party verification of closeout procedures. The survey design 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). Final status surveys (FSS) were designed to implement the protocols and guidance provided in MARSSIM to demonstrate compliance with NRC default screening values (DSV). These methods ensured technically defensible data were generated to aid in determining whether or not the facility meets the release criteria for unrestricted use specified in 10 CFR 20 Subpart E.

CMU established conservative ALARA goals for building structural surfaces and systems based on the release criteria specified in NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment." Specifically, the following surface contamination goals were used:

- 5,000 dpm/100 cm^2 total surface contamination
- 200 dpm/100 cm^2 removable surface contamination

On-site activities were performed on December 14, 2016. No elevated activity above the investigation levels were identified during facility characterization surveys.

This report presents sufficient data to conclude the facility is suitable for unrestricted release in accordance with NRC requirements. Final status surveys demonstrate that building structural surfaces and systems included in the scope of this report are below release criteria and are suitable for unrestricted release. All final status surface activity measurements were a small fraction of the DSVs. Based on the Building Occupancy Scenario of NRC DandD dose modeling software Version 2.1, **the Total Effective Dose Equivalent (TEDE) to an average member of the critical group is 0.003 mrem/year (<0.012% of the release criterion of 25 mrem/yr).**

2.0 FACILITY DESCRIPTION AND HISTORY

The CART building is located on the campus of Central Michigan University at 2625 Denison Dr. The facility was constructed in 2001 and is a single-story steel frame building. Interior walls are made of sheetrock. Floors are poured concrete covered with vinyl sheeting. A mezzanine mechanical room houses heating, ventilation and air conditioning equipment.

Licensed activities at the facility commenced in August 2013 and were limited to rooms 102 and 111. Tracer studies using sodium bicarbonate and leucine were conducted in room 102. Room 111 was used for radioactive waste storage only. A total of 880 µCi C-14 and 3,300 µCi H-3 were used/stored in the rooms, and there is no history of prior spills or uncontrolled releases.

Room 102 is fitted with two fume hoods (each with two exhaust ducts and two cup sinks), laboratory casework and one sink. Room 111 contains an autoclave with an exhaust duct and drain.

Drains discharge directly from the building without retention or treatment. There is no central vacuum system. Exhaust ventilation is provided primarily via the fume hood exhausts. The hood exhaust ducts combine into a common plenum for the entire building and the flow from the hoods is a very small fraction of the building exhaust flow.

A building floor plan is provided as Appendix B.

2.1 Potential Contaminants

The table below lists the nuclides used in dispersible form.

Table 2-1: Radionuclides Used in Dispersible Form

Nuclide	Half-life (years)	Predominant Emission
C-14	5.7E+03	Low Energy Beta
H-3	1.2E+01	Low Energy Beta

2.2 License History

The facility has been in operation under a radioactive materials license since the mid 1960's. The current license was renewed in entirety on May 8, 2012, and is currently on Amendment 39 dated August 18, 2016 with an expiration date of May 31, 2022.

2.3 Previous Decommissioning Activities

There are no previous decommissioning activities.

3.0 CURRENT/FUTURE USE

CART building is currently partially occupied as a result of occupants moving to a newly constructed research building and no licensed activities are being performed at the facility. CMU plans to retain CART building for future non-radioactive materials use after decommissioning.

4.0 FACILITY RELEASE CRITERIA

The radiological release criteria are specified in NRC 10 CFR 20 Subpart E. Specifically, impacted areas of the facility 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." The criteria are that residual radioactivity results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

5.0 NUCLIDES OF CONCERN

After considering quantities used, half-lives, and dates of usage of licensed materials, only C-14 and H-3 are of concern for decommissioning.

Table 5-1: Nuclides of Concern for Decommissioning

Nuclide	Half-life (years)	Predominant Emissions
C-14	5.7E+03	Low Energy Beta
H-3	1.2E+01	Low Energy Beta

6.0 DERIVED CONCENTRATION GUIDELINE LEVELS

The NRC has published DSVs in NUREG 1757, Volume 1, Appendix B for commonly used radionuclides. Screening values for the nuclides of concern are provided in the table below.

Table 6-1: Default Screening Values for Nuclides of Concern

Nuclide	Half-life (years)	Predominant Emissions	Default Screening Value ($dpm/100\ cm^2$)
C-14	5.7E+03	Low Energy Beta	3.7E+06
H-3	1.2E+01	Low Energy Beta	1.2E+08

The DSV's are the basis for developing the derived concentration guideline levels (DCGL's). The DCGL is the radionuclide specific surface activity concentration that could result in a dose equal to the release criterion. $DCGL_W$ is the concentration if the residual activity is essentially evenly distributed over a large area. For this project, $DCGL_W$ is equal to the DSV. In the case of non-uniform contamination, MARSSIM allows for evaluation of

higher levels of permissible activity over small areas using the $DCGL_{EMC}$. Due to the radiological cleanliness of the facility, $DCGL_{EMC}$ is not used. Additionally, due to the conservative ALARA goal, application of the unity rule for multiple radionuclides is not required to demonstrate compliance with the release criteria.

An important assumption of the dose model is that removable contamination is <10% of total contamination. Historical survey results as well as characterization, final status and quality assurance (QA) survey results confirm that removable contamination levels are very low and meet this assumption. H-3 cannot be accurately detected directly by field instrumentation due to its low energy. Therefore, H-3 contamination was evaluated by removable contamination measurements only.

7.0 ALARA GOALS (INVESTIGATION LEVELS)

CMU established conservative ALARA goals 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 used:

- 5,000 dpm/100 cm^2 total surface contamination
- 200 dpm/100 cm^2 removable surface contamination

Because of the conservatism of the ALARA goals, these criteria were applied to gross beta measurements and the unity rule was not applied. The number of measurements required by MARSSIM to demonstrate compliance with the release criteria was calculated using the $DCGL_W$.

8.0 ALARA ANALYSIS

Due to the extremely low doses associated with residual radioactivity at the facility, a quantitative ALARA analysis was not required. Default screening values were used to establish DCGLs.

NUREG 1757, Volume 2, Appendix N states in part: "For ALARA during decommissioning, all licensees should use typical good-practice efforts such as floor and wall washing, removal of readily removable radioactivity in buildings or in soil areas, and other good housekeeping practices. In addition, licensees should provide a description in the Final Status Survey Report (FSSR) of how these practices were employed to achieve the final activity levels. In light of the conservatism in the building surface and surface soil generic screening levels developed by NRC, NRC staff presumes, absent information to the contrary, that licensees who remediate building surfaces or soil to the generic screening levels do not need to provide analyses to demonstrate that these screening levels are ALARA. In addition, if residual radioactivity cannot be detected, it may be assumed that it has been reduced to levels that are ALARA. Therefore, the licensee may not need to conduct an explicit analysis to meet the ALARA requirement."

9.0 SURVEY INSTRUMENTATION

9.1 Instrument Calibration

Laboratory and portable field instruments were calibrated within the previous year with National Institute of Standards and Technology (NIST) traceable sources to radiation emission types and energies to provide detection capabilities similar to the nuclides of concern. Portable instrument calibration records are included as Appendix C.

9.2 Functional Checks

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.

Daily functional checks of the liquid scintillation counter consisted of performing the instrument's automatic quality assurance protocol that utilizes H-3 and C-14 sources as well as a background standard.

9.3 Minimum Detectable Concentrations

Minimum counting times for background determinations and measurement of total and removable contamination were chosen to provide a minimum detectable concentration (MDC) that met the data quality objectives (DQOs). MARSSIM equations relative to building surfaces have been modified to convert to units of dpm/100 cm^2. Count times and scanning rates are determined using the following equations:

9.3.1 Static Counting

Static counting Minimum Detectable Concentration at a 95% confidence level is 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):

$$MDC_{static} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E_{tot} \cdot \frac{A}{100cm^2}}$$

Where:

MDC_{static} = minimum detectable concentration (dpm/100 cm^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 C-14 using the Ludlum Model 43-68 gas flow proportional detector is shown below:

$$MDC_{STATIC} = \frac{3 + 3.29\sqrt{(500)(.1)\left(1+\frac{0.1}{0.1}\right)}}{(0.1)(0.075)\frac{126}{100}} = 3{,}799\,\text{dpm}/100\,\text{cm}^2$$

9.3.2 Ratemeter Scanning

Scanning Minimum Detectable Concentration at a 95% confidence level is 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/100 cm^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 C-14 using the Ludlum 43-37 gas flow proportional detector is shown below:

$$i = 13.3\,\text{cm} \cdot \frac{\text{inch}}{2.54\,\text{cm}} \cdot \frac{\text{sec}}{20\,\text{inch}} \cdot = 0.262\,\text{sec}$$

$$b_i = 0.262\,\text{sec} \cdot \frac{1500\,\text{counts}}{\text{minute}} \cdot \frac{\text{minute}}{60\,\text{sec}} = 6.55\,\text{counts}$$

$$MDC_{SCAN} = \frac{1.38\sqrt{6.55}\left(\frac{60}{0.262}\right)}{\left(\sqrt{0.5}\right)(0.075)\left(\frac{584}{100}\right)} = 2{,}612\ \text{dpm}/100\ \text{cm}^2$$

9.3.3 Smear Counting

Smear counting Minimum Detectable Concentration at a 95% confidence level is calculated using the following equation, which is NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", 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 level (dpm/smear)
B_r = background count rate (counts per minute)
t_b = background count time (minutes)
t_s = sample count time (minutes)
E = instrument efficiency for radionuclide emission of interest (cpm/dpm)

The liquid scintillation counter was setup to count samples in three channels as described in Section 14.4. The MDC calculation for each LSC channel using conservative parameters is shown below. Even though channel 3 results were used qualitatively, the MDCR was calculated for evaluation of survey results. To use the same MDC equation for all three LSC channels, the efficiency for Channel 3 is set to 1 to report MDCR in cpm.

$$^{3}\text{H MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(15)(1)\left(1+\frac{1}{1}\right)}}{(1)(0.6)} = 35 \text{ dpm}$$

$$^{14}\text{C MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(25)(1)\left(1+\frac{1}{1}\right)}}{(1)(0.8)} = 33 \text{ dpm}$$

$$\text{Channel3 MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(50)(1)\left(1+\frac{1}{1}\right)}}{(1)(1)} = 36 \text{ cpm}$$

Because the counting efficiency is different for each LSC measurement depending on quench characteristics, and in consideration of the errors associated with wipe counting (i.e., area wiped, wiping pressure, etc.), the *a priori* estimates of smear MDCs calculated above are applied to all removable contamination measurements.

9.4 Uncertainty

The uncertainty for each static measurement is 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.

9.5 Instrumentation Specifications

The instrumentation used for facility decommissioning surveys is summarized in the following tables.

Table 9-1: Instrumentation Specifications

Detector Model	Detector Type	Detector Area	Meter Model	Window Thickness	Typical Efficiency
Ludlum 43-68	Gas Flow Proportional	126 cm^2	Ludlum 2241-3	0.8 mg/cm^2	7.5 % (C-14)
Ludlum 43-37	Gas Flow Proportional	584 cm^2	Ludlum 2241-3	0.8 mg/cm^2	7.5 % (C-14)
Packard TriCarb	Liquid Scintillation	N/A	N/A	N/A	60% (H-3) 80% (C-14)

Table 9-2: Typical Instrument Operating Parameters and Sensitivities

Measurement Type	Detector Model	Max. Scan Rate[1]	Count Time	Background (cpm)	MDC (dpm/100 cm^2)
Surface Scans	Ludlum 43-68	5 in./sec.	N/A	500	4,297 (C-14)
Surface Scans	Ludlum 43-37	20 in./sec.	N/A	1,500	2,612 (C-14)
Total Surface Activity	Ludlum 43-68	N/A	6 sec.	500	3,799 (C-14)
Total Surface Activity	Ludlum 43-37	N/A	6 sec.	1,500	1,370 (C-14)
Removable Activity	Packard TriCarb	N/A	60 sec.	15 (H-3) 25 (C-14)	35 (H-3) 33 (C-14)

9.6 Efficiency Determination

ISO 7503-1 methods were used for the limiting nuclide (C-14) to determine field concentrations for final status data and calculation of resultant doses from residual radioactivity. MARSSIM protocols for building structures use ISO-7503-1 methodology that takes into account the texture of the surface and the 2π detector efficiency. Under MARSSIM, the default surface efficiency for beta emitters with maximum energies less than 400 keV is conservatively set at 0.25.

9.7 Datalogging

Structural surface scans and static measurements were performed using datalogging instrumentation. While scanning, in addition to the surveyor listening to the audible output, integrated counts were recorded. Logged data were downloaded and processed using data management software to perform data analyses and reporting. Reporting

[1] Maximum scan rates are calculated based on the instrument MDCs. Actual scan rates were much slower.

includes graphical (4-plot) presentation of scan data as well as summary statistics functions. The 4-Plot is described in the NIST e-Handbook of Statistical Methods (http://www.itl.nist.gov/div898/handbook/index.htm).

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. Non-random structure in the lag plot indicates that the underlying data are not random.
- 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 are 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

10.0 DATA QUALITY OBJECTIVES (DQO)

The following is a list of the major DQOs for the survey design:

- Static measurements were taken to achieve an MDC_{static} of less than the ALARA goal of 5,000 dpm/100 cm^2.
- Scanning was conducted at a rate to achieve an MDC_{scan} of less than the ALARA goal of 5,000 dpm/100 cm^2.
- Removable contamination measurements were counted to an MDC_{smear} of less than 200 dpm/100 cm^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 alternative hypothesis (H_A) are that of NUREG 1505 scenario A:
  - H_0 is that the survey unit does not meet the release criteria
  - H_A is that the survey unit meets the release criteria
- Characterization and remedial action support surveys were conducted under the same quality assurance criteria as final status surveys such that the data may be used as final status survey data to the maximum extent possible.

11.0 AREA CLASSIFICATIONS

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

11.1 Non-Impacted Area

Non-impacted areas were 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
- Internal surfaces of positively pressurized systems (air, gas, water, etc.)
- Surface and subsurface soils of outside grounds
- Areas with no history of radioactive materials usage

Laboratory work was performed on benchtops or within fume hoods and no volatile work was performed; therefore, there is no reasonable probability for residual radioactivity above a two-meter height. Based on historical operations, a potential existed for residual contamination from spills or tracking on surfaces less than two meters in height. Thorough surveys of impacted area entrances/exits and ventilation exhausts were conducted during characterization to provide adequate assurance that any residual contamination was contained within impacted areas.

11.2 Impacted Areas

Impacted areas were those areas that had potential residual radioactivity from licensed activities. Impacted areas are subdivided into Class 1, Class 2 or Class 3 areas. Class 1 areas have the greatest potential for contamination and therefore receive the highest degree of survey effort for the final status survey using a graded approach, followed by Class 2, and then by Class 3. Impacted sub-classifications are defined as follows:

11.2.1 Class 1 Area

Areas with the highest potential for contamination, and meet the following criteria: (1) impacted; (2) potential for delivering a dose above the release criterion; (3) potential for small areas of elevated activity; and (4) insufficient evidence to support classification as Class 2 or Class 3.

There are no Class 1 areas.

11.2.2 Class 2 Area

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.

Areas with a history of radioactive materials usage were classified as Class 2.

11.2.3 Class 3 Area

Areas that meet the following criteria: (1) impacted; (2) little or no potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.

There are no Class 3 areas.

11.3 Survey Units

A survey unit is a geographical area of specified size and shape for which a separate decision is made whether or not that area meets the release criteria. A survey unit is normally a portion of a building or site that is surveyed, evaluated, and released as a single unit.

The number of discrete sampling locations needed to determine if a uniform level of residual radioactivity exists within a survey unit does not depend on the survey unit size. However, the sampling density should reflect 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.

Survey Unit Numbering Protocol
Each survey unit is assigned a unique number consisting of the building number followed by a dash and a four digit identifier. The four digit identifier consists of one digit for the elevation, one digit for the classification, and two digits as a numerical identifier in the event the first 2 digits are the same for two or more survey units using the format below:

Building Number – Elevation/Classification/Numerical Identifier

The default numeric identifier is 01

Buildings:
CRT = CART Building

Elevations:
1 = 1st Floor

Building systems survey units were arranged by building and system type. There are two types of systems – ventilation and drain. Each system survey unit encompasses all of a certain type within impacted areas of the building.

Systems Components:
DR – Drain
VE – Ventilation

Examples:
CRT-1201 is CART building, first floor, Class 2
CRT-DR01 is CART building drains

Survey unit classifications and designations were determined from the historical site assessment and are listed in the tables below. Survey unit designations are presented on the building floor plans presented in Appendix B and listed in the tables below.

Table 11-1: Building Structural Survey Units

Survey Unit	Description	Floor Area (ft^2)	Percent of Maximum Recommended Floor Area
CRT-1201	Rooms 102 & 111	696	6.5

Table 11-2: Building Systems Survey Units

Survey Unit	Description
CRT-DR01	Drain System
CRT-VE01	Ventilation System

12.0 CHARACTERIZATION SURVEYS

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 areas of highest probability for residual radioactivity. Judgmental static measurements and smears were taken on vertical surfaces as part of the Class 2 final status survey protocols described in section 14.3.5.

The purpose of scanning was to identify locations of elevated activity. The minimum scan percentages are presented in section 14.2. Scanning was performed by moving the probe over surfaces at a distance of approximately 0.5 cm or less and at a rate less than the maximum allowable scan rate necessary to achieve DQOs.

The survey protocol for building system surveys consisted of performing removable contamination measurements of accessible internal surfaces of ventilation and drain systems. Fume hood baffles were removed, and static measurements performed in addition to the removable contamination measurements. Static measurements were not possible in drain systems due to geometry.

No elevated activity above the investigation levels were identified during facility characterization surveys.

13.0 REMEDIATION

No elevated activity was detected during characterization scan surveys of building structural surfaces or building system surveys, therefore no remediation was performed.

14.0 FINAL STATUS SURVEYS

Final status surveys were performed using the DQO process to demonstrate that residual radioactivity in each survey unit satisfied the predetermined criteria for release for unrestricted use. Final status surveys were 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 were documented on survey maps and/or associated data information sheets.

14.1 Background Determination

The use of reference background areas or paired background comparisons was not necessary. Material and ambient background values were not significant in comparison to the DCGLs or ALARA goals. For direct measurements, an ambient background was determined for each survey, was subtracted from gross measurements, and was used to calculate the actual survey MDCs and associated count errors. Material-specific background determinations were not performed. The background count rate for removable activity measurements was automatically subtracted by the LSC. Removable results are reported in net dpm/100 cm^2 for H-3 and C-14. Channel 3 results are reported in net cpm/100 cm^2.

14.2 Surface Scans

Scanning was used to identify locations within the survey unit that exceed the investigation level. The table below summarizes the minimum scan percentage of accessible building structural surfaces based on classification.

Table 14-1: Scan Survey Coverage by Classification

Structure	Class 2
Floors	75%
Fume Hoods	75%
Other Structures	25%

For surfaces that received less than 100% scan survey, the surfaces scanned were those with the highest potential to contain residual radioactivity at the discretion of the surveyor.

14.3 Total Surface Activity Measurements

Direct surveys (static measurements) for total surface activity were taken on building surfaces in impacted areas utilizing instrumentation of the best geometry based on the surface at the survey location. Static measurements were taken in impacted areas at each

identified sample location. Scaler count times were determined to achieve the detection sensitivities stated in the DQOs. Field measurements were converted to activity concentrations using the following equation:

$$Activity\ (dpm/100\ cm^2) = \frac{R_{s+b} - R_b}{E_{total} \times \frac{A}{100\ cm^2}}$$

Where:

R_{s+b} = The gross count rate of the measurement (cpm)
R_b = The background count rate (cpm)
E_{total} = Total Efficiency (cpm/dpm)
A = Area of the detector window (cm^2)

14.3.1 Determining the Number of Samples

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 was used. The LBGR was set at one half of the DCGL. The calculations performed to determine the required numbers of samples are provided below.

14.3.2 Determination of the Relative Shift

The number of required samples depends on the ratio involving the activity level to be measured relative to the variability in the concentration. The ratio to be used 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 (dpm/100 cm^2)
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 (dpm/100 cm^2)
σ_S = an estimate of the standard deviation of the residual radioactivity in the survey unit (dpm/100 cm^2)

The actual calculation is provided below:

$$\Delta / \sigma_S = \frac{3.7E6 - 1.85E6}{1{,}000} = 1{,}850$$

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.

14.3.3 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). The decision errors are 0.05 for both α and β.

14.3.4 Determination of Number of Data Points (Sign Test)

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

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

Where:

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

Note: SignP is determined from MARSSIM Table 5.4

MARSSIM recommends increasing the calculated number of measurements by 20% to ensure sufficient power of the statistical tests and to allow for possible data losses. MARSSIM Table 5.5 values include an increase of 20% of the calculated value. The approach for this project was to predetermine a number of samples to be applied to all survey units. This approach provides sufficient power for the statistical test while streamlining the survey planning process. 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 for planning purposes was **14.**

14.3.5 Determination of Sample Locations

Class 2 survey units generally consist of multiple rooms. The process to identify, map and locate measurement coordinates in survey units with many rooms is complicated due to the noncontiguous nature of the survey unit once walls are "folded-out". Therefore, the MARSSIM sample measurement locations (i.e., random static and wipe measurements) were determined only on horizontal surfaces as determined on floor plans. This protocol increases the sample density on the surfaces with the highest probability for residual contamination (floors, benchtops, fume hood working surfaces, etc.). The appropriate percentage of all survey unit surfaces (including vertical surfaces) was scanned according to the survey unit classification. In laboratory areas, permanent counter tops and other horizontal surfaces that block floor surfaces were included as a replacement to the blocked floor surface. Internal surfaces of permanent furnishings (i.e., drawer or cabinetry interior surfaces) were not included in the systematic measurement location placement. However, these surfaces were included in the scan surveys.

As part of characterization, the survey technician judgmentally selected ten locations with the highest probability of contamination on vertical surfaces for a static measurement and smear, such as light switches, door knobs, door pulls, push plates, and other locations. These measurements were in addition to and were not included in the statistical analysis of the locations selected by MARSSIM protocols.

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. Sample spacing was determined from MARSSIM equation 5-8:

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

Where:

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

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. Maps of final status survey locations for all survey units are included in Appendix D.

14.4 Removable Contamination Measurements

Removable contamination measurements were collected by wiping an area of approximately 100 cm^2 on structural surfaces, ventilation systems, and drain systems. The smears/swabs were counted to achieve the detection sensitivities stated in the DQOs. The LSC was set up for three channels with background subtraction at the following energies:

Channel 1 (^3H dpm):	0 – 18.6 keV
Channel 2 (^{14}C dpm):	18.6 – 156 keV
Channel 3 (cpm):	156 – 2,000 keV

Channel 3 results were used to verify that H-3 and C-14 are the only nuclides of concern.

14.5 Surveys of Building Mechanical System Internals

Surveys of various building system components were performed. Survey design for these systems is out of the scope of MARSSIM. For the purposes of identifying potential residual contamination within these systems, a survey protocol was established and is presented in the table below.

Table 14-2: System Survey Coverage

System Component	Coverage
Fume Hood Vent Ducts	100%
Drain Openings/Traps	100%

Surveys of building systems consisted of scan surveys, total activity measurements and removable contamination measurements of accessible openings and at locations of potential collection or buildup. Scan surveys and static measurements were not possible at some locations (such as drain pipe internals) due to small geometry.

The hood baffles were removed and the internal surfaces of each exhaust duct were surveyed. Because the fume hood exhaust flow is a very small fraction of the total flow from the building and no elevated activity was identified in the lab, hoods, or exhaust duct inlets, the building exhaust system was not shut down to accommodate surveys of the exhaust fans.

14.6 Survey Documentation

A survey package was developed for each survey unit containing the following:

- Survey Unit number (e.g., Building and Room Number, System Number, etc.)
- Survey Instruction Sheets
- General survey requirements
- Percentage of surfaces requiring scan surveys
- Number of total and removable contamination measurements required, instrument requirements with associated MDCs, count times and scan rates

- Overview maps detailing survey locations and placement methodology
- Survey Data Sheets
- Any additional specific survey instruction
- Signature of Data Collector and Reviewer

To ensure proper data management and organization, a unique location code 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 14-3: 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) CRT: CART Building 2625 Denison Dr
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 F1 = Floor H1 = Fume Hood D1 = Fume Hood Drains D3 = Sink Drains D4 = Other Drain E1 = Hood Exhaust Duct E5 = Local Exhaust Vent
M:	=	Structural Material Code. This field represents the type of structural material on which a particular measurement is taken. (1 character) M = Miscellaneous
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)

15.0 SURVEY RESULTS AND DATA QUALITY ASSESSMENT

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

15.1 Data Validation

Field data were reviewed by the Project Manager and validated to ensure:

- Completeness of forms
- Proper types of surveys were performed
- The MDCs for measurements met the established data quality objectives
- Independent calculations were performed on a representative sample of data sheets
- Satisfactory instrument calibrations and daily functionality checks were performed as required

Additionally, all final status survey data were 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.

15.2 Preliminary Data Review

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

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

- Review of the 4-Plot graphs of scan data
- 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
- Comparison of survey data with applicable investigation levels

The actual standard deviation for all survey units were less than the assumed standard deviation used for calculating the number of measurements, therefore an adequate number of samples were collected for each survey unit.

15.3 Building Structural Surfaces Scan Data

No elevated activity was identified by listening to the audible detector response. Additionally, a 4-Plot was produced of scan survey data for the survey unit. The 4-Plot

graphs indicate that the data has a perceivable bimodal distribution, but these two distributions are tightly grouped with significant overlap. This is likely due to the differences in material composition between the floors and other structures. The scan data indicates that surface contamination levels are significantly less than the investigation level of 5,000 dpm/100 cm^2. 4-Plot graphs of scan results are provided in Appendix E.

15.4 Data Summary Tables

All calculations of means, standard deviations, minimum and maximum values and comparisons between survey data and investigation levels are presented in the following tables. Building structural surface activity reports for each survey unit are included as Appendix F. Reports for building systems surveys are presented in Appendix G.

Table 15-1: Structural Surfaces Total Beta Surface Activity Summary

Survey Unit	# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)						
CRT-1201	18	412	3,104	706	-664	1,660	5,000	NO

Table 15-2: Building Structural Surfaces Removable H-3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)					
CRT-1201	18	3	5	0	15	200	NO

Table 15-3: Building Structural Surfaces Removable C-14 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)					
CRT-1201	18	6	3	0	12	200	NO

Table 15-4: Building Structural Surfaces Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net cpm/100 cm^2)					
CRT-1201	18	0	1	0	5	200	NO

Table 15-5: Building Systems Total Beta Surface Activity Summary

Survey Unit	# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)						
CRT-VE01	5	-288	3,104	201	-553	0	5,000	NO

Table 15-6: Building Systems Removable H-3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)					
CRT-DR01	6	31	15	7	49	200	NO
CRT-VE01	5	14	14	0	37	200	NO

Table 15-7: Building Systems Removable C-14 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)					
CRT-DR01	6	5	5	0	15	200	NO
CRT-VE01	5	7	3	3	12	200	NO

Table 15-8: Building Systems Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net cpm/100 cm^2)					
CRT-DR01	6	1	2	0	4	200	NO
CRT-VE01	5	0	1	0	2	200	NO

15.5 Determining Compliance for Building Surfaces and Structures

All total and removable surface activity results on building structural surfaces were less than investigation levels and a small fraction of the DCGL, and an adequate number of samples were obtained; therefore the survey unit passes the Sign test.

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 15-9: Structural Surfaces Total Beta Surface Activity Dose Calculations

Survey Unit	Standard Deviation (dpm/100 cm^2)	# Samples Required	Actual # of Samples	Adequate # of Samples?	Mean (dpm/100 cm^2)	Calculated Annual TEDE [2] (mrem/yr)
CRT-1201	706	11	18	YES	412	0.003

All measurement results are less than the DCGL and an adequate number of measurements were taken; therefore the null hypothesis is rejected and the survey unit meets the release criterion and is suitable for release for unrestricted use.

15.6 Determining Compliance for Building Systems

All building systems final status survey results are less than the investigation levels and a small fraction of the DCGL

All total and removable surface activity measurement results are less than the applicable DCGL; therefore all systems survey units meet the release criteria and are suitable for release.

16.0 QUALITY ASSURANCE SURVEYS

Quality assurance surveys consisted of re-performing the FSS protocol for building structural surfaces to achieve a minimum of 5% duplication of scans, static measurements and smears. QA surveys were implemented by re-performing judgmentally selected survey locations as survey unit CRT-QA01. The locations of QA survey total and removable surface activity measurements are presented in the table below.

Table 16-1: QA Survey Locations

QA Survey Location	FSS Location
CRT-QA01-H1-M-001	CRT-1201-H1-M-012

16.1 QA Survey Results

All QA survey results were similar to FSS data and the conclusions were the same as those based on the initial surveys. QA survey results are presented in Appendix H and are summarized in the tables below.

[2] The TEDE shown is conservatively calculated by multiplying 25 mrem/yr by the ratio of the mean total surface activity to the C-14 DCGL of 3.7E6 dpm/100 cm^2.

Table 16-2: QA Survey Building Structural Surfaces Total Activity Summary

Survey Unit	# of Sample Locations	Mean	MDC	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)						
CRT-QA01	1	553	3,104	N/A	553	553	5,000	NO

Table 16-3: QA Survey Building Structural Surfaces Removable H-3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)					
CRT-QA01	1	3	N/A	3	3	200	NO

Table 16-4: QA Survey Building Structural Surfaces Removable C-14 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net dpm/100 cm^2)					
CRT-QA01	1	9	N/A	9	9	200	NO

Table 16-5: QA Survey Building Structural Surfaces Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(net cpm/100 cm^2)					
CRT-QA01	1	4	N/A	4	4	200	NO

17.0 REFERENCES

- Central Michigan University NRC radioactive materials license number 21-01432-02
- NRC Regulations 10 CFR 20 Subpart E
- NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM)
- NUREG-1757, Volume 1, Rev. 2 "Consolidated NMSS Decommissioning Guidance: Decommissioning Process for Materials Licensees," September, 2006
- NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"

- ISO-7503-1, "Evaluation of Surface Contamination – Part 1: Beta Emitters and Alpha Emitters." 1988
- NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment," December 1999

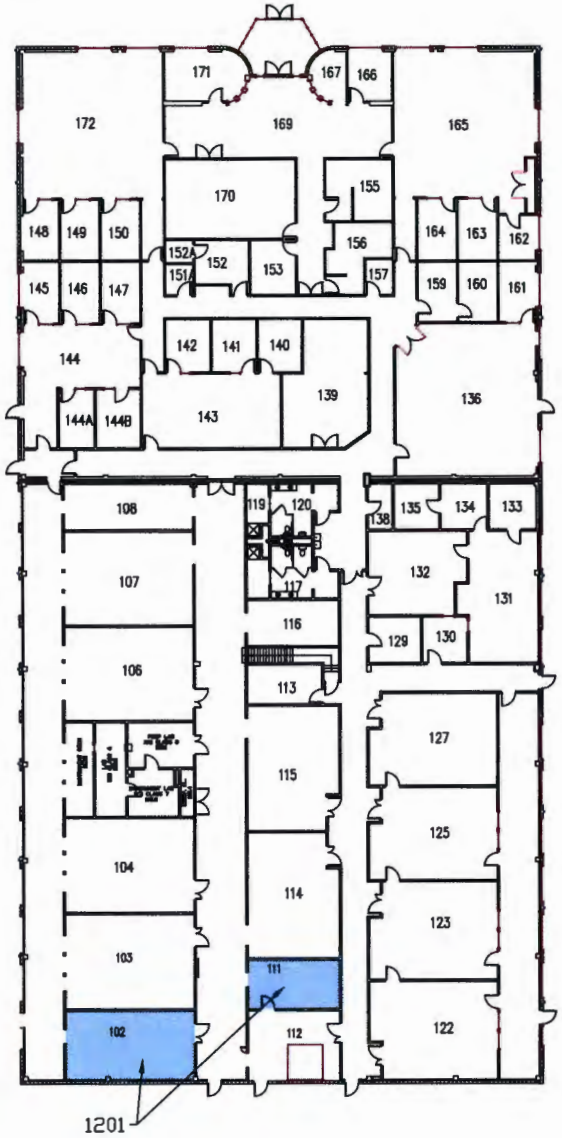
Appendix A
Site Satellite Photo



Central Michigan University
CART Building Decommissioning
Final Status Report

Building: CRT	Site Satellite Photo	Page: A.1 of A.1

Appendix B
Building Floor Plans



Class 2

Central Michigan University
CART Building
Final Status Report

Building: CRT	Elevation: 1st	Page: B.1 of B.1

Appendix C
Instrument Calibration Records

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

SEC Corporate
2800 Solway Road
Knoxville, TN 37931

Model 2241-3 CALIBRATION FORM

Serial number :	267113	**Customer Name :**	Chase
Previous due date :	1/28/2017	**P.O Number :**	
Date :	6/30/2016	**Technician :**	Carl Hall
		Reason For Calibration :	REPAIR

INSTRUMENT(S) USED DURING CALIBRATION					
Model Number:	500-2	**Serial Number:**	132896	**Calibration Due date:**	6/20/2017
Model Number:		**Serial Number:**		**Calibration Due date:**	

Instrument Condition	
As Found	As Left
OK	OK

Threshold	
As Found	As Left
4.0	4.0

Battery Indicator
SAT

SCA/RATE Switch
SAT

	Set Voltage		High Voltage Range	
Detector #	As Found	As Left	As Found	As Left
1	1648	1650	UNSAT	SAT
2	1798	1800	UNSAT	SAT
3	1321	1325	UNSAT	SAT
4	1342	1350	UNSAT	SAT

Digital Scaler				
Target	As Found	%Error	As Left	%Error
250	250	0.00%	250	0.00%
2,500	2,500	0.00%	2,500	0.00%
25,000	25,007	0.03%	25,007	0.03%
250,000	250,072	0.03%	250,072	0.03%

Reproducability		
x.1 or x1 Scale		
250	250	250
x1 or x10 Scale		
2500	2500	2500
x10 or x100 Scale		
25K	25K	25K
x100 or x1000 Scale		
250K	250K	250K

OK	Is the As Found Data within 20% of the set point?	OK	Audio Response
OK	Are the individual counts within 10% of the average?	OK	Push Buttons
OK	Fast / Slow response switch functions properly?	OK	RESET
OK	Does Instrument meet final Acceptance Criteria?	OK	Audio Switch
OK	Calibration sticker attached?	OK	Light

Married with:							
	1650V	DET 1	**Model:**	43-68	**Serial Number:**	PR285700
	1800V	DET 2	**Model:**	43-37	**Serial Number:**	PR286836
	1325V	DET 3	**Model:**	43-68	**Serial Number:**	PR285700
Comments :	1350V	DET 4	**Model:**	43-37	**Serial Number:**	PR286836

Instrument calibrated per SEC-IS-423.
5 foot cable used for the 43-68
10 foot cable used for the 43-37

As Found High Voltage was unstable and maxed out at ~1,500 volts.
Replaced bad Main Board 5408-226

Date instrument is due for next calibration : 6/30/2017

Performed by : Date: 6/30/16 Reviewed by: Date: 7-5-16

Printed name : Carl Hall

Calibration Certificate

Calibration Certificate for 43-68,Serial # PR285700, Bar Code # ,Property # Chase53

Date: 06/30/16 Date Last Cal. Expires: 01/28/17 Technician: Carl Hall

Location: 102624, Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 267113 CAL DUE 06/30/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239: 20.86 %
Tc-99: 25.09 %
Th-230: 19.46 %
SrY-90: 33.17 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1325 V HV (Beta): 1650 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Background:	0	CPM	0	CPM	
Pu-239:	0	CPM	N/A		0.00%
Tc-99:	N/A		0	CPM	0.00%
Th-230:	0	CPM	N/A		0.00%
SrY-90:	N/A		0	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1325 V HV (Beta): 1650 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Background:	2	CPM	260	CPM	
Pu-239:	4922	CPM	N/A		19.07%
Tc-99:	N/A		7881	CPM	23.89%
Th-230:	5940	CPM	N/A		17.01%
SrY-90:	N/A		6202	CPM	35.30%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6214 6178 6228 Average: 6206.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source – flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 PI Efficiencies:

Pu-239	Tc-99	Th-230	SrY-90
37.56%	38.11%	33.56%	50.31%

Comments: Married as a set with: Model: 2241-3 Serial #: 267113 Bar Code #:

Replaced damaged mylar.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 06/30/17

Performed by: _____ Reviewed by: _____ Date: 7-5-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-68 **Customer Name :** Chase Environmental
Probe Serial Number : PR285700 **Technician :** Carl Hall
Date of Calibration : 6/30/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	267113	Calibration Due Date:	6/30/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

			Activity(s)			
	Source S/N	Emission Rate	2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1650

Background: 260

C-14 Count: 7697

2π Efficiency: **28.69%**
4π Efficiency: **10.97%**

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 267113
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 6/30/2017

Performed by : _____ Reviewed by : _____ Date : 7-5-16
Printed Name : Carl Hall
Entered in computer inventory by: _____ Date : _____

Calibration Certificate

Calibration Certificate for 43-37,Serial # PR286836, Bar Code # ,Property # Chase94

Date: 06/30/16 Date Last Cal. Expires: 01/28/17 Technician: Carl Hall
Location: 102624, Reason For Calibration: Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 267113 CAL DUE 06/30/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	20.37 %
Tc-99:	25.37 %
Th-230:	18.51 %
SrY-90:	38.93 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1350 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AF 4 π Efficiencies
Back ground:	0	CPM	0	CPM	
Pu-239:	0	CPM	N/A		0.00%
Tc-99:	N/A		0	CPM	0.00%
Th-230:	0	CPM	N/A		0.00%
SrY-90:	N/A		0	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1350 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	6	CPM	870	CPM	
Pu-239:	4926	CPM	N/A		19.07%
Tc-99:	N/A		8445	CPM	23.75%
Th-230:	5959	CPM	N/A		17.06%
SrY-90:	N/A		6705	CPM	34.66%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6671 6729 6692 Average: 6697.3 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:	Pu-239	Tc-99	Th-230	SrY-90
	37.56%	37.88%	33.63%	49.40%

Comments: Married as a set with: Model: 2241-3 Serial #: 267113 Bar Code #:

Replaced damaged mylar.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 06/30/17

Performed by: _____ Reviewed by: _____ Date: 7-5-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-37 **Customer Name :** Chase Environmental
Probe Serial Number : PR286836 **Technician :** Carl Hall
Date of Calibration : 6/30/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	267113	Calibration Due Date:	6/30/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N	Emission Rate	Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1800

Background: 870

C-14 Count: 9119

2π Efficiency: 31.82%
4π Efficiency: 12.17%

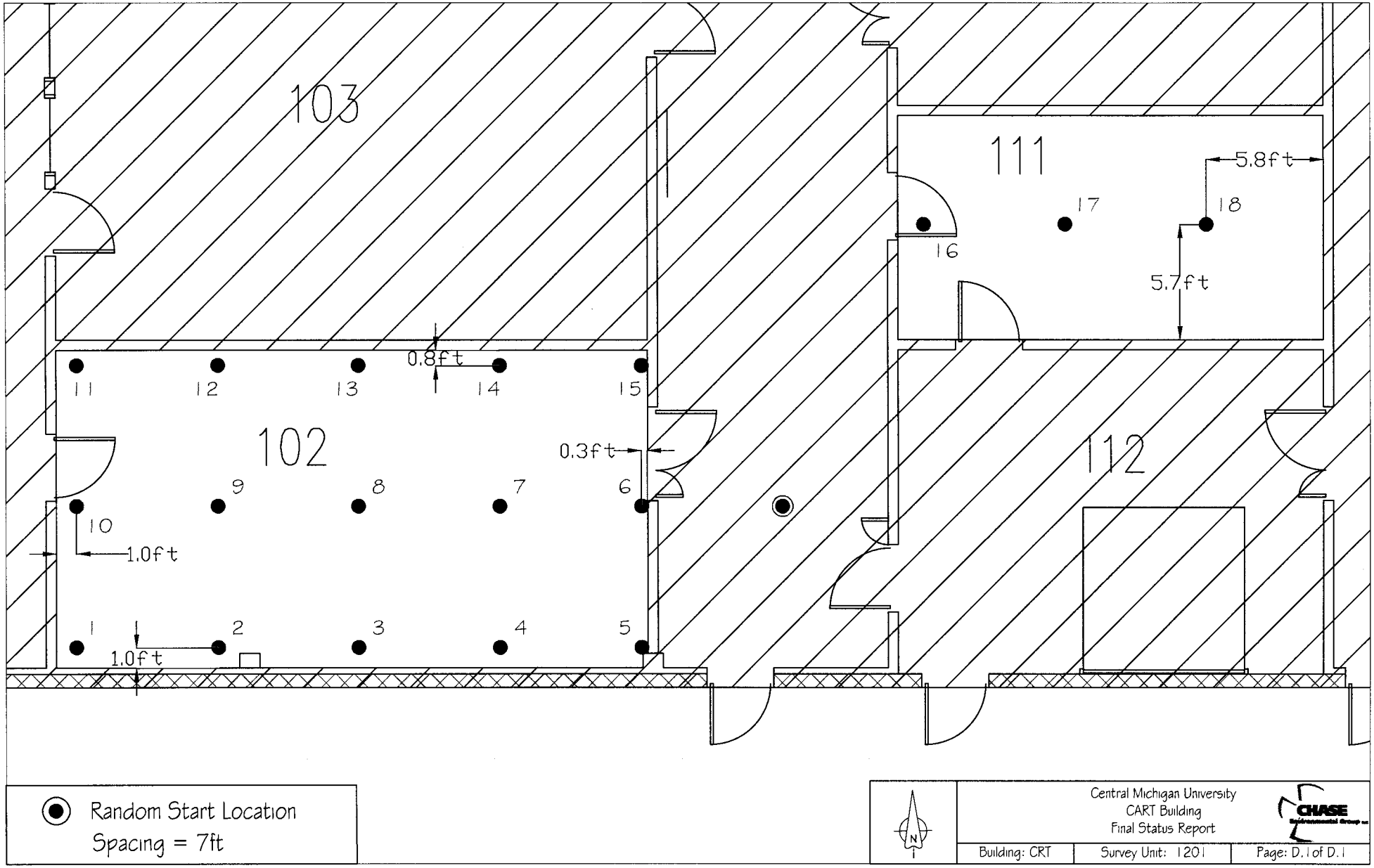
Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 267113
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 6/30/2017

Performed by : [signature] Reviewed by: [signature] Date : 7-5-16
Printed Name : Carl Hall
Entered in computer inventory by: [signature] Date :

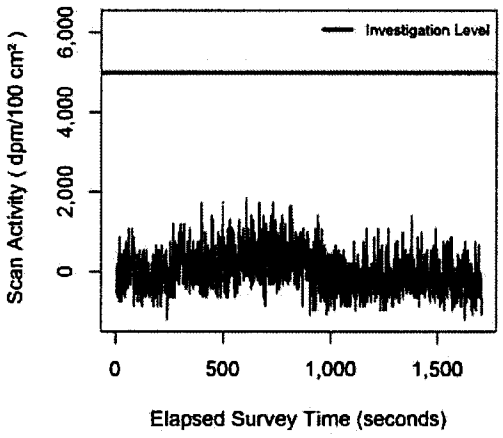
Appendix D
Final Status Survey Location Maps


103
111
102
112
11
12
13
14
15
16
17
18
10
9
8
7
6
1
2
3
4
5
0.8ft
0.3ft
1.0ft
1.0ft
5.8ft
5.7ft
Random Start Location
Spacing = 7ft
N
Central Michigan University
CART Building
Final Status Report
CHASE
Building: CRT
Survey Unit: 1201
Page: D.1 of D.1

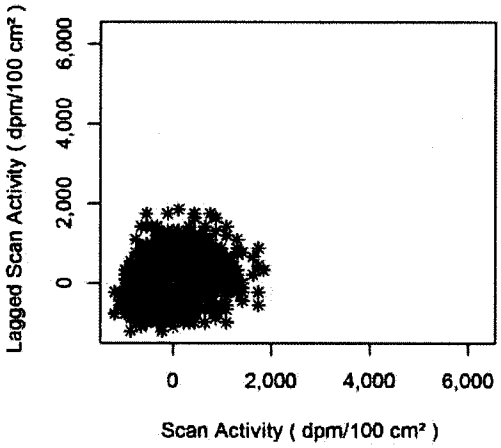
Appendix E
4-Plot Graphs

Survey Unit: CRT-1201 Probe: PR286836 (43-37)

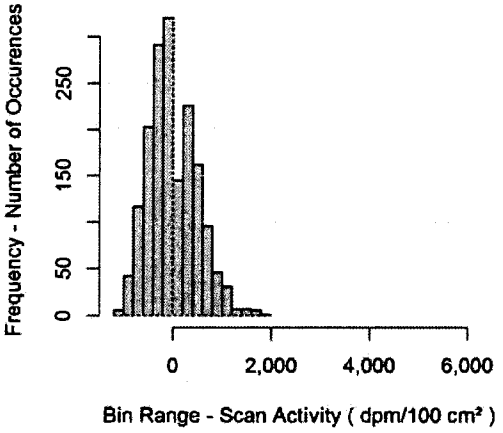
Scan Data



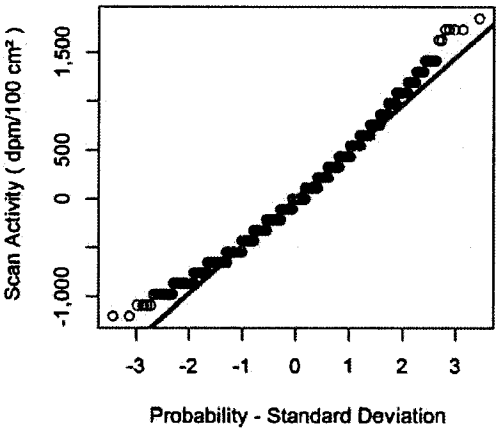
Lagged Scan Data



Histogram of Scan Data



Normal Probability Plot of Data



Appendix F
Structural Surfaces Final Status Survey Results

Survey Results

Building: CRT Survey Unit: 1201 Survey Type: Structural

	Total Activity Measurements		Removable Activity Measurements					
Location Code	Activity	MDC	H-3	MDC	C-14	MDC	CH3	MDCR
CRT-1201-B1-M-001	-332 +/- 1,608	3,104	0	35	0	33	0	36
CRT-1201-B1-M-002	-221 +/- 1,623	3,104	3	35	6	33	0	36
CRT-1201-B1-M-003	-443 +/- 1,594	3,104	0	35	6	33	0	36
CRT-1201-B1-M-004	-664 +/- 1,564	3,104	0	35	4	33	2	36
CRT-1201-F1-M-005	996 +/- 1,775	3,104	3	35	1	33	5	36
CRT-1201-F1-M-006	775 +/- 1,749	3,104	15	35	9	33	0	36
CRT-1201-F1-M-007	-221 +/- 1,623	3,104	0	35	5	33	0	36
CRT-1201-F1-M-008	775 +/- 1,749	3,104	0	35	8	33	0	36
CRT-1201-F1-M-009	1,107 +/- 1,788	3,104	1	35	9	33	0	36
CRT-1201-F1-M-010	1,660 +/- 1,853	3,104	0	35	5	33	0	36
CRT-1201-B1-M-011	332 +/- 1,694	3,104	0	35	12	33	0	36
CRT-1201-H1-M-012	996 +/- 1,775	3,104	14	35	8	33	1	36
CRT-1201-H1-M-013	885 +/- 1,762	3,104	0	35	8	33	0	36
CRT-1201-F1-M-014	221 +/- 1,680	3,104	0	35	7	33	0	36
CRT-1201-F1-M-015	332 +/- 1,694	3,104	0	35	5	33	0	36
CRT-1201-F1-M-016	1,549 +/- 1,840	3,104	0	35	3	33	0	36
CRT-1201-F1-M-017	-111 +/- 1,637	3,104	9	35	5	33	0	36
CRT-1201-F1-M-018	-221 +/- 1,623	3,104	8	35	0	33	0	36

Static Count	18	**Sample Count**	18		
Average	412		3	6	0
Minimum	-664		0	0	0
Maximum	1,660		15	12	5
Standard Deviation	706		5	3	1

Total activity results are reported in net dpm/100 cm².
H-3 and C-14 removable results are reported in net dpm/100 cm². CH3 removable results are reported in net cpm/100 cm².
Results above MDC are in bold print. Results above Investigation Levels are in red print.
Removable Activity: H-3 = 0-18.6 keV, C-14 = 18.6-156 keV, CH3 = 156-2,000 keV.

Appendix G
Systems Final Status Survey Results

Survey Results

Building: CRT Survey Unit: DR01 Survey Type: System

	Total Activity Measurements		Removable Activity Measurements					
Location Code	Activity	MDC	H-3	MDC	C-14	MDC	CH3	MDCR
CRT-DR01-D1-M-001	+/-		7	35	6	33	0	36
CRT-DR01-D1-M-002	+/-		**49**	35	2	33	0	36
CRT-DR01-D1-M-003	+/-		**42**	35	15	33	0	36
CRT-DR01-D1-M-004	+/-		**39**	35	0	33	0	36
CRT-DR01-D3-M-005	+/-		25	35	4	33	4	36
CRT-DR01-D4-M-006	+/-		24	35	3	33	0	36

Static Count	0	**Sample Count**	6			
Average			31	5	1	
Minimum			7	0	0	
Maximum			49	15	4	
Standard Deviation			15	5	2	

Total activity results are reported in net dpm/100 cm².
H-3 and C-14 removable results are reported in net dpm/100 cm². CH3 removable results are reported in net cpm/100 cm².
Results above MDC are in bold print. Results above Investigation Levels are in red print.
Removable Activity: H-3 = 0-18.6 keV, C-14 = 18.6-156 keV, CH3 = 156-2,000 keV.

Survey Results

Building: CRT Survey Unit: VE01 Survey Type: System

	Total Activity Measurements		Removable Activity Measurements					
Location Code	Activity	MDC	H-3	MDC	C-14	MDC	CH3	MDCR
CRT-VE01-E1-M-001	-332 +/- 1,608	3,104	0	35	8	33	2	36
CRT-VE01-E1-M-002	-553 +/- 1,579	3,104	10	35	6	33	0	36
CRT-VE01-E1-M-003	-332 +/- 1,608	3,104	15	35	3	33	0	36
CRT-VE01-E1-M-004	-221 +/- 1,623	3,104	8	35	5	33	0	36
CRT-VE01-E5-M-005	0 +/- 1,652	3,104	**37**	35	12	33	0	36
Static Count	5	**Sample Count**	5					
Average	-288		14		7		0	
Minimum	-553		0		3		0	
Maximum	0		37		12		2	
Standard Deviation	201		14		3		1	

Total activity results are reported in net dpm/100 cm².
H-3 and C-14 removable results are reported in net dpm/100 cm². CH3 removable results are reported in net cpm/100 cm².
Results above MDC are in bold print. Results above Investigation Levels are in red print.
Removable Activity: H-3 = 0-18.6 keV, C-14 = 18.6-156 keV, CH3 = 156-2,000 keV.

Appendix H
Quality Assurance Survey Results

Survey Results

Building: CRT Survey Unit: QA01 Survey Type: QA

	Total Activity Measurements		Removable Activity Measurements					
Location Code	Activity	MDC	H-3	MDC	C-14	MDC	CH3	MDCR
CRT-QA01-H1-M-001	553 +/- 1,721	3,104	3	35	9	33	4	36
Static Count	1	Sample Count	1					
Average	553		3		9		4	
Minimum	553		3		9		4	
Maximum	553		3		9		4	
Standard Deviation								

Total activity results are reported in net dpm/100 cm².
H-3 and C-14 removable results are reported in net dpm/100 cm². CH3 removable results are reported in net cpm/100 cm².
Results above MDC are in bold print. Results above Investigation Levels are in red print.
Removable Activity: H-3 = 0-18.6 keV, C-14 = 18.6-156 keV, CH3 = 156-2,000 keV.

Central Michigan University
Brooks Hall
Decommissioning Final Status Report

Brooks Hall - Central Michigan University
Mount Pleasant, MI 48859

NRC License Number:
21-01432-02

January 6, 2017

Prepared:	Mike Culp	Project Manager	Date:	1-6-17
Approved:	Dave Culp	Radiological Engineer	Date:	1-30-17
Approved:	Jennifer Walton	Central Michigan University Radiation Safety Officer	Date:	2-2-17

Prepared by:
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109 Flint Road
Oak Ridge, TN 37830
865-481-8801

Document Control: 17002-R0-01

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APPENDICES

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Appendix B – Building Floor Plans
Appendix C – Instrument Calibration Records
Appendix D – Final Status Survey Location Maps
Appendix E – 4-Plot Graphs
Appendix F – Structural Surfaces Final Status Survey Results
Appendix G – Systems Final Status Survey Results
Appendix H – Quality Assurance Survey Results
Appendix I – Dose Modeling Output Reports

ACRONYMS

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
CMU	Central Michigan University
DCF	Dose Conversion Factor
DCGL	Derived Concentration Guideline Level
$DCGL_{EMC}$	Derived Concentration Guideline Level – Elevated Measurement Comparison
$DCGL_W$	Derived Concentration Guideline Level – Wilcoxon Rank Sum
DWP	Decommissioning Work Plan
DQO	Data Quality Objective
DSV	Default Screening Value
FSS	Final Status Survey
FSSR	Final Status Survey Report
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
MDCR	Minimum Detectable Count Rate
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NORM	Naturally Occurring Radioactive Materials
QA	Quality Assurance
RF	Resuspension Factor
TEDE	Total Effective Dose Equivalent

1.0 INTRODUCTION

Central Michigan University (CMU) has decided to permanently cease licensed activities within the Brooks Hall building located on the CMU campus in Mount Pleasant, MI 48859. CMU will decommission Brooks Hall, listed as an authorized usage area under NRC license number 21-01432-02, and release for unrestricted use. A site satellite photo is presented in Appendix A.

The facility includes research laboratories, offices, and other support areas. Radioactive materials used at the facility consisted of a variety of alpha, beta, and gamma emitting radionuclides for teaching and research.

Decommissioning activities were conducted under the Chase Commonwealth of Kentucky radioactive materials license number 201-605-15, utilizing a reciprocal agreement with the NRC, and in accordance with a decommissioning work plan (DWP). The DWP 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). Final status surveys (FSS) were designed to implement the protocols and guidance provided in MARSSIM to demonstrate compliance with NRC default screening values (DSV) generated using the default scenarios and parameters of the DandD code v.2.1, except that the resuspension factor recommended by the NRC in NUREG 1720 was used in place of the default for alpha emitting nuclides. These methods ensured technically defensible data were generated to aid in determining whether or not the site meets the release criteria for unrestricted use specified in 10 CFR 20 Subpart E.

CMU and Chase conducted a Historical Site Assessment (HSA) that included operations conducted under current NRC License #21-01432-02, any general licenses, and any operations conducted prior to the current NRC license. On June 15, 2016 Chase conducted a site visit with the CMU Radiation Safety Officer to review historical records associated with Brooks Hall. On-site decommissioning activities were performed under the Chase license from December 7-20, 2016. Facility characterization surveys identified six small discrete locations up to 1,181 dpm/100cm^2 alpha and 3,368 dpm/100cm^2 beta on building structural surfaces. Areas of elevated activity were remediated as described in section 19.0.

This report presents sufficient data to conclude the facility is suitable for unrestricted release in accordance with NRC requirements. Final status surveys demonstrate that building structural surfaces and systems included in the scope of this report are below release criteria and are suitable for unrestricted release. All final status surface activity measurements were less than the DSVs. Based on the Building Occupancy Scenario of NRC DandD dose modeling software Version 2.1, **the Total Effective Dose Equivalent (TEDE) to an average member of the critical group is 4.25 mrem/year (17% of the release criterion of 25 mrem/yr).**

2.0 FACILITY DESCRIPTION AND HISTORY

Brooks Hall, built in 1965, is a five-story (basement to 4th floor) with a brick exterior. Interior walls are made of sheetrock or concrete block. Floors in hallways and laboratory areas are covered in vinyl tile or vinyl sheet product. Brooks Hall is currently home to the departments of biology and earth and atmospheric sciences. The building features research laboratories, an animal room, a 24-station departmental computer laboratory, electron microscopes and a greenhouse.

The laboratory drain system consists of sink and cup sink drains located in fume hoods and casework throughout the laboratory spaces. The drains discharge directly from the building without retention or treatment. The central vacuum system consists of nozzles located throughout the laboratory spaces and a pump and accumulator located in the basement mechanical room. Exhaust ventilation is provided primarily via the fume hood exhausts with various room exhausts provided in the ceiling.

Building floor plans are provided in Appendix B.

2.1 Potential Contaminants

CMU and Chase conducted a HSA that included operations conducted under current NRC License #21-01432-02, any general licenses, and any operations conducted prior to the current NRC license. On June 15, 2016 Chase conducted a site visit with the CMU Radiation Safety Officer to review historical records associated with Brooks Hall. A variety of records were reviewed, including surveys, license documents, leak tests, logbooks, disposal records, and material inventories. Some of the more important information obtained is listed below.

- The entirety of Brooks Hall was authorized for isotope use in License 21-01432-02.
- License documents indicated that radioactive material could be used for physics, biophysics, and radioisotope techniques.
- Survey records identified usage locations, but did not regularly include information regarding the isotopes of concern.
- Survey documents indicate that uranium ore was used.
- Sealed sources were used, including a neutron source.
- Notes regarding two separate spills in 1992 were found. On June 15th, a Cs-137 plastic check source was broken in room 209. On June 18th, a spill of C14 liquid occurred in room 209A.
- CMU has a burial site where millicurie quantities of materials were disposed. Brooks Hall was the only facility where these materials would have been used prior to burial.
- In 1990 a questionnaire was sent to the faculty to determine material usage and locations. In some cases, it is unclear whether faculty responded with their laboratory location or office location. The response for rooms 006, 024, and 026 were not detailed as to whether samples were prepared with uranium-based

stains in those rooms or if those rooms were merely for analysis of prepared samples.

- Leak test notes beginning in the 1960s indicate that there was a Plutonium-Beryllium (PuBe) source and a Co-60 source in Brooks.
- There are leak tests in 1979 for a Cs-137 source.
- In 1981, there are notes regarding surveys of an "ore box."
- While none of the sealed source leak tests indicated any leakage, a violation was issued in 1996 for failure to perform leak tests and instrument calibrations.
- In 1982, an inventory sheet listed a variety of isotopes and activities in "solution."
- In 1991, five microcuries of Ra-226 was disposed.
- Uranium and thorium compounds were possessed under the general license provisions of 10 CFR 40.22.

Known locations of materials usage are presented in the table below.

Table 2-1: Locations of Materials Usage

Room	Material Used
006	Electron Microscopy
024	Electron Microscopy
026	Electron Microscopy
027	Generally Licensed Source Materials
101	Ni-63 Electron Capture Device
101C	Unknown
102	C-14
112	H-3
117	Unknown
129	C-14
137	C-14
141	Powdered Uranium Compounds
148	C-14, Chemistry Teaching Laboratory
149	C-14, Chemistry Teaching Laboratory
150	C-14, Chemistry Teaching Laboratory
151	Chemistry Teaching Laboratory
152	Chemistry Teaching Laboratory
208	Liquid Scintillation Counter, P-32, H-3
209	Cs-137, Physics Radiation Laboratory
209A	C-14, Lead-lined Storage Area
210	H-3
212	C-14
221	Thorium Metal

The table below lists the nuclides known to have been possessed in Brooks Hall.

Table 2-2: Radionuclides Possessed in Brooks Hall

Nuclide	Half-life (years)	Half-Life > 120 days?	Emission Type
Ag-110m	6.9E-01	YES	Beta/Gamma
Ba-133	1.1E+01	YES	Gamma
C-14	5.7E+03	YES	Low Energy Beta
Cl-36	3.0E+05	YES	Beta
Co-57	7.4E-01	YES	Gamma
Co-60	5.3E+00	YES	Beta/Gamma
Co-62	2.9E-06	NO	Beta
Cs-137	3.0E+01	YES	Beta/Gamma
Fe-55	2.7E+00	YES	Low Energy Gamma
Fe-59	1.2E-01	NO	Beta/Gamma
H-3	1.2E+01	YES	Low Energy Beta
I-124	1.1E-02	NO	Positron/Gamma
I-131	2.2E-02	NO	Beta/Gamma
I-132	2.6E-04	NO	Beta/Gamma
Na-22	2.6E+00	YES	Positron/Gamma
Ni-63	1.0E+02	YES	Low Energy Beta
P-32	3.9E-02	NO	Beta
Pb-210	2.2E+01	YES	Alpha/Beta/Gamma
Pm-147	2.6E+00	YES	Beta
Pu-238	8.8E+01	YES	Alpha
Ra-226	1.6E+03	YES	Alpha/Beta/Gamma
S-35	2.4E-01	NO	Beta
Sr-90	2.9E+01	YES	Beta
Th-232 (Th_{nat})	1.4E+10	YES	Alpha/Beta/Gamma
Tl-204	3.8E+00	YES	Beta/Gamma
U-238 (U_{nat})	4.5E+09	YES	Alpha/Beta/Gamma
U-238 (DU)	4.5E+09	YES	Alpha/Beta/Gamma
Zn-65	6.7E-01	YES	Positron/Gamma

2.2 License History

The facility has been in operation under a radioactive materials license since the mid 1960's. The current license was renewed in entirety on May 8, 2012, and is currently on Amendment 39 dated August 18, 2016 with an expiration date of May 31, 2022.

2.3 Previous Decommissioning Activities

There are no previous decommissioning activities.

3.0 CURRENT/FUTURE USE

Brooks Hall is currently partially occupied as a result of occupants moving to a newly constructed research building. CMU plans to retain Brooks Hall for future non-radioactive materials use after decommissioning.

4.0 FACILITY RELEASE CRITERIA

The unrestricted use criteria are specified in NRC 10 CFR 20 Subpart E. Specifically, impacted areas of the facility 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." The criteria are that residual radioactivity results in a TEDE to an average member of the critical group that does not exceed 25 mrem per year, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

5.0 NUCLIDES OF CONCERN

Based on the historical site assessment and eliminating nuclides with half-lives less than 120 days, the nuclides of concern for decommissioning are summarized below.

Table 5-1: Nuclides of Concern

Nuclide	Half-life (years)	Predominant Emission
Ag-110m	6.9E-01	Beta/Gamma
Ba-133	1.1E+01	Gamma
C-14	5.7E+03	Low Energy Beta
Cl-36	3.0E+05	Beta
Co-57	7.4E-01	Gamma
Co-60	5.3E+00	Beta/Gamma
Cs-137	3.0E+01	Beta/Gamma
Fe-55	2.7E+00	Low Energy Gamma
H-3	1.2E+01	Low Energy Beta
Na-22	2.6E+00	Positron/Gamma
Ni-63	1.0E+02	Low Energy Beta
Pb-210	2.2E+01	Alpha/Beta/Gamma
Pm-147	2.6E+00	Beta
Pu-238	8.8E+01	Alpha
Ra-226	1.6E+03	Alpha/Beta/Gamma
Sr-90	2.9E+01	Beta
Th-232 (Th_{nat})	1.4E+10	Alpha/Beta/Gamma
Tl-204	3.8E+00	Beta/Gamma
U-238 (U_{nat})	4.5E+09	Alpha/Beta/Gamma
U-238 (DU)	4.5E+09	Alpha/Beta/Gamma
Zn-65	6.7E-01	Positron/Gamma

6.0 DERIVED CONCENTRATION GUIDELINE LEVELS

The NRC has published default screening values (DSVs) [1] in NUREG 5512, Volume 3, Table 5.19 for common 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 Version 2.1 dose modeling software. As a result of the restrictive screening values for alpha-emitting nuclides, the NRC published NUREG 1720 "Re-evaluation of the Indoor Resuspension Factor for the Screening Analysis of the Building Occupancy Scenario for NRC's License Termination Rule."

The screening values listed in NUREG 5512 are used for beta gamma emitters. Screening values for alpha emitters were determined by modeling in DandD using the resuspension factor (RF) recommended in NUREG 1720.

6.1 Screening Values for Beta-Gamma Emitters

The screening values for beta-gamma emitters listed in NUREG 5512, Volume 3, Table 5.19 are presented in the table below.

Table 6-1: DSVs for Nuclides of Concern

Nuclide	DSV (dpm/100 cm^2)
Ag-110m	1.02E+04
Ba-133	Not Listed
C-14	3.67E+06
Cl-36	4.99E+05
Co-57	2.11E+05
Co-60	7.05E+03
Cs-137	2.80E+04
Fe-55	4.50E+06
H-3	1.24E+08
Na-22	9.54E+03
Ni-63	1.82E+06
Pm-147	3.4E+05
Sr-90	8.71E+03
Tl-204	Not Listed
Zn-65	4.81E+04
Minimum	**7.05E+03**

Ba-133 and Tl-204 are not supported by DandD, therefore to show survey protocols adequately considered these nuclides, their dose conversion factors (DCF) were

[1] For convenience, the term DSV is extended to include the screening values for alpha emitters that are calculated using the NUREG 1720 recommended resuspension factor.

compared to those of Co-60. The external DCFs were obtained from FGR-12 and the internal DCFs were obtained from ICRP 72 (Adult). The dose conversion factors are presented and compared in the tables below.

Table 6-2: DCFs for Co-60, Ba-133, and Tl-204

Nuclide	Ingestion DCF	Inhalation DCF	External Volume DCF	External Surface DCF
Co-60	1.26E-05	1.15E-04	1.62E+01	2.74E+00
Ba-133	5.55E-06	3.70E-05	1.98E+00	4.64E-01
Tl-204	4.44E-06	1.44E-06	4.05E-03	1.73E-03

The table below shows that the DCFs for Ba-133 and Tl-204 are a small fraction of the Co-60 DCFs. Therefore compliance with the Co-60 screening value will ensure Ba-133 and Tl-204 do not exist above their screening values.

Table 6-3: Comparison of Ba-133 and Tl-204 DCFs to Co-60 DCF

Nuclide	Ingestion DCF	Inhalation DCF	External Volume DCF	External Surface DCF
Ba-133 Fraction of Co-60	44%	32%	12%	17%
Tl-204 Fraction of Co-60	35%	1%	0.02%	0.06%

6.2 Screening Values for Alpha Emitters

Building structural surface screening values for alpha-emitting radionuclides were modeled using DandD, Version 2.1 software. For nuclides with decay chains, the parent nuclide was modeled at an activity concentration of 1 dpm/100 cm^2. All default parameter values were used except the RF. The RF of 1E-6/m (as recommended in NUREG 1720) was used instead of the default RF of 1.42E-5/m. The dose modeling output reports are presented in Appendix I and the results are summarized in the table below.

Table 6-4: Screening Values for Alpha Emitters

Nuclide	DandD Result [2] (mrem/yr per dpm/100 cm^2)	DSV [3] (dpm/100 cm^2)
Pb-210+C	0.01	2.50E+03
Pu-238	0.0614	4.07E+02
Ra-226 + C	0.0172	1.45E+03
Th-232 + C	0.303	8.25E+01
U-238 (DU)	0.0178	1.40E+03
U-238 + C 4	0.103	2.43E+02

[2] The DandD result is in terms of mrem/yr per dpm/100 cm^2 of the parent radionuclide.
[3] The DSV is determined by dividing 25 mrem/year by the DandD result in mrem/yr per dpm/100 cm^2.
[4] U-238+C is used for natural uranium. U-235 is not included because it is not a significant contributor to dose due to low abundance.

Thorium and uranium isotopes have decay chains that emit a variety of different types of radiation. It is important to understand the equilibrium state of the chain in order to convert from activity of the parent to gross activity of the entire decay chain. Because there are multiple alpha emissions per decay of the parent, the number of alphas per decay must also be considered in establishing DCGLs. Calculations of the number of alpha emissions per decay of the parent are presented in the table below.

Table 6-5: Alphas per Decay Calculations

Nuclide	Alphas per Decay Before Rn	Alphas per Decay Rn+C	EF [5]	Corrected Alphas per Decay Rn+C [6]	Total Alphas per Decay [7]
Pb-210+C	0	1	N/A	1	1
Pu-238	1	0	0.8	1	1
Ra-226+C	1	4	0.8	3.2	4.2
Th-232+C	3	3	0.8	2.4	5.4
U-238 (DU)	1	0	0.8	1	1
U-238+C	4	4	0.8	3.2	7.2

From the DSV calculated above and the number of alphas per decay, a gross alpha DCGL is calculated for each nuclide as shown in the table below.

Table 6-6: Gross Alpha DCGLs

Nuclide	DCGL (dpm/100 cm^2)	Total Alphas per Decay	Gross Alpha DCGL (dpm/100 cm^2)
Pb-210+C	2.50E+03	1	2,500
Pu-238	4.07E+02	1	407
Ra-226+C	1.45E+03	4.2	6,090
Th-232+C	8.25E+01	5.4	446
U-238 (DU)	1.40E+03	1	1,400
U-238+C	2.43E+02	7.2	1,750
		Minimum	**407**

6.3 Summary of DCGLs

Co-60 has the lowest DSV of any of the beta emitters, so the Co-60 DSV is used as the gross beta DCGL. Pu-238 has the lowest DSV of any of the alpha emitters, so the Pu-238 DSV is used as the gross alpha limit.[8] DandD assumes a removable fraction of

[5] Emanation Factor (EF) = (1- the RESRAD-BUILD default radon emanation fraction of 0.2)
[6] (alphas per decay Rn +C)*(EF)
[7] (alphas per decay before Rn) + (corrected alphas per decay of Rn + C)
[8] This is conservative because the only documented Pu-238 usage is as a sealed source.

10%; therefore removable surface activity DCGLs are established separately. DCGLs are summarized in the table below.

Table 6-7: Summary of DCGLs

Measurement Type	Surface Activity (dpm/100 cm^2)	
	Total	Removable
Gross Alpha	407	40
Gross Beta	7,050	705

Because two different measurements are taken, unity applies. The sum of fractions were determined for each sample location using the following equation.

$$\frac{C_{Alpha}}{DCGL_{Alpha}} + \frac{C_{Beta}}{\mathrm{DCGL}_{Beta}} < 1$$

Where:

C_{Alpha} = Gross alpha result in dpm/100 cm^2
C_{Beta} = Gross beta result in dpm/100 cm^2
$DCGL_{Alpha}$ = Gross alpha DCGL in dpm/100 cm^2
$DCGL_{Beta}$ = Gross beta DCGL in dpm/100 cm^2

For direct measurements, these unity calculations are conservative in that the beta channel also detects alpha emissions. Total beta surface activity results are not corrected for the contribution of alpha emissions, resulting in an overestimation of the surface activity.

7.0 ALARA GOALS (INVESTIGATION LEVELS)

ALARA goals are established at 50% of the DCGLs calculated above. Specifically, the following surface contamination levels were used as investigation levels:

Table 7-1: Summary of Investigation Levels

Measurement Type	Surface Activity (dpm/100 cm^2)	
	Total	Removable
Gross Alpha	203	20
Gross Beta	3,525	352

Data Quality Objectives (DQOs) are designed to ensure instrument detection sensitivities are below the ALARA goals. The number of measurements required by MARSSIM to demonstrate compliance with the release criteria was calculated using the $DCGL_W$.

8.0 ALARA ANALYSIS

Due to the extremely low doses associated with residual radioactivity at the facility, a quantitative ALARA analysis was not required. The screening values listed in NUREG 5512 were used to establish DCGLs for beta gamma emitters. DCGLs for alpha emitters were determined by modeling in DandD using the resuspension factor (RF) recommended in

NUREG 1720. Furthermore, gross measurement DCGLs are conservatively based on the most limiting nuclide.

NUREG 1757, Volume 2, Appendix N states in part: "For ALARA during decommissioning, all licensees should use typical good-practice efforts such as floor and wall washing, removal of readily removable radioactivity in buildings or in soil areas, and other good housekeeping practices. In addition, licensees should provide a description in the Final Status Survey Report (FSSR) of how these practices were employed to achieve the final activity levels. In light of the conservatism in the building surface and surface soil generic screening levels developed by NRC, NRC staff presumes, absent information to the contrary, that licensees who remediate building surfaces or soil to the generic screening levels do not need to provide analyses to demonstrate that these screening levels are ALARA. In addition, if residual radioactivity cannot be detected, it may be assumed that it has been reduced to levels that are ALARA. Therefore, the licensee may not need to conduct an explicit analysis to meet the ALARA requirement."

9.0 PROJECT MANAGEMENT AND ORGANIZATION

Decommissioning activities were performed under Chase Commonwealth of Kentucky radioactive materials license number 201-605-15, and in accordance with the DWP. CMU oversaw decommissioning activities and maintained responsibility for building maintenance, fire, and security functions.

10.0 TRAINING

CMU provided Chase personnel with site specific Contractor Site Orientation 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 required by the DWP.

11.0 RADIATION SAFETY AND HEALTH PROGRAM

Radiological work was performed according to the Chase radioactive materials license Radiation Safety Program.

12.0 ENVIRONMENTAL MONITORING PROGRAM

Due to the limited scope of the project, a project-specific environmental monitoring program was not required.

13.0 RADIOACTIVE WASTE MANAGEMENT

All radioactive wastes generated during remediation were packaged and sealed to prevent release of radioactivity and turned over to CMU.

14.0 QUALITY ASSURANCE PROGRAM

Project-specific QA requirements were included in the DWP to meet the guidelines of MARSSIM Section 9.

15.0 SURVEY INSTRUMENTATION

15.1 Instrument Calibration

Laboratory and portable field instruments were calibrated within the previous year with National Institute of Standards and Technology (NIST) traceable sources to radiation emission types and energies to provide detection capabilities similar to the nuclides of concern. Portable instrument calibration records are included as Appendix C.

15.2 Functional Checks

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.

Daily functional checks of the liquid scintillation counter consisted of performing the instrument's automatic quality assurance protocol that utilizes H-3 and C-14 sources as well as a background standard.

15.3 Minimum Detectable Concentrations

Minimum counting times for background determinations and measurement of total and removable surface activity were chosen to provide a minimum detectable concentration (MDC) that met the data quality objectives (DQOs). MARSSIM equations relative to building surfaces have been modified to convert to units of dpm/100 cm^2. Count times and scanning rates are determined using the following equations:

15.3.1 Static Counting

Static counting Minimum Detectable Concentration at a 95% confidence level is 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):

$$MDC_{static} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E_{tot} \cdot \frac{A}{100cm^2}}$$

Where:

MDC_{static} = minimum detectable concentration (dpm/100 cm^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 beta static MDC calculation for the Ludlum Model 43-37 gas flow proportional detector is shown below:

$$MDC_{STATIC} = \frac{3 + 3.29\sqrt{(1500)(.1)\left(1+\frac{0.1}{0.1}\right)}}{(0.1)(0.085)\frac{584}{100}} = 1{,}208\ \text{dpm}/100\text{cm}^2$$

15.3.2 Beta Ratemeter Scanning

Scanning Minimum Detectable Concentration at a 95% confidence level is 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/100 cm^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:

$$\text{i} = 13.3\,\text{cm}\cdot\frac{\text{inch}}{2.54\,\text{cm}}\cdot\frac{\text{sec}}{20\,\text{inch}}\cdot = 0.262\,\text{sec}$$

$$\text{b}_\text{i} = 0.262\,\text{sec}\cdot\frac{1500\,\text{counts}}{\text{minute}}\cdot\frac{\text{minute}}{60\,\text{sec}} = 6.55\,\text{counts}$$

$$MDC_{SCAN} = \frac{1.38\sqrt{6.55}\left(\frac{60}{0.262}\right)}{\left(\sqrt{0.5}\right)(0.085)\left(\frac{584}{100}\right)} = 2{,}305 \text{ dpm/100cm}^2$$

15.3.3 Alpha Ratemeter Scanning

Per MARSSIM section 6.7.2.2 it is not practical to determine a fixed MDC for alpha scanning. It is more useful to determine the probability of detecting an area of contamination at a predetermined DCGL for a given scan rate. MARSSIM provides formulas and probability concepts for alpha scanning when the background is less than 3 cpm and with background values of 5-10 cpm. MARSSIM Appendix J provides derivations of the formulas used to determine these detection probabilities. Scan detection sensitivities for this project are based on a 90% probability of detection.

Background Rates up to 3 cpm

When the instrument background count rate is 3 cpm or less, the scan process consists of two stages: continuous monitoring and stationary sampling. During continuous monitoring, the surveyor listens to the audible output of the instrument. Because the background rate is very low, a single count causes the surveyor to investigate by pausing to determine if the count rate is sustained. The scan MDC is based on the continuous monitoring stage. MARSSIM Equation 6-12 is used to calculate the probability of observing single count while passing over a contaminated area:

$$P(n \geq 1) = 1 - e^{\frac{-GEd}{60v}}$$

Where:

- $P(n \geq 1)$ = probability of observing a single count
- G = contamination activity (dpm)
- E = detector total efficiency (cpm/dpm)
- d = width of detector in direction of scan (cm)
- v = scan speed (cm/s)

Once a count is observed, the surveyor stops and waits a sufficient period of time to achieve a 90% probability of detecting another count. This time interval is calculated using the MARSSIM Equation 6-13:

$$t = \frac{13{,}800}{CAE}$$

Where:

- t = time period for static count (s)
- C = contamination guideline (dpm/100 cm^2)
- A = probe area (cm^2)

E = detector total efficiency (cpm/dpm)

Background Rates of ~ 5-10 cpm

For instruments with background levels from 5-10 cpm, the surveyor usually will need to get at least 2 counts while passing over the source before stopping for further investigation. Therefore, the MDC is determined based on the probability of detecting two or more counts. MARSSIM Equation 6-14 is used to determine the probability of observing two or more counts:

$$P(n \geq 2) = 1 - \left(1 + \frac{(GE + B)t}{60}\right)\left(e^{-\frac{(GE+B)t}{60}}\right)$$

Where:

P(n≥2) = probability of getting two or more counts during time interval t
G = source activity (dpm)
E = detector total efficiency (cpm/dpm)
B = background count rate (cpm)
t = time period over the source

Background Rates >10 cpm

For instruments with background levels above 10 cpm, it becomes more appropriate to use the beta ratemeter scan MDC equation.

15.3.4 Smear Counting

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

$$MDC_{smear} = \frac{3 + 3.29\sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E}$$

Where:

MDC_{smear} = minimum detectable concentration level (dpm/smear)
B_r = background count rate (counts per minute)
t_b = background count time (minutes)
t_s = sample count time (minutes)
E = instrument efficiency for radionuclide emission of interest (cpm/dpm)

The liquid scintillation counter was setup to count samples in three channels as described in Section 20.4. The MDC calculation for each LSC channel using conservative parameters is shown below. Even though channel 3 results were used qualitatively, the MDCR was calculated for evaluation of survey results to use the same MDC equation for all three LSC channels, the efficiency for Channel 3 is set to 1 to report MDCR in cpm.

$$^{3}\text{H MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(15)(1)\left(1+\frac{1}{1}\right)}}{(1)(0.60)} = 35\ \text{dpm}$$

$$^{14}\text{C MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(25)(1)\left(1+\frac{1}{1}\right)}}{(1)(0.80)} = 33\ \text{dpm}$$

$$\text{Channel 3 MDC}_{\text{SMEAR}} = \frac{3 + 3.29\sqrt{(50)(1)\left(1+\frac{1}{1}\right)}}{(1)(1)} = 36\ \text{cpm}$$

Because the counting efficiency is different for each LSC measurement depending on quench characteristics, and in consideration of the errors associated with wipe counting (i.e., area wiped, wiping pressure, etc.), the *a priori* estimates of smear MDCs calculated above are applied to all removable contamination measurements.

15.4 Instrumentation Specifications

The instrumentation used for facility decommissioning surveys is summarized in the following tables.

Table 15-1: Instrumentation Specifications

Detector Model	Detector Type	Detector Area (cm^2)	Meter Model	Window Thickness (mg/cm^2)	Typical Efficiency [9]
Ludlum 43-68	Gas Flow Proportional	126 cm^2	Ludlum 2241-3	0.8 mg/cm^2	38% (2-pi Tc-99) 40% (2-pi Th-230)
Ludlum 43-37	Gas Flow Proportional	584 cm^2	Ludlum 2241-3	0.8 mg/cm^2	38% (2-pi Tc-99) 40% (2-pi Th-230)

[9] The efficiency for each smear sample is automatically determined by the liquid scintillation counter for the H-3 and C-14 channels, depending on the quench characteristics of the sample. The values presented are typical values for samples that are not highly quenched as would be expected in a facility that was recently decontaminated.

Detector Model	Detector Type	Detector Area (cm^2)	Meter Model	Window Thickness (mg/cm^2)	Typical Efficiency [9]
Ludlum 43-10-1	Phoswich	N/A	Ludlum 2929	0.4 mg/cm^2	22% (Tc-99) 34% (Th-230)
Packard TriCarb	Liquid Scintillation	N/A	N/A	N/A	60% (H-3) 80% (C-14) 100% (Channel 3)

Table 15-2: Typical Instrument Operating Parameters and Sensitivities

Measurement Type	Detector Model	Max. Scan Rate[10] (in/s)	Count Time (sec)	Background (cpm)	MDC ($dpm/100\ cm^2$)
Beta Surface Scans	Ludlum 43-68	5	N/A	500	3,392
Beta Surface Scans	Ludlum 43-37	20	N/A	1,500	2,062
Alpha Surface Scans	Ludlum 43-68	1.4	N/A	3	225
Alpha Surface Scans	Ludlum 43-37	6	N/A	10	225
Beta Total Surface Activity	Ludlum 43-68	N/A	6	500	2,999
Beta Total Surface Activity	Ludlum 43-37	N/A	6	1,500	1,081
Alpha Total Surface Activity	Ludlum 43-68	N/A	60	3	88
Alpha Total Surface Activity	Ludlum 43-37	N/A	6	10	131
Beta Removable Activity	Ludlum 2929	N/A	60 600 bkg.	75	149
Alpha Removable Activity	Ludlum 2929	N/A	60 600 bkg.	1	19
Removable Activity	Packard TriCarb	N/A	60	15 (H-3) 25 (C-14) 50 (Channel 3)	35 (H-3) 33 (C-14) 36 (Channel 3)

15.5 Efficiency Determination

ISO 7503-1 methods were used to determine field concentrations for final status data and calculation of resultant doses from residual radioactivity. MARSSIM protocols for

[10] Maximum scan rates are calculated based on the instrument MDCs. Actual scan rates were much slower.

building structures use ISO-7503-1 methodology that takes into account the texture of the surface and the 2π detector efficiency. Under MARSSIM, the default surface efficiency for beta emitters with maximum energies less than 400 keV is conservatively set at 0.25. For smear counting, 4π efficiencies were used.

15.6 Datalogging

Structural surface scans and static measurements were performed using datalogging instrumentation. While scanning, in addition to the surveyor listening to the audible output, integrated counts were recorded. Logged data were downloaded and processed using data management software to perform data analyses and reporting. Reporting includes graphical (4-plot) presentation of scan data as well as summary statistics functions. The 4-Plot is described in the NIST e-Handbook of Statistical Methods (http://www.itl.nist.gov/div898/handbook/index.htm).

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. Non-random structure in the lag plot indicates that the underlying data are not random.
- 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 are 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

16.0 DATA QUALITY OBJECTIVES (DQO)

The following is a list of the major DQOs for the survey design:

- Static measurements were taken to achieve an MDC_{static} of less than 50% of the applicable DCGL.
- Scanning was conducted at a rate to achieve an MDC_{scan} of less than 50% of the applicable DCGL.
- Removable contamination measurements were counted to an MDC_{smear} of less than 50% of the applicable removable DCGL.
- 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 alternative hypothesis (H_A) were that of NUREG 1505 scenario A:

- H_0 is that the survey unit does not meet the release criteria
- H_A is that the survey unit meets the release criteria

- Characterization and remedial action support surveys were conducted under the same quality assurance criteria as final status surveys such that the data may be used as final status survey data to the maximum extent possible.

17.0 AREA CLASSIFICATIONS

Based on the results of the historical site assessment, facility areas were classified as impacted or non-impacted.

17.1 Non-Impacted Area

Non-impacted areas were 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
- Internal surfaces of positively pressurized systems (air, gas, water, etc.)
- Surface and subsurface soils of outside grounds
- Vertical surfaces in non-laboratory rooms with no history of radioactive materials usage.

Laboratory work was performed on benchtops; volatile work was performed within fume hoods; therefore, there is no reasonable probability for residual radioactivity above a two-meter height. Based on historical operations, a potential existed for residual contamination from spills or tracking on surfaces less than two meters in height. Thorough surveys of impacted area entrances/exits and ventilation exhausts were conducted during characterization to provide adequate assurance that any residual contamination was contained within impacted areas.

17.2 Impacted Areas

Impacted areas were those areas that had potential residual radioactivity from licensed activities. Impacted areas are subdivided into Class 1, Class 2 or Class 3 areas. Class 1 areas have the greatest potential for contamination and therefore receive the highest degree of survey effort for the final status survey using a graded approach, followed by Class 2, and then by Class 3. Impacted sub-classifications are defined as follows:

17.2.1 Class 1 Area

Areas with the highest potential for contamination, and meet the following criteria: (1) impacted; (2) potential for delivering a dose above the release criterion; (3) potential for small areas of elevated activity; and (4) insufficient evidence to support classification as Class 2 or Class 3.

Areas with a history of using alpha-emitting nuclides were Class 1 areas.

17.2.2 Class 2 Area

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.

Areas with a history of using only beta-gamma emitting radioactive materials were Class 2 areas.

17.2.3 Class 3 Area

Areas that meet the following criteria: (1) impacted; (2) little or no potential for delivering a dose above the release criterion; and (3) little or no potential for small areas of elevated activity.

Areas not classified as Class 1 or Class 2 were classified as Class 3 areas.

17.3 Survey Units

A survey unit is a geographical area of specified size and shape for which a separate decision is made whether or not that area meets the release criteria. A survey unit is normally a portion of a building or site that is surveyed, evaluated, and released as a single unit. For the purposes of this project, areas of similar construction and composition were grouped together as survey units and tested individually against the DCGLs and the null hypothesis to show compliance with 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 exists within a survey unit does not depend on the survey unit size. However, the sampling density should reflect 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 1,000 m^2 and Class 3: no limit.

Because MARSSIM only addresses building structural surfaces and surface soils of outside grounds, survey design for building mechanical systems is out of the scope of MARSSIM. Therefore, the concept of a survey unit for the purpose of performing MARSSIM statistical tests is not applicable to systems. However building mechanical systems were divided into sections for convenience of data collection and management. The survey unit terminology is extended to describe these sections of building mechanical systems, even though no MARSSIM statistical tests were performed on the measurements.

Survey Unit Numbering Protocol

Each survey unit is assigned a unique number consisting of the building number followed by a dash and a four digit identifier. The four digit identifier consists of one

digit for the elevation, one digit for the classification, and two digits as a numerical identifier in the event the first 2 digits are the same for two or more survey units using the format below:

Building Number – Elevation/Classification/Numerical Identifier

The default numeric identifier is 01

Buildings:
BHB = Brooks Hall Building

Elevations:
B = Basement
1 = 1st Floor
2 = 2nd Floor
3 = 3rd Floor
4 = 4th Floor

Building systems survey units were arranged by building and system type. There are three types of systems – ventilation, vacuum, and drain. Each system survey unit encompasses all of a certain type within the building.

Systems Components:
DR – Drain
VA – Vacuum
VE – Ventilation

Examples:
BHB-1201 is Brooks Hall Building, first floor, Class 2
BHB-2101 is Brooks Hall Building, second floor, Class 1
BHB-DR01 is Brooks Hall Building drains

Survey unit classifications and designations were determined from the historical site assessment and are listed in the tables below. Survey unit designations are shown on the building floor plans presented in Appendix B.

Table 17-1: Building Structural Survey Units

Survey Unit	Floor Area (ft^2)	Percent of Maximum Recommended Floor Area
BHB-B101	148	14
BHB-B102	570	53
BHB-B103	173	16
BHB-B104	1,056	98
BHB-B301	3,548	N/A

Survey Unit	Floor Area (ft^2)	Percent of Maximum Recommended Floor Area
BHB-1101	897	83
BHB-1102	299	28
BHB-1103	837	78
BHB-1201	164	2
BHB-1202	887	8
BHB-1203	878	8
BHB-1204	263	2
BHB-1205	4,219	39
BHB-1301	11,200	N/A
BHB-1302	16,255	N/A
BHB-1303	17,296	N/A
BHB-2101	286	27
BHB-2201	1,726	16
BHB-2301	18,399	N/A
BHB-3101 [11]	621	58
BHB-3301	20,464	N/A
BHB-4301	611	N/A

Table 17-2: Building Systems Survey Units

Survey Unit	Description
BHB-DR01	Drain System
BHB-VE01	Ventilation System
BHB-VA01	Vacuum System

18.0 CHARACTERIZATION SURVEYS

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 areas of highest probability for residual radioactivity. Judgmental static measurements and smears were taken on vertical surfaces as part of the Class 2 and Class 3 final status survey protocols described in section 20.3.5. All survey results at judgmental locations on vertical surfaces were less than the applicable investigation levels.

The purpose of scanning was to identify locations of elevated activity. The minimum scan percentages are presented in section 20.2. Scanning was performed by moving the probe over surfaces at a distance of approximately 0.5 cm or less and at a rate less than the maximum allowable scan rate necessary to achieve DQOs.

[11] Survey Unit BHB-3101 was originally part of BHB-3301, but was upgraded to Class 1 as a result of elevated activity on a benchtop.

In addition to MARSSIM-based surveys, gamma walk-through surveys were performed throughout the building with a 2" x 2" sodium iodide detector. The purpose of this survey was to identify Naturally Occurring Radioactive Material (NORM) and generally licensed materials that may not be identified by surface activity measurements. Results were generally consistent with levels normally encountered in building structural materials. Three locations on the third floor exhibited elevated activity due to mineral samples in the Geology Department. Locations of elevated gamma exposure rate identified included up to 30k cpm in a drawer of samples in room 337, up to 18k cpm in a display case in hallway 312, 750k cpm on a jar of ore (probable Uranium Oxide), and up to 110k cpm on a plastic box containing Vaseline glass. The surveyor informed the responsible faculty of the survey results and the faculty moved the ore and Vaseline glass to a secure location to allow completion of the surveys.

The survey protocol for building system surveys consisted of performing removable contamination measurements of accessible internal surfaces of ventilation, vacuum, and drain systems. Fume hood baffles were removed in Class 1 and Class 2 survey units, and static measurements were performed on internal duct work in addition to the removable contamination measurements. Duct work associated with one fume hood located in survey unit BHB-1204 (Room 137) had previously been removed prior to Chase arrival on site. The existing baffle was removed and measurements were performed on newly exposed surfaces at this location. Static measurements were not possible in vacuum and drain systems due to geometry.

Characterization scan surveys of building structural surfaces identified six small discrete areas of elevated activity in survey units BHB-B104 and BHB-3301. Elevated activity identified in survey unit BHB – B104 (room 027) consisted of fume hood surfaces, a fume hood cup sink, vinyl tile flooring, and a shelf. Elevated activity identified in survey unit BHB-3301 (room 308) consisted of a laboratory benchtop working surface. Because the elevated activity on the laboratory benchtop was above the gross alpha DCGL, the room was upgraded to a Class 1 survey unit (BHB-3101) and the Class 1 survey protocol was implemented. Remediation was performed as described in section 19.0.

Additionally, alpha scan surveys identified sustained audible increase on a fume hood air foil in survey unit BHB-1205, room 152. Static measurements and smears were performed resulting in <MDC for total and removable activity. Although the activity was less than the associated MDCs, the scanning percentage was increased to 100% in room 152 to ensure no other elevated areas were present.

During characterization scan surveys, elevated radioactivity from NORM was identified in glazed ceramic tile on walls throughout the facility. Radioactivity levels were evenly distributed across the surfaces, were within typical ranges associated with glazed tiles, and were less than the Investigation Levels.

All measurements in building systems had results less than the investigation levels.

19.0 REMEDIATION

Remediation consisted of simple decontamination (i.e. wet wiping with a mild detergent using a scrub pad or wire brush), and removal of contaminated material. In room 027, four vinyl floor tiles were removed and turned over to CMU for disposal as radioactive waste. The vinyl floor tiles were removed ensure contamination had not penetrated to underlying surfaces. Post remediation measurements at this location were performed on the newly exposed concrete floor. Fume hood air foils were removed, newly exposed surfaces underneath were surveyed to ensure no elevated activity was present, and the air foils were reassembled. All remediation activities were conducted to control the spread of contamination and to maintain personnel exposures ALARA.

All post remediation total and removable surface activity results are below the investigation levels, and well below the applicable DCGLs. Therefore, no further remediation was performed.

Remediation performed on building surfaces is summarized in the table below.

Table 19-1: Remediated Building Surfaces

Survey Unit (Room #)	Location (Area ft^2)	Maximum Activity		Remediation Method	Post-Remediation Maximum Activity	
		Total (dpm/100 cm^2)	Removable[12] (dpm/100 cm^2)		Total (dpm/100 cm^2)	Removable[12] (dpm/100 cm^2)
BHB-B104 (027)	Fume Hood Cup Sink (<1)	523 (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)	Wet Wipe/Wire Brush/ Scrub	<MDC (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)
BHB-B104 (027)	Fume Hood Air Foil (2)	328 (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)	Wet Wipe/ Scrub	<MDC (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)
BHB-B104 (027)	Fume Hood Air Foil (2)	284 (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)	Wet Wipe	<MDC (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)
BHB-B104 (027)	Shelf (1)	1,181 (Alpha) 3,368 (Beta)	<MDC (Alpha) <MDC (Beta)	Wet Wipe/Wire Brush/ Scrub	<MDC (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)
BHB-B104 (027)	Floor (1)	169 (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)	Wet Wipe/ Scrub/Tile Removal	<MDC (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)

[12] Liquid scintillation results indicated that H-3 and C-14 were below the investigation levels of 352 dpm/100 cm^2. Therefore, compliance with the applicable removable DCGL is demonstrated using a Ludlum 2929 dual channel scaler.

BHB-3101 (308)	Benchtop (2)	1,093 (Alpha) 2,423 (Beta)	<MDC (Alpha) <MDC (Beta)	Wet Wipe/ Scrub	<MDC (Alpha) <MDC (Beta)	<MDC (Alpha) <MDC (Beta)

19.1 Remedial Action Surveys

Remedial action surveys were conducted in support of remediation activities to help determine when an area was ready for a final status survey and to provide updated estimates for final status survey planning. Remedial action surveys served to monitor the effectiveness of decontamination efforts and to ensure that surrounding areas were not cross-contaminated from remediation.

Remedial action surveys consisted of scan surveys and removable contamination measurements. These were conducted following remediation activities to establish the success or failure of decontamination efforts. Results of the survey were the decision basis for continued remediation or conduct of final status surveys. Remedial action surveys were designed to meet the objectives of the final status surveys and, to the extent allowed by MARSSIM, the results of the remedial action surveys were used to supplement the final status survey.

20.0 FINAL STATUS SURVEYS

Final status surveys were performed using the DQO process to demonstrate that residual radioactivity in each survey unit satisfied the predetermined criteria for release for unrestricted use. Final status surveys were 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 were documented on survey maps and/or associated data information sheets.

20.1 Background Determination

The use of reference background areas or paired background comparisons was not necessary. Material and ambient background values were not significant in comparison to the DCGLs or ALARA goals. For direct measurements, an ambient background was determined for each survey, was subtracted from gross measurements, and was used to calculate the actual survey MDCs and associated count errors. Material-specific background determinations were not performed. The background count rate was determined at least daily for laboratory smear counters and was subtracted from removable activity results.

20.2 Surface Scans

Scanning was used to identify locations within the survey unit that exceed the investigation level. The table below summarizes the minimum scan percentage of accessible building structural surfaces based on classification.

Table 20-1: Scan Survey Coverage by Classification

Structure	Class 1	Class 2	Class 3
Floors	100%	75%	20%
Fume Hoods	100%	75%	20%
Other Structures	100%	25%	10%

For surfaces that received less than 100% scan survey, the surfaces scanned were those with the highest potential to contain residual radioactivity at the discretion of the surveyor.

20.3 Total Surface Activity Measurements

Direct surveys (static measurements) for total surface activity were taken on building surfaces in impacted areas utilizing instrumentation of the best geometry based on the surface at the survey location. Additionally, locations of elevated activity identified and marked during the scan survey received direct survey measurements. Static measurements were taken in impacted areas at each identified sample location. Scaler count times were determined to achieve the detection sensitivities stated in the DQOs. Field measurements were converted to activity concentrations using the following equation:

$$Activity\ (dpm/100\ cm^2) = \frac{R_{s+b} - R_b}{E_{total} \times \frac{A}{100\ cm^2}}$$

Where:

R_{s+b} = The gross count rate of the measurement (cpm)
R_b = The background count rate (cpm)
E_{total} = Total Efficiency (cpm/dpm)
A = Area of the detector window (cm^2)

20.3.1 Determining the Number of Samples

A minimum number of samples are needed to obtain sufficient statistical confidence that the conclusions drawn from the samples are correct. The number of samples depends on the Relative Shift (the ratio of the concentration to be measured relative to the statistical variability of the contaminant concentration). The minimum number of samples required for the Sign Test was calculated using equations in Section 5 of MARSSIM, and are provided below.

20.3.2 Determination of the Relative Shift

The number of required samples depends on the ratio involving the activity level to be measured relative to the variability in the concentration. The ratio to be used 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 (1 for unity)
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 (0.5)
σ_S = an estimate of the standard deviation of the residual radioactivity in the survey unit

The relative shift was calculated using the highest standard deviation. The actual calculation is provided below:

$$\Delta / \sigma_S = \frac{1 - 0.5}{0.17} = 2.94$$

Since the number of samples required increases with a decreasing relative shift, the relative shift was conservatively set at 2.5.

20.3.3 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). The decision errors are 0.05 for both α and β.

20.3.4 Determination of Number of Data Points (Sign Test)

The number of direct measurements for a particular survey unit, employing the Sign Test, is 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 an increase of 20% of the

calculated value. The following calculations were made to determine this number:

$$N = \frac{(1.645+1.645)^2}{4(0.993790-0.5)^2} = 12$$

$Z_{1-\alpha}$ 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 0.993790 from MARSSIM Table 5.4. Adding an additional 20% to account for data losses resulted in a value of **15**.

20.3.5 Determination of Sample Locations

Determination of 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 provides an unbiased method for obtaining measurement locations to be used in the statistical tests. MARSSIM recommends random sampling (random x, random y) for Class 3 areas; however, Class 3 areas were sampled on a systematic grid pattern in the same manner as MARSSIM recommends for Class 1 and Class 2 areas.

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 was determined from MARSSIM equation 5-8:

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

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 surfaces included in the statistical tests (floors, walls, ceilings, fixed cabinetry, etc.). 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. Maps of final status survey locations for all survey units are included in Appendix D.

In laboratory areas, permanent counter tops, and other horizontal surfaces that block floor surfaces, were used as replacements to blocked floor surfaces.

Likewise, fixed cabinetry faces and other permanent equipment replaced blocked wall surfaces. Internal surfaces of permanent furnishings (i.e., drawer or cabinetry interior surfaces) are not included in the systematic measurement location placement. However, these surfaces were included in the scan surveys. Additional total surface activity measurements were collected at each area of elevated activity identified during the scan surveys.

Class 1 survey units generally consist of one or two rooms or laboratories. Class 2 and Class 3 survey units generally consist of many rooms. Representing each room in a "fold-out" view to show all surfaces is difficult and time-consuming. The processes to identify, map, and locate measurement coordinates in survey units with many rooms are complicated due to the noncontiguous nature of the survey unit once walls are "folded-out." Therefore, the MARSSIM sample measurement locations (i.e., static measurements and smears) for Class 2 and Class 3 survey units were determined only on horizontal surfaces as determined on floor plans. This protocol increases the sample density on the surfaces with the highest probability for residual contamination (floors, benchtops, fume hood working surfaces, etc.). The appropriate percentage of all survey unit surfaces (including vertical surfaces) was scanned according to the survey unit classification. As part of characterization, the survey technician judgmentally selected 10 locations with the highest probability of contamination on vertical surfaces for a static measurement and smear such as light switches, door knobs, door pulls, push plates, and other locations. These measurements are in addition to and not included in the statistical analysis of the locations selected by MARSSIM protocols.

20.4 Removable Surface Activity Measurements

Removable surface activity measurements were collected by wiping an area of approximately 100 cm^2 on structural surfaces and in ventilation, vacuum, and drain systems. For structural surfaces, removable alpha and beta measurements were determined using cloth disc smears and were counted using a Ludlum 2929 dual channel scaler. Additionally, an adjacent LSC disc smear was collected on structural surfaces to quantify low energy beta emitters that may not be detected in the scaler.

For building system internals where geometry precluded the use of disc smears, removable activity measurements were collected with cotton swabs and counted on the LSC. All smears/swabs were counted to achieve the detection sensitivities stated in the DQOs. Removable contamination measurements on vacuum systems are reported in dpm/swab.

The LSC was set up for three channels with background subtraction at the following energies:

Channel 1 (^{3}H dpm):	0 – 18.6 keV
Channel 2 (^{14}C dpm):	18.6 – 156 keV
Channel 3 (cpm):	156 – 2,000 keV

Channel 3 results were used to measure beta emissions with energies above C-14 and H-3 emissions and alpha emissions.[13]

20.5 Surveys of Building Mechanical System Internals

Surveys of various building system components were performed. Survey design for these systems is out of the scope of MARSSIM. For the purposes of identifying potential residual contamination within these systems, a survey protocol was established and is presented in the table below.

Table 20-2: System Survey Coverage

System Component	Coverage
Vacuum Nozzles, Pumps, Accumulators	100%
Fume Hood Vent Ducts and Fans	100%
Drain Openings/Traps	100%

Surveys of building systems consisted of scan surveys, total activity measurements and removable contamination measurements of accessible openings and at locations of potential collection or buildup. Scan surveys and static measurements were not possible at some locations (such as drain pipe and vacuum system internals) due to small geometry.

20.6 Survey Documentation

A survey package was developed for each survey unit containing the following:

- Survey Unit number (e.g., Building and Room Number, System Number, etc.)
- Survey Instruction Sheets
- General survey requirements
- Percentage of surfaces requiring scan surveys
- Number of total and removable contamination measurements required, instrument requirements with associated MDCs, count times and scan rates
- Overview maps detailing survey locations and placement methodology
- Survey Data Sheets
- Any additional specific survey instruction
- Signature of Data Collector and Reviewer

To ensure proper data management and organization, a unique location code 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.

[13] Alpha emissions would be detected in Channel 3 with 100% efficiency.

Table 20-3: 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)
BHB: Brooks Hall Building

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)

F1 = Floor	D1 = Fumehood Drain	E1 = Hood Exhaust Duct
W1 = Wall	D2 = Floor Drain	E3 = Hood Exhaust Fan / Component
C1 = Casework	D3 = Sink Drain	
B1 = Benchtop		V1 = Vacuum Nozzle
		V2 = Vacuum Component

M: = Structural Material Code. This field represents the type of structural material on which a particular measurement is taken. (1 character)

M = Miscellaneous	C = Concrete
V = Vinyl Tile/Sheeting	B = Cinder Block
T = Tile (Terracotta/Porcelain/Glazed)	

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)

21.0 SURVEY RESULTS AND DATA QUALITY ASSESSMENT

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

21.1 Data Validation

Field data were reviewed by the Project Manager and validated to ensure:

- Completeness of forms
- Proper types of surveys were performed
- The MDCs for measurements met the established data quality objectives
- Independent calculations were performed on a representative sample of data sheets
- Satisfactory instrument calibrations and daily functionality checks were performed as required

Additionally, all final status survey data were 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.

21.2 Preliminary Data Review

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

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

- Review of the 4-Plot graphs of beta scan data
- 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
- Comparison of survey data with applicable investigation levels

The minimum number of measurements required was recalculated using the highest standard deviation from survey unit BHB-1302, and conservatively applied to all survey units. An adequate number of samples were collected for each survey unit.

21.3 Building Structural Surfaces Scan Data

No elevated activity was identified by listening to the audible detector response except for six discrete areas of elevated activity as described in Section 18.0. Additionally, a 4-Plot was produced of beta scan survey data for each survey unit.

The 4-Plot graphs show occasional spikes that have one-second count rates higher than the ALARA goal of 3,525 dpm/100 cm^2 due to normal statistical variability associated with a relatively short (one second) sampling interval. Additionally, it was noted during the survey that ceramic tile, sinks, and porcelain fixtures used in the building construction consistently demonstrated elevated count rates. Where these materials were encountered, the elevated count rates combined with normal statistical variations caused one-second spikes slightly above the DCGL on four occasions. This is a statistical anomaly due to the short sample interval; the surveyor did not encounter sustained elevated audible count rates at these locations. Based on the peak one second count rate, scan speed and the local average of the count rate, the data is consistent with surface contamination less than 3,525 dpm/100 cm^2.

Due to the short sampling interval (one second) combined with the low alpha count rate (typically less than 10 cpm), there is a low probability that the instrument will detect radiation over a one second interval; therefore the recorded data is dominated by zero counts and there is little variability within the distribution. This limits the utility of the 4-Plot as an analytical tool; therefore 4-Plots were not generated for alpha scan data. Instead, logged data was reviewed to ensure there were no results above the investigation level.

4-Plot graphs of beta scan results are provided in Appendix E.

21.4 Data Summary Tables

All calculations of means, standard deviations, minimum and maximum values and comparisons between survey data and investigation levels are presented in the following tables. Building structural surface activity reports for each survey unit are included as Appendix F. Reports for building systems surveys are presented in Appendix G.

Table 21-1: Structural Surfaces Total Surface Activity Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-B101	12	0.15	0.07	0.06	0.27	0.5	NO
BHB-B102	15	0.12	0.09	0.02	0.37	0.5	NO
BHB-B103	16	0.04	0.08	0.00	0.14	0.5	NO
BHB-B104	12	0.11	0.09	0.00	0.25	0.5	NO
BHB-B301	12	0.09	0.11	0.00	0.33	0.5	NO
BHB-1101	22	0.11	0.16	0.00	0.45	0.5	NO
BHB-1102	14	0.04	0.06	0.00	0.09	0.5	NO
BHB-1103	14	0.08	0.06	0.01	0.14	0.5	NO
BHB-1201	15	0.04	0.08	0.00	0.23	0.5	NO

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-1202	16	0.02	0.05	0.00	0.08	0.5	NO
BHB-1203	16	0.04	0.05	0.00	0.12	0.5	NO
BHB-1204	17	0.09	0.08	0.02	0.24	0.5	NO
BHB-1205	14	0.05	0.06	0.00	0.14	0.5	NO
BHB-1301	15	0.17	0.12	0.04	0.55	0.5	YES
BHB-1302	16	0.15	0.17	0.02	0.58	0.5	YES
BHB-1303	15	0.04	0.07	0.00	0.23	0.5	NO
BHB-2101	16	0.03	0.06	0.00	0.12	0.5	NO
BHB-2201	15	0.04	0.06	0.00	0.13	0.5	NO
BHB-2301	14	0.06	0.15	0.00	0.46	0.5	NO
BHB-3101	13	0.03	0.03	0.00	0.07	0.5	NO
BHB-3301	14	0.10	0.12	0.00	0.45	0.5	NO
BHB-4301	15	0.08	0.09	0.00	0.24	0.5	NO

Table 21-2: Structural Surfaces Removable Activity Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-B101	12	0.05	0.09	0.00	0.17	0.5	NO
BHB-B102	15	0.02	0.07	0.00	0.15	0.5	NO
BHB-B103	16	0.04	0.07	0.00	0.10	0.5	NO
BHB-B104	12	0.04	0.09	0.00	0.25	0.5	NO
BHB-B301	12	0.05	0.08	0.00	0.16	0.5	NO
BHB-1101	22	0.05	0.07	0.00	0.22	0.5	NO
BHB-1102	14	0.06	0.08	0.00	0.26	0.5	NO
BHB-1103	14	0.05	0.10	0.00	0.23	0.5	NO
BHB-1201	15	0.04	0.08	0.00	0.10	0.5	NO
BHB-1202	16	0.01	0.05	0.00	0.06	0.5	NO
BHB-1203	16	0.06	0.09	0.00	0.19	0.5	NO
BHB-1204	17	0.06	0.07	0.01	0.11	0.5	NO
BHB-1205	14	0.04	0.06	0.00	0.15	0.5	NO
BHB-1301	15	0.05	0.08	0.00	0.12	0.5	NO
BHB-1302	16	0.06	0.07	0.00	0.12	0.5	NO
BHB-1303	15	0.03	0.08	0.00	0.13	0.5	NO
BHB-2101	16	0.06	0.10	0.00	0.23	0.5	NO
BHB-2201	15	0.04	0.10	0.00	0.27	0.5	NO
BHB-2301	14	0.05	0.08	0.00	0.22	0.5	NO

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-3101	13	0.03	0.09	0.00	0.15	0.5	NO
BHB-3301	14	0.04	0.08	0.00	0.16	0.5	NO
BHB-4301	15	0.04	0.10	0.00	0.13	0.5	NO

Table 21-3: Building Structural Surfaces Removable H-3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($dpm/100\ cm^2$)					
BHB-B101	12	39	28	19	126	352	NO
BHB-B102	15	100	30	36	165	352	NO
BHB-B103	16	56	35	19	136	352	NO
BHB-B104	12	159	62	84	280	352	NO
BHB-B301	12	48	18	25	90	352	NO
BHB-1101	22	50	24	0	104	352	NO
BHB-1102	14	60	26	24	120	352	NO
BHB-1103	14	26	13	11	45	352	NO
BHB-1201	15	22	14	0	55	352	NO
BHB-1202	16	34	19	0	69	352	NO
BHB-1203	16	40	37	0	143	352	NO
BHB-1204	17	31	11	20	59	352	NO
BHB-1205	14	35	12	18	51	352	NO
BHB-1301	15	37	21	8	80	352	NO
BHB-1302	16	46	18	14	82	352	NO
BHB-1303	15	55	21	23	101	352	NO
BHB-2101	16	38	18	6	67	352	NO
BHB-2201	15	53	19	26	85	352	NO
BHB-2301	14	62	14	36	82	352	NO
BHB-3101	13	17	13	0	43	352	NO
BHB-3301	14	57	19	21	85	352	NO
BHB-4301	15	166	57	88	245	352	NO

Table 21-4: Building Structural Surfaces Removable C-14 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($dpm/100\ cm^2$)					
BHB-B101	12	5	3	0	10	352	NO
BHB-B102	15	4	4	0	14	352	NO
BHB-B103	16	8	5	0	21	352	NO
BHB-B104	12	3	2	0	6	352	NO
BHB-B301	12	5	4	0	12	352	NO
BHB-1101	22	6	5	0	14	352	NO
BHB-1102	14	6	5	0	16	352	NO
BHB-1103	14	8	6	0	20	352	NO
BHB-1201	15	4	4	0	12	352	NO
BHB-1202	16	3	4	0	10	352	NO
BHB-1203	16	7	5	1	17	352	NO
BHB-1204	17	5	5	0	13	352	NO
BHB-1205	14	5	3	0	10	352	NO
BHB-1301	15	6	6	0	20	352	NO
BHB-1302	16	5	4	0	13	352	NO
BHB-1303	15	7	6	0	18	352	NO
BHB-2101	16	4	4	0	12	352	NO
BHB-2201	15	6	3	0	11	352	NO
BHB-2301	14	8	5	0	18	352	NO
BHB-3101	13	4	3	0	9	352	NO
BHB-3301	14	5	4	0	12	352	NO
BHB-4301	15	3	3	0	9	352	NO

Table 21-5: Building Structural Surfaces Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($cpm/100\ cm^2$)					
BHB-B101	12	0	0	0	1	36	NO
BHB-B102	15	1	1	0	3	36	NO
BHB-B103	16	1	1	0	3	36	NO
BHB-B104	12	0	1	0	2	36	NO
BHB-B301	12	3	3	0	11	36	NO
BHB-1101	22	1	1	0	3	36	NO
BHB-1102	14	1	1	0	5	36	NO
BHB-1103	14	3	4	0	11	36	NO
BHB-1201	15	1	2	0	5	36	NO

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
BHB-1202	16	1	1	0	5	36	NO
BHB-1203	16	1	2	0	5	36	NO
BHB-1204	17	1	1	0	4	36	NO
BHB-1205	14	1	1	0	4	36	NO
BHB-1301	15	2	2	0	5	36	NO
BHB-1302	16	1	2	0	6	36	NO
BHB-1303	15	2	3	0	9	36	NO
BHB-2101	16	1	2	0	7	36	NO
BHB-2201	15	0	1	0	5	36	NO
BHB-2301	14	1	1	0	4	36	NO
BHB-3101	13	1	2	0	6	36	NO
BHB-3301	14	1	1	0	4	36	NO
BHB-4301	15	0	1	0	2	36	NO

Table 21-6: Building Systems Total Surface Activity Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-VE01	53	0.24	0.09	0.05	0.37	0.5	NO

Table 21-7: Building Systems Removable Surface Activity Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-VE01	53	0.05	0.10	0.00	0.26	0.5	NO

Table 21-8: Building Systems Removable H-3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(dpm/100 cm^2) [14]					
BHB-DR01	378	31	29	0	228	352	NO
BHB-VA01	210	55	39	0	216	352	NO
BHB-VE01	119	62	29	0	141	352	NO

[14] Vacuum nozzle removable activity results are reported in dpm/swab.

Table 21-9: Building Systems Removable C-14 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($dpm/100\ cm^2$) [14]					
BHB-DR01	378	5	5	0	29	352	NO
BHB-VA01	210	4	4	0	18	352	NO
BHB-VE01	119	4	4	0	17	352	NO

Table 21-10: Building Systems Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($cpm/100\ cm^2$) [14]					
BHB-DR01	378	1	1	0	12	36	NO
BHB-VA01	210	1	2	0	11	36	NO
BHB-VE01	119	1	2	0	10	36	NO

21.5 Determining Compliance for Building Surfaces and Structures

Final status survey results were initially compared to the investigation levels. Six small discrete areas of elevated activity above the investigation levels were identified on building structural surfaces during characterization surveys. The areas were remediated and resurveyed with results of <MDC for total and removable activity. No further action was taken because this is an extremely small fraction of the DCGL.

Survey Units BHB-1301 and BHB-1302 each had one result slightly above the investigation level due to ceramic tile flooring materials. The results were below the DCGL so no further action was taken.

All total and removable surface activity results on building structural surfaces were less than the DCGL and an adequate number of samples were obtained, therefore all survey units pass the Sign test.

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 21-11: Structural Surfaces Total Surface Activity Dose Calculations

Survey Unit	Standard Deviation (SOF)	# Samples Required	Actual # of Samples	Adequate # of Samples?	Mean (SOF)	Calculated Annual TEDE[15] (mrem/yr)
BHB-B101	0.07	11	12	YES	0.15	3.75
BHB-B102	0.09	11	15	YES	0.12	3.00
BHB-B103	0.08	11	16	YES	0.04	1.00
BHB-B104	0.09	11	12	YES	0.11	2.75
BHB-B301	0.11	11	12	YES	0.09	2.25
BHB-1101	0.16	11	22	YES	0.11	2.75
BHB-1102	0.06	11	14	YES	0.04	1.00
BHB-1103	0.06	11	14	YES	0.08	2.00
BHB-1201	0.08	11	15	YES	0.04	1.00
BHB-1202	0.05	11	16	YES	0.02	0.50
BHB-1203	0.05	11	16	YES	0.04	1.00
BHB-1204	0.08	11	17	YES	0.09	2.25
BHB-1205	0.06	11	14	YES	0.05	1.25
BHB-1301	0.12	11	15	YES	0.17	4.25
BHB-1302	0.17	11	16	YES	0.15	3.75
BHB-1303	0.07	11	15	YES	0.04	1.00
BHB-2101	0.06	11	16	YES	0.03	0.75
BHB-2201	0.06	11	15	YES	0.04	1.00
BHB-2301	0.15	11	14	YES	0.06	1.50
BHB-3101	0.03	11	13	YES	0.03	0.75
BHB-3301	0.12	11	14	YES	0.10	2.50
BHB-4301	0.09	11	15	YES	0.08	2.00
					Maximum:	**4.25**

All measurement results are less than the DCGL and an adequate number of measurements were taken; therefore the null hypothesis is rejected and all survey units meet the release criterion and are suitable for release for unrestricted use.

[15] The TEDE shown is conservatively calculated by multiplying 25 mrem/yr by the ratio of the mean total surface activity to the DCGL of 1.

21.6 Determining Compliance for Building Systems

All building systems final status survey results are less than the investigation levels.

All total and removable surface activity measurement results are less than the applicable DCGL; therefore all systems survey units meet the release criteria and are suitable for release.

22.0 QUALITY ASSURANCE SURVEYS

Quality assurance surveys consisted of re-performing the FSS protocol for building structural surfaces to achieve a minimum of 5% duplication of scans, static measurements and smears. The Project Manager implemented QA surveys by re-performing judgmentally selected survey locations as survey unit QA01. The locations of QA survey total and removable surface activity measurements are presented in the table below.

Table 22-1: QA Survey Locations

QA Survey Location	FSS Location
BHB-QA01-F1-C-001	BHB-4301-F1-C-009
BHB-QA01-F1-V-002	BHB-2201-F1-V-010
BHB-QA01-F1-V-003	BHB-1303-F1-V-006
BHB-QA01-F1-V-004	BHB-1302-F1-V-008
BHB-QA01-F1-V-005	BHB-1301-F1-V-003
BHB-QA01-F1-M-006	BHB-1201-F1-M-012
BHB-QA01-F1-V-007	BHB-1202-F1-V-002
BHB-QA01-F1-V-008	BHB-1203-F1-V-014
BHB-QA01-F1-V-009	BHB-1204-F1-V-015
BHB-QA01-F1-V-010	BHB-1205-F1-V-010
BHB-QA01-W1-B-011	BHB-1101-W1-B-009
BHB-QA01-W1-C-012	BHB-B104-W1-C-005
BHB-QA01-W1-C-013	BHB-B101-W1-C-001
BHB-QA01-W1-B-014	BHB-B102-W1-B-010
BHB-QA01-W1-C-015	BHB-B103-W1-C-004
BHB-QA01-F1-V-016	BHB-B301-F1-V-005
BHB-QA01-F1-V-017	BHB-2301-F1-V-004
BHB-QA01-W1-B-018	BHB-2101-W1-B-010
BHB-QA01-F1-V-019	BHB-1103-F1-V-005
BHB-QA01-F1-V-020	BHB-3301-F1-V-008

QA Survey Location	FSS Location
BHB-QA01-F1-V-021	BHB-1102-F1-V-010
BHB-QA01-F1-V-022	BHB-3101-F1-V-005

22.1 QA Survey Results

All QA survey results were similar to FSS data and the conclusions were the same as those based on the initial surveys. QA survey results are presented in Appendix H and are summarized in the tables below.

Table 22-2: QA Survey Building Structural Surfaces Total Activity Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-QA01	22	0.06	0.05	0.00	0.17	0.5	NO

Table 22-3: QA Survey Building Structural Surfaces Removable Activity Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(Sum of Fractions)					
BHB-QA01	22	0.03	0.07	0.00	0.17	0.5	NO

Table 22-4: QA Survey Building Structural Surfaces Removable H-3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($dpm/100\ cm^2$)					
BHB-QA01	22	73	31	2	144	352	NO

Table 22-5: QA Survey Building Structural Surfaces Removable C-14 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		($dpm/100\ cm^2$)					
BHB-QA01	22	5	4	0	16	352	NO

Table 22-6: QA Survey Building Structural Surfaces Removable Channel 3 Summary

Survey Unit	# of Sample Locations	Mean	Standard Deviation	Min.	Max.	Investigation Level	Any Result Exceeding Investigation Level?
		(cpm/100 cm^2)					
BHB-QA01	22	1	2	0	6	36	NO

23.0 REFERENCES

- NRC Regulations 10 CFR 20 Subpart E
- Central Michigan University Brooks Hall Decommissioning Work Plan, October 7, 2016
- CMU Radioactive Materials License Number 21-01432-02
- Chase Kentucky License Number 201-605-15
- Chase Radiation Safety Manual
- Chase Quality Assurance Program
- NUREG 1757, Volume 1 "Consolidated NMSS Decommissioning Guidance," September, 2002
- NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM)
- NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"
- ISO-7503-1, "Evaluation of Surface Contamination – Part 1: Beta Emitters and Alpha Emitters." 1988
- NUREG 1556, Volume 7, Table Q.2, "Acceptable Surface Contamination Levels for Equipment," December 1999

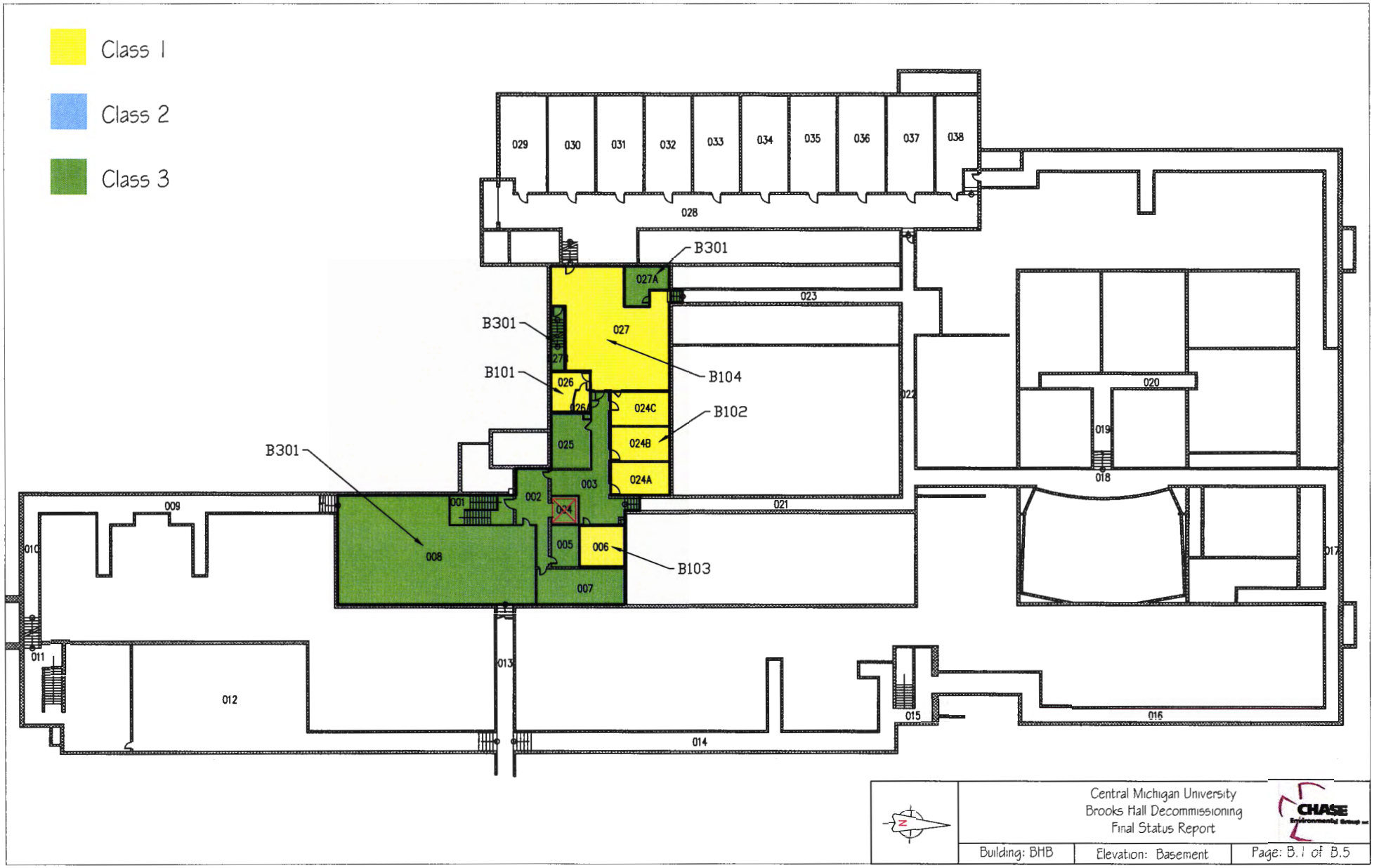
Appendix A
Site Satellite Photo



Central Michigan University
Brooks Hall Decommissioning
Final Status Report

Site Satellite Photo | Page: A.1 of A.1

Appendix B
Building Floor Plans


Class 1
Class 2
Class 3
029
030
031
032
033
034
035
036
037
038
028
B301
027A
023
B301
027
B104
B101
026
026A
024C
B102
025
024B
B301
024A
003
002
001
024
021
009
010
008
005
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B103
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CHASE
Environmental Group Inc.



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Class 1

Class 2

Class 3



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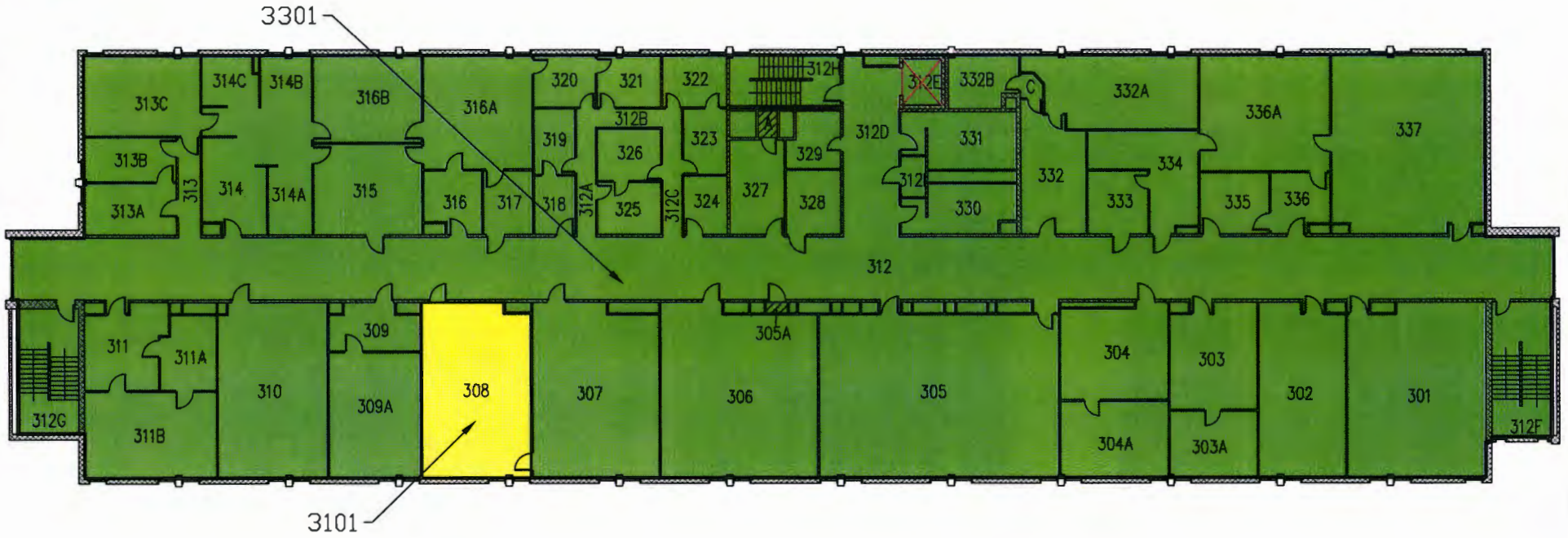
CHASE Environmental Group, Inc.

Building: BHB	Elevation: 2nd	Page: B.3 of B.5

Class 1

Class 2

Class 3



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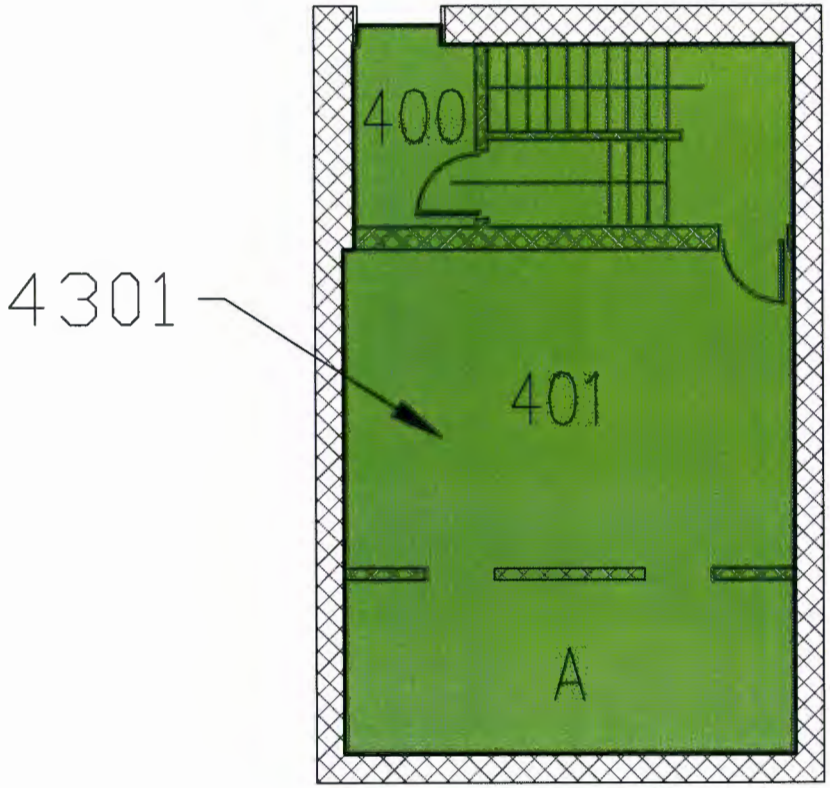
CHASE Environmental Group

Building: BHB	Elevation: 3rd	Page: B.4 of B.5

Class 1

Class 2

Class 3



Central Michigan University
Brooks Hall Decommissioning
Final Status Report

Building: BHB	Elevation: 4th	Page: B.5 of B.5

Appendix C
Instrument Calibration Records

Safety and Ecology Corporation SEC PROCEDURE # SEC-IS-406 Rev 2
2800 Solway Road
Knoxville, TN 37931

Calibration Certificate

11/23/2016

Calibration Certificate for 2929,Serial # 160013, Bar Code # ,Property # Chase44

Date: 11/23/16 Date Last Cal. Expires: 11/30/16 Technician: Carl Hall

Location: 999999, Reason For Calibration: Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2 SERIAL #: 132896 CAL DUE: 06/20/17

MODEL: SERIAL #: CAL DUE:

AS FOUND DATA

AS FOUND Instrument Condition: SAT AS LEFT Instrument Condition: SAT

AS FOUND Mechanical Zero: 0 AS LEFT Mechanical Zero: 0

Scaler Function Check	AS FOUND		AS LEFT		
Beta Channel Window (4-50 mV):	4-50	mV	AF	mV	
Alpha Channel Threshold (175 mV):	175	mV	AF	mV	
Alpha Counts w/Pulser @ 10,000 CPM:	9,993	CPM	AF	CPM	% Error: 0.07%
Beta Counts w/Pulser @ 10,000 CPM:	9,994	CPM	AF	CPM	% Error: 0.06%

If AS FOUND data in Scaler Function Check is within 10%, the technician may place AF in AS LEFT section and proceed to High Voltage power supply section.

HIGH VOLTAGE POWER SUPPLY CALIBRATION	AS FOUND		AS LEFT	
Vernier Setting:	3.40		AF	
HV Setpoints:	850	V	AF	V
500 V Reading:	497	V	AF	V
1000 V Reading:	1000	V	AF	V
1500 V Reading:	1505	V	AF	V
Max HV (1500 V +):				

DIGITAL SCALER

AF 250: 250 % ERR: 0.00% AL 250: AF % ERR: 0.00%

AF 2500: 2500 % ERR: 0.00% AL 2500: AF % ERR: 0.00%

AF 25K: 25.0 K % ERR: 0.00% AL 25K: AF K % ERR: 0.00%

AF 250K: 250.0 K % ERR: 0.00% AL 250K: AF K % ERR: 0.00%

☑ Is the As Found Data Within 20% of the Set Point?

Comments: Married as a set with: Model: 43-10-1 Serial #: PR167231 Bar Code #:

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 11/23/17

Performed by: Reviewed by: Date: 11-23-16

Printed Name: Carl Hall

Calibration Certificate for 43-10-1,Serial # PR167231, Bar Code # ,Property # Chase45

Date: 11/23/16 **Date Last Cal. Expires:** 11/30/16 **Technician:** Carl Hall

Location: 999999, **Reason For Calibration:** Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 2929 **SERIAL #:** 160013 **CAL DUE:** 11/23/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	37.15 %
Tc-99:	22.23 %
Th-230:	39.12 %
SrY-90:	37.5 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

HV: Calibration Setpoints 850 V Vernier: 3.40

Threshold Beta: 4 - 50 mV Alpha: 175 mV

Background:	Alpha		Beta		AF Efficiencies	A-B XTLK
Pu-239:	9566	CPM	305	CPM	37.08%	2.7%
Tc-99:	3	CPM	7678	CPM	23.92%	B-A XTLK
Th-230:	12734	CPM	N/A		36.49%	0.0%
SrY-90:	N/A		6408	CPM	37.79%	

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust, or Plateau

HV: 850 V **Vernier:** 3.40

Background:	Alpha		Beta		AL Efficiencies	A-B XTLK
Pu-239:	9566	CPM	305	CPM	37.08%	2.6%
Tc-99:	3	CPM	7678	CPM	23.92%	B-A XTLK
Th-230:	12734	CPM	N/A		36.49%	0.0%
SrY-90:	N/A		6408	CPM	37.79%	

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

☑ Is the As Found Data Within 20% of the efficiency from the last cal.?

Reproducibility: Isotope: Sr-90 | 6421 | 6389 | 6401 Average: 6403.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) 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 Data and go directly to Comments. Geometry = NaI probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

PLATEAU DATA

Source 1: Tc-99 Source 2: Th-230

High Voltage	Response (CPM) A ch.	B ch.	Net Eff.	Response (CPM) A ch.	B ch.	Net Eff.	Background (CPM) A ch.	B ch.	Net A to B Xtalk: <10%	Net B to A Xtalk: <1%
N/A									N/A	
									N/A	
									N/A	
									N/A	
									N/A	
									N/A	

2 Pi Efficiencies: Pu-239: 73.02% Tc-99: 38.16% Th-230: 71.94% SrY-90: 53.86%

Comments: Married as a set with: Model: 2929 Serial #: 160013 Bar Code #:

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 11/23/17

Performed by: Printed Name: Carl Hall

Reviewed by: Date: 11-23-14

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-10-1 **Customer Name :** Chase Environmental

Probe Serial Number : PR167231 **Technician :** Carl Hall

Date of Calibration : 11/23/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	160013	Calibration Due Date:	11/23/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N		Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	77173-513		19,100	0.0305405	30,600	6/3/2008

Data

Instrument condition : Sat

High Voltage: 850

Background: 47

C-14 Count: 4181

2π Efficiency: 21.64%

4π Efficiency: 13.51%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 160013

Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 11/23/2017

Performed by : Carl Hall Reviewed by : Date : 11-22-16

Printed Name : Carl Hall

Entered in computer inventory by: Date :

SEC/Perma-Fix Instrument Services
Calibration Data Sheet

Form 99
Rev. C

Meter Serial Number :	181301	**Customer Name :**	Chase Environmental
Meter Model Number:	2241-3	**P.O Number :**	
Previous Due Date :	8/11/2016	**Technician :**	Thomas Thompson
Date :	2/4/2016	**Reason For Calibration :**	Due
		M&TE Used	

Instrument model number : 500-2 Serial No.: 209797 Due Date: 7/30/2016

As Found Instrument Condition	SAT

Meter

Threshold		HV Check 400V - 1500V	Pass
AF	AL		
35mV	35mV		

Digital Scaler

Target	As Found	%Error	As Left	%Error
250	249	0.40%	249	0.40%
2,500	2,495	0.20%	2,495	0.20%
25,000	24,953	0.19%	24,953	0.19%
250,000	249,495	0.20%	249,495	0.20%

Rate meter

	AF	% Error	AL	% Error
100	100	0.00%	100	0.00%
250	250	0.00%	250	0.00%
400	400	0.00%	400	0.00%
1,000	1,000	0.00%	1000	0.00%
2,500	2,500	0.00%	2500	0.00%
4,000	4,000	0.00%	4000	0.00%
10,000	10,000	0.00%	10000	0.00%
25,000	25,000	0.00%	25000	0.00%
40,000	40,000	0.00%	40000	0.00%
100,000	100,000	0.00%	100000	0.00%
250,000	250,000	0.00%	250000	0.00%
400,000	400,000	0.00%	400000	0.00%

Alarm	OK
Lamp	OK
Response	OK
Reproducible	OK
Sticker Attached	OK

As Left Instrument Condition	SAT

Probe Settings — Probe 1

Model Number		44-9	
Serial Number		PR171793	
	AF		AL
HV	905V	HV	900V
Dead Time	0.00E+00	Dead Time	0.00E+00
CC	1.00E+00	CC	1.00E+00

Probe Settings — Probe 2

Model Number		43-5	
Serial Number		PR089621	
	AF		AL
HV	628V	HV	700V
Dead Time	0.00E+00	Dead Time	0.00E+00
CC	1.00E+00	CC	1.00E+00

Probe Settings — Probe 3

Model Number		44-6	
Serial Number		PR140972	
	AF		AL
HV	905V	HV	900V
Dead Time	1.25E-04	Dead Time	9.00E-05
CC	6.20E+07	CC	6.00E+07

Probe Settings — Probe 4

Model Number		N/A	
Serial Number		N/A	
	AF		AL
HV	N/A	HV	N/A
Dead Time	N/A	Dead Time	N/A
CC	N/A	CC	N/A

Comments/Remarks :

Date unit is due for next calibration: 2/4/2017

Performed by :
Printed Name : Thomas Thompson

Reviewed by :

Date : 2/4/16

Calibration Certificate

2/4/2016

Calibration Certificate for 44-9,Serial # PR171793, Bar Code # ,Property # Chase7

Date: 02/04/16 **Date Last Cal. Expires:** 08/11/16 **Technician:** Thomas Thompson

Location: 999999, **Reason For Calibration:** Short Cycled

EQUIPMENT USED DURING CALIBRATION

MODEL: 2241-3 **SERIAL #** 181301 **CAL DUE:** 02/04/17

MODEL: **SERIAL #** **CAL DUE:**

NIST TRACEABLE SOURCES USED

SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
4050-02	Tc-99	36800 dpm	23,000 cpm	1/1/2015
4052-02	Sr-90	17243 dpm	12,023 cpm	1/1/2015

Geometry: 4π Contact with surface unless otherwise specified

PREVIOUS Tc-99 EFFICIENCY: 14.07 % **Calibration Voltage:** 900 V **Calibration Threshold:** 35 mV

AS FOUND Instrument Condition: SAT

AS FOUND DATA

1 MINUTE COUNTS (CPM)

				AVERAGE
AF Background:	40			
Tc-99 Count:	5009	5328	5208	5181.7
Sr-90 Count:	4957			

4π Efficiencies

Tc-99 EFF: 14.07% Sr-90 EFF: 28.62%

AS LEFT Instrument Condition: SAT

AS LEFT DATA

1 MINUTE COUNTS (CPM)

				AVERAGE
AL Background:	31			
Tc-99 Count:	5208	5278	5335	5273.7
Sr-90 Count:	4863			

4π Efficiencies

Tc-99 EFF: 14.26% Sr-90 EFF: 28.02%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

- ☑ Is the AS FOUND efficiency within 20% of efficiency from last calibration?
- ☑ Reproducibility: Are the individual counts within 10% of the average?
- ☑ Does the probe meet final acceptance criteria?
- ☑ Calibration sticker attached?

Comments: Married as a set with: Model: 2241-3 Serial #: 181301 Bar Code #:

Date Instrument Is Due For Next Calibration: 02/04/17

Performed by: _____ Reviewed by: _____ Date: 2/4/16

Printed Name: Thomas Thompson

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

SEC Corporate
2800 Solway Road
Knoxville, TN 37931

Model 2241-3 CALIBRATION FORM

Serial number : 253346 **Customer Name :** Chase
Previous due date : 12/5/2015 **P.O Number :**
Date : 1/11/2016 **Technician :** Carl Hall
Reason For Calibration : Probe needed repair

INSTRUMENT(S) USED DURING CALIBRATION					
Model Number:	500-2	**Serial Number:**	132896	**Calibration Due date:**	6/15/2016
Model Number:		**Serial Number:**		**Calibration Due date:**	

Instrument Condition	
As Found	As Left
OK	OK

Threshold	
As Found	As Left
4.0	4.0

Battery Indicator
SAT

SCA/RATE Switch
SAT

	Set Voltage		High Voltage Range	
Detector #	As Found	As Left	As Found	As Left
1	1678	1675	SAT	SAT
2	1779	1775	SAT	SAT
3	1153	1150	SAT	SAT
4	1281	1325	SAT	SAT

Digital Scaler				
Target	As Found	%Error	As Left	%Error
250	251	0.40%	251	0.40%
2,500	2,506	0.24%	2,506	0.24%
25,000	25,064	0.26%	25,064	0.26%
250,000	250,643	0.26%	250,643	0.26%

Reproducability		
x.1 or x1 Scale		
250	250	250
x1 or x10 Scale		
2500	2500	2500
x10 or x100 Scale		
25K	25K	25K
x100 or x1000 Scale		
250K	250K	250K

OK	Is the As Found Data within 20% of the set point?	OK	Audio Response
OK	Are the individual counts within 10% of the average?	OK	Push Buttons
OK	Fast / Slow response switch functions properly?	OK	RESET
OK	Does Instrument meet final Acceptance Criteria?	OK	Audio Switch
OK	Calibration sticker attached?	OK	Light

Married with:						
	1675V	**DET 1**	**Model:**	43-68	**Serial Number:**	PR285701
	1775V	**DET 2**	**Model:**	43-37	**Serial Number:**	PR259902
	1150V	**DET 3**	**Model:**	43-68	**Serial Number:**	PR285701
Comments :	**1325V**	**DET 4**	**Model:**	43-37	**Serial Number:**	PR259902

Instrument calibrated per SEC-IS-423.
5 foot cable used for the 43-68
10 foot cable used for the 43-37

Date instrument is due for next calibration : 1/11/2017

Performed by : Date: 1/11/16 Reviewed by: Date: 1-11-16
Printed name : Carl Hall

Calibration Certificate

Calibration Certificate for 43-37,Serial # PR259902, Bar Code # ,Property # Chase104

Date: 01/11/16 Date Last Cal. Expires: 12/05/15 Technician: Carl Hall

Location: 999999, Reason For Calibration: Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 253346 CAL DUE 01/11/16

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	4079-02	Pu-239	28997 dpm	14,698 cpm	1/1/2015
	4071-02	Th-230	40299 dpm	20,499 cpm	1/1/2015
	4076-02	Sr-90	11037 dpm	7,744 cpm	1/1/2015
	4072-02	Tc-99	28300 dpm	17,700 cpm	1/1/2015

Efficiencies from last calibration

Pu-239:	18.68 %
Tc-99:	24.54 %
Th-230:	16.23 %
SrY-90:	34.16 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1275 V HV (Beta): 1775 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	2	CPM	716	CPM	
Pu-239:	5292	CPM	N/A		18.24%
Tc-99:	N/A		6959	CPM	22.06%
Th-230:	6334	CPM	N/A		15.71%
SrY-90:	N/A		3962	CPM	29.41%

☑ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1325 V HV (Beta): 1775 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	7	CPM	716	CPM	
Pu-239:	5512	CPM	N/A		18.98%
Tc-99:	N/A		6959	CPM	22.06%
Th-230:	6575	CPM	N/A		16.30%
SrY-90:	N/A		3962	CPM	29.41%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 3949 3930 3993 Average: 3957.3 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:	Pu-239	Tc-99	Th-230	SrY-90
	37.45%	35.27%	32.04%	41.92%

Comments: Married as a set with: Model: 2241-3 Serial #: 253346 Bar Code #:

Replaced damaged mylar.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 01/11/17

Performed by: _____ Reviewed by: _____ Date: 1-16-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-37 **Customer Name :** Chase Environmental
Probe Serial Number : PR259902 **Technician :** Carl Hall
Date of Calibration : 1/11/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	253346	Calibration Due Date:	1/11/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used : Activity(s)

	Source S/N	Emission Rate	2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1775

Background: 716

C-14 Count: 8559

2π Efficiency: 30.26%
4π Efficiency: 11.57%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 253346
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 1/11/2017

Performed by : Reviewed by : Date : 1-11-16
Printed Name : Carl Hall
Entered in computer inventory by: Date :

Calibration Certificate

Calibration Certificate for 43-68,Serial # PR285701, Bar Code # ,Property # Chase105

Date: 01/11/16 Date Last Cal. Expires: 12/05/15 Technician: Carl Hall

Location: 999999, Reason For Calibration: Short Cycled

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 253346 CAL DUE 01/11/16

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	4079-02	Pu-239	28997 dpm	14,698 cpm	1/1/2015
	4071-02	Th-230	40299 dpm	20,499 cpm	1/1/2015
	4076-02	Sr-90	11037 dpm	7,744 cpm	1/1/2015
	4072-02	Tc-99	28300 dpm	17,700 cpm	1/1/2015

Efficiencies from last calibration

Pu-239: 18.20 %
Tc-99: 23.66 %
Th-230: 16.05 %
SrY-90: 34.18 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1150 V HV (Beta): 1675 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	1	CPM	168	CPM	
Pu-239:	5728	CPM	N/A		19.75%
Tc-99:	N/A		7075	CPM	24.41%
Th-230:	6886	CPM	N/A		17.08%
SrY-90:	N/A		4213	CPM	36.65%

☑ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1150 V HV (Beta): 1675 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	1	CPM	168	CPM	
Pu-239:	5728	CPM	N/A		19.75%
Tc-99:	N/A		7075	CPM	24.41%
Th-230:	6886	CPM	N/A		17.08%
SrY-90:	N/A		4213	CPM	36.65%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 4240 4178 4205 Average: 4207.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:	Pu-239	Tc-99	Th-230	SrY-90
	38.96%	39.02%	33.59%	52.23%

Comments: Married as a set with: Model: 2241-3 Serial #: 253346 Bar Code #:

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 01/11/17

Performed by: _____ Reviewed by: _____ Date: 1-11-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-68 **Customer Name :** Chase Environmental
Probe Serial Number : PR285701 **Technician :** Carl Hall
Date of Calibration : 1/11/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	253346	Calibration Due Date:	1/11/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used : Activity(s)

	Source S/N	Emission Rate	2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1675

Background: 168

C-14 Count: 8576

2π Efficiency: 32.44%
4π Efficiency: 12.40%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 253346
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 1/11/2017

Performed by : Carl Hall Reviewed by: Date : 1-12-16
Printed Name : Carl Hall

Entered in computer inventory by: Date :

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

SEC Corporate
2800 Solway Road
Knoxville, TN 37931

Model 2241-3 CALIBRATION FORM

Serial number : 253351 **Customer Name :** Chase

Previous due date : 5/4/2017 **P.O Number :**

Date : 8/24/2016 **Technician :** Carl Hall

Reason For Calibration : Short Cycled

INSTRUMENT(S) USED DURING CALIBRATION					
Model Number:	500-2	**Serial Number:**	132896	**Calibration Due date:**	6/20/2017
Model Number:		**Serial Number:**		**Calibration Due date:**	

Instrument Condition	
As Found	As Left
OK	OK

Threshold	
As Found	As Left
4.1	4.0

Battery Indicator
SAT

SCA/RATE Switch
SAT

	Set Voltage		High Voltage Range	
Detector #	As Found	As Left	As Found	As Left
1	1616	1675	SAT	SAT
2	1691	1800	SAT	SAT
3	1214	1275	SAT	SAT
4	1316	1350	SAT	SAT

Digital Scaler				
Target	As Found	%Error	As Left	%Error
250	250	0.00%	250	0.00%
2,500	2,500	0.00%	2,500	0.00%
25,000	25,008	0.03%	25,008	0.03%
250,000	250,081	0.03%	250,081	0.03%

Reproducability		
x.1 or x1 Scale		
250	250	250
x1 or x10 Scale		
2500	2500	2500
x10 or x100 Scale		
25K	25K	25K
x100 or x1000 Scale		
250K	250K	250K

OK	Is the As Found Data within 20% of the set point?	OK	Audio Response
OK	Are the individual counts within 10% of the average?	OK	Push Buttons
OK	Fast / Slow response switch functions properly?	OK	RESET
OK	Does Instrument meet final Acceptance Criteria?	OK	Audio Switch
OK	Calibration sticker attached?	OK	Light

Married with:	**1675V**	**DET 1**	**Model:**	43-68	**Serial Number:**	PR216394
	1800V	**DET 2**	**Model:**	43-37	**Serial Number:**	PR178300
	1275V	**DET 3**	**Model:**	43-68	**Serial Number:**	PR216394
Comments :	**1350V**	**DET 4**	**Model:**	43-37	**Serial Number:**	PR178300

Instrument calibrated per SEC-IS-423.

5 foot cable used for the 43-68

10 foot cable used for the 43-37

Date instrument is due for next calibration : 8/24/2017

Performed by : Date: 8/24/16 Reviewed by: Date: 8-24-16

Printed name : Carl Hall

Calibration Certificate for 43-68,Serial # PR216394, Bar Code # ,Property # Chase108

Date: 08/24/16 **Date Last Cal. Expires:** 05/04/17 **Technician:** Carl Hall

Location: 999999, **Reason For Calibration:** Short Cycled

EQUIPMENT USED DURING CALIBRATION

MODEL: 2241-3 **SERIAL #:** 253351 **CAL DUE** 08/24/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	22.09 %
Tc-99:	25.21 %
Th-230:	20.29 %
SrY-90:	34.54 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1275 V **HV (Beta):** 1675 V **Threshold:** 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	1	CPM	191	CPM	
Pu-239:	4944	CPM	N/A		19.16%
Tc-99:	N/A		7661	CPM	23.42%
Th-230:	5770	CPM	N/A		16.53%
SrY-90:	N/A		5748	CPM	33.01%

☑ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1275 V **HV (Beta):** 1675 V **Threshold:** 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	1	CPM	191	CPM	
Pu-239:	4944	CPM	N/A		19.16%
Tc-99:	N/A		7661	CPM	23.42%
Th-230:	5770	CPM	N/A		16.53%
SrY-90:	N/A		5748	CPM	33.01%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 5769 5742 5723 **Average:** 5744.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 PI Efficiencies:

Pu-239	Tc-99	Th-230	SrY-90
37.74%	37.35%	32.59%	47.05%

Comments: **Married as a set with:** **Model:** 2241-3 **Serial #:** 253351 **Bar Code #:**

DET 1 ß = 1675V, DET 3 a = 1275V. Calibrated with plastic spacers attached.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 08/24/17

Performed by: _____ **Reviewed by:** _____ **Date:** 8-24-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-68 **Customer Name :** Chase Environmental

Probe Serial Number : PR216394 **Technician :** Carl Hall

Date of Calibration : 8/24/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	253351	Calibration Due Date:	8/24/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N	Emission Rate	Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat

High Voltage: 1675

Background: 191

C-14 Count: 7906

2π Efficiency: 29.76%

4π Efficiency: 11.38%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 253351

Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 8/24/2017

Performed by : Carl Hall Reviewed by : Date : 8-24-16

Printed Name : Carl Hall

Entered in computer inventory by: Date :

Calibration Certificate

Calibration Certificate for 43-37,Serial # PR178300, Bar Code # ,Property # Chase107

Date: 08/24/16 Date Last Cal. Expires: 05/04/17 Technician: Carl Hall

Location: 999999, Reason For Calibration: Short Cycled

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 253351 CAL DUE 08/24/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	18.88 %
Tc-99:	22.31 %
Th-230:	17.19 %
SrY-90:	30.62 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1350 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Background:	3	CPM	850	CPM	
Pu-239:	4503	CPM	N/A		17.44%
Tc-99:	N/A		7643	CPM	21.29%
Th-230:	5590	CPM	N/A		16.01%
SrY-90:	N/A		5603	CPM	28.23%

☑ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1350 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Background:	3	CPM	850	CPM	
Pu-239:	4503	CPM	N/A		17.44%
Tc-99:	N/A		7643	CPM	21.29%
Th-230:	5590	CPM	N/A		16.01%
SrY-90:	N/A		5603	CPM	28.23%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 5621 5582 5611 Average: 5604.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:

Pu-239	Tc-99	Th-230	SrY-90
34.35%	33.97%	31.56%	40.24%

Comments: Married as a set with: Model: 2241-3 Serial #: 253351 Bar Code #:

DET 2 ß = 1800V, DET 4 a = 1350V. Calibrated with plastic spacers attached.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 08/24/17

Performed by: _____ Reviewed by: _____ Date: 8-24-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-37 **Customer Name :** Chase Environmental
Probe Serial Number : PR178300 **Technician :** Carl Hall
Date of Calibration : 8/24/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	253351	Calibration Due Date:	8/24/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N	Emission Rate	Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1800

Background: 850

C-14 Count: 8369

2π Efficiency: 29.01%
4π Efficiency: 11.09%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 253351
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 8/24/2017

Performed by : Carl Hall Reviewed by : Date : 8-24-16
Printed Name : Carl Hall

Entered in computer inventory by: Date :

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

SEC Corporate
2800 Solway Road
Knoxville, TN 37931

Model 2241-3 CALIBRATION FORM

Serial number :	253356	**Customer Name :**	Chase
Previous due date :	9/22/2016	**P.O Number :**	
Date :	9/28/2016	**Technician :**	Carl Hall
		Reason For Calibration :	Due For Calibration

INSTRUMENT(S) USED DURING CALIBRATION					
Model Number:	500-2	**Serial Number:**	132896	**Calibration Due date:**	6/20/2017
Model Number:		**Serial Number:**		**Calibration Due date:**	

Instrument Condition	
As Found	As Left
OK	OK

Threshold	
As Found	As Left
4.0	4.0

Battery Indicator
SAT

SCA/RATE Switch
SAT

	Set Voltage		High Voltage Range	
Detector #	As Found	As Left	As Found	As Left
1	1741	1750	SAT	SAT
2	1869	1875	SAT	SAT
3	1119	1125	SAT	SAT
4	1266	1275	SAT	SAT

Digital Scaler				
Target	**As Found**	**%Error**	**As Left**	**%Error**
250	250	0.00%	250	0.00%
2,500	2,500	0.00%	2,500	0.00%
25,000	25,011	0.04%	25,011	0.04%
250,000	250,113	0.05%	250,113	0.05%

Reproducability		
x.1 or x1 Scale		
250	250	250
x1 or x10 Scale		
2500	2500	2500
x10 or x100 Scale		
25K	25K	25K
x100 or x1000 Scale		
250K	250K	250K

OK	Is the As Found Data within 20% of the set point?	OK	Audio Response
OK	Are the individual counts within 10% of the average?	OK	Push Buttons
OK	Fast / Slow response switch functions properly?	OK	RESET
OK	Does Instrument meet final Acceptance Criteria?	OK	Audio Switch
OK	Calibration sticker attached?	OK	Light

Married with:	**1750V**	**DET 1**	**Model:**	43-68	**Serial Number:**	PR289219
	1875V	**DET 2**	**Model:**	43-37	**Serial Number:**	PR281040
	1125V	**DET 3**	**Model:**	43-68	**Serial Number:**	PR289219
Comments :	**1275V**	**DET 4**	**Model:**	43-37	**Serial Number:**	PR281040

Instrument calibrated per SEC-IS-423.

5 foot cable used for the 43-68

10 foot cable used for the 43-37

Date instrument is due for next calibration : 9/28/2017

Performed by : Date: 9/28/16 Reviewed by: Date: 9-29-16

Printed name : Carl Hall

Calibration Certificate for 43-68,Serial # PR289219, Bar Code # ,Property # Chase51

Date: 09/28/16 Date Last Cal. Expires: 09/22/16 Technician: Carl Hall

Location: 999999, Reason For Calibration: Due and Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 253356 CAL DUE 09/28/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239: 18.28 %
Tc-99: 25.07 %
Th-230: 17.35 %
SrY-90: 36.95 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1125 V HV (Beta): 1750 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	0	CPM	0	CPM	
Pu-239:	0	CPM	N/A		0.00%
Tc-99:	N/A		0	CPM	0.00%
Th-230:	0	CPM	N/A		0.00%
SrY-90:	N/A		0	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1125 V HV (Beta): 1750 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	2	CPM	260	CPM	
Pu-239:	4668	CPM	N/A		18.09%
Tc-99:	N/A		8059	CPM	24.45%
Th-230:	5758	CPM	N/A		16.49%
SrY-90:	N/A		6544	CPM	37.33%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6520 6562 6537 Average: 6539.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:

Pu-239	Tc-99	Th-230	SrY-90
35.62%	39.00%	32.52%	53.20%

Comments: Married as a set with: Model: 2241-3 Serial #: 253356 Bar Code #:

Replaced damaged mylar. DET 1 ß = 1750V, DET 3 a = 1125V.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument Is Due For Next Calibration: 09/28/17

Performed by: Printed Name: Carl Hall

Reviewed by: Date: 9-29-16

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-68 **Customer Name :** Chase Environmental

Probe Serial Number : PR289219 **Technician :** Carl Hall

Date of Calibration : 9/28/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	253356	Calibration Due Date:	9/28/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used : Activity(s)

	Source S/N	Emission Rate	2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat

High Voltage: 1750

Background: 260

C-14 Count: 7877

2π Efficiency: 29.39%

4π Efficiency: 11.23%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 253356

Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 9/28/2017

Performed by : Carl Hall Reviewed by : Date : 9-29-16

Printed Name : Carl Hall

Entered in computer inventory by: Date :

Calibration Certificate for 43-37,Serial # PR281040, Bar Code # ,Property # Chase50

Date: 09/28/16 Date Last Cal. Expires: 09/22/16 Technician: Carl Hall

Location: 999999, Reason For Calibration: Due and Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 253356 CAL DUE 09/28/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239: 17.63 %
Tc-99: 24.26 %
Th-230: 16.93 %
SrY-90: 33.33 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1275 V HV (Beta): 1875 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	0	CPM	0	CPM	
Pu-239:	0	CPM	N/A		0.00%
Tc-99:	N/A		0	CPM	0.00%
Th-230:	0	CPM	N/A		0.00%
SrY-90:	N/A		0	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1275 V HV (Beta): 1875 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	7	CPM	1020	CPM	
Pu-239:	4643	CPM	N/A		17.97%
Tc-99:	N/A		8654	CPM	23.93%
Th-230:	5701	CPM	N/A		16.32%
SrY-90:	N/A		6923	CPM	35.07%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6937 6907 6942 Average: 6928.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:	Pu-239	Tc-99	Th-230	SrY-90
	35.39%	38.17%	32.17%	49.98%

Comments: Married as a set with: Model: 2241-3 Serial #: 253356 Bar Code #:

Replaced damaged mylar. DET 2 ß = 1875V, DET 4 a = 1275V.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument Is Due For Next Calibration: 09/28/17

Performed by: Printed Name: Carl Hall

Reviewed by: Date: 9-29-16

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-37 **Customer Name :** Chase Environmental
Probe Serial Number : PR281040 **Technician :** Carl Hall
Date of Calibration : 9/28/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	253356	Calibration Due Date:	9/28/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N	Emission Rate	Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1875

Background: 1020

C-14 Count: 9208

2π Efficiency: 31.59%
4π Efficiency: 12.08%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 253356
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 9/28/2017

Performed by : Printed Name : Carl Hall Reviewed by : Date : 9-29-16

Entered in computer inventory by: Date :

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

SEC Corporate
2800 Solway Road
Knoxville, TN 37931

Model 2241-3 CALIBRATION FORM

Serial number :	267113	**Customer Name :**	Chase
Previous due date :	1/28/2017	**P.O Number :**	
Date :	6/30/2016	**Technician :**	Carl Hall
		Reason For Calibration :	REPAIR

INSTRUMENT(S) USED DURING CALIBRATION					
Model Number:	500-2	**Serial Number:**	132896	**Calibration Due date:**	6/20/2017
Model Number:		**Serial Number:**		**Calibration Due date:**	

Instrument Condition	
As Found	As Left
OK	OK

Threshold	
As Found	As Left
4.0	4.0

Battery Indicator
SAT

SCA/RATE Switch
SAT

	Set Voltage		High Voltage Range	
Detector #	As Found	As Left	As Found	As Left
1	1648	1650	UNSAT	SAT
2	1798	1800	UNSAT	SAT
3	1321	1325	UNSAT	SAT
4	1342	1350	UNSAT	SAT

Digital Scaler				
Target	As Found	%Error	As Left	%Error
250	250	0.00%	250	0.00%
2,500	2,500	0.00%	2,500	0.00%
25,000	25,007	0.03%	25,007	0.03%
250,000	250,072	0.03%	250,072	0.03%

Reproducability		
x.1 or x1 Scale		
250	250	250
x1 or x10 Scale		
2500	2500	2500
x10 or x100 Scale		
25K	25K	25K
x100 or x1000 Scale		
250K	250K	250K

OK	Is the As Found Data within 20% of the set point?	OK	Audio Response
OK	Are the individual counts within 10% of the average?	OK	Push Buttons
OK	Fast / Slow response switch functions properly?	OK	RESET
OK	Does Instrument meet final Acceptance Criteria?	OK	Audio Switch
OK	Calibration sticker attached?	OK	Light

Married with:	**1650V**	**DET 1**	**Model:**	43-68	**Serial Number:**	PR285700
	1800V	**DET 2**	**Model:**	43-37	**Serial Number:**	PR286836
	1325V	**DET 3**	**Model:**	43-68	**Serial Number:**	PR285700
Comments :	**1350V**	**DET 4**	**Model:**	43-37	**Serial Number:**	PR286836

Instrument calibrated per SEC-IS-423.
5 foot cable used for the 43-68
10 foot cable used for the 43-37

As Found High Voltage was unstable and maxed out at ~1,500 volts.
Replaced bad Main Board 5408-226

Date instrument is due for next calibration : 6/30/2017

Performed by : Date: 6/30/16 Reviewed by: Date: 7-5-16

Printed name : Carl Hall

Calibration Certificate for 43-68,Serial # PR285700, Bar Code # ,Property # Chase53

Date: 06/30/16 **Date Last Cal. Expires:** 01/28/17 **Technician:** Carl Hall
Location: 102624, **Reason For Calibration:** Due for Calibration

EQUIPMENT USED DURING CALIBRATION **MODEL:** 2241-3 **SERIAL #:** 267113 **CAL DUE** 06/30/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	20.86 %
Tc-99:	25.09 %
Th-230:	19.46 %
SrY-90:	33.17 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1325 V HV (Beta): 1650 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	0	CPM	0	CPM	
Pu-239:	0	CPM	N/A		0.00%
Tc-99:	N/A		0	CPM	0.00%
Th-230:	0	CPM	N/A		0.00%
SrY-90:	N/A		0	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1325 V HV (Beta): 1650 V Threshold: 4 mV

	Alpha		Beta	AL 4 π Efficiencies
Back ground:	2	CPM	260	CPM	
Pu-239:	4922	CPM	N/A		19.07%
Tc-99:	N/A		7881	CPM	23.89%
Th-230:	5940	CPM	N/A		17.01%
SrY-90:	N/A		6202	CPM	35.30%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6214 6178 6228 Average: 6206.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:

Pu-239	Tc-99	Th-230	SrY-90
37.56%	38.11%	33.65%	50.31%

Comments: Married as a set with: Model: 2241-3 Serial #: 267113 Bar Code #:

Replaced damaged mylar.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 06/30/17

Performed by: _____ Reviewed by: _____ Date: 7-5-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-68 **Customer Name :** Chase Environmental
Probe Serial Number : PR285700 **Technician :** Carl Hall
Date of Calibration : 6/30/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	267113	Calibration Due Date:	6/30/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N	Emission Rate	Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1650

Background: 260

C-14 Count: 7697

2π Efficiency: **28.69%**
4π Efficiency: **10.97%**

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 267113
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 6/30/2017

Performed by : Carl Hall Reviewed by : _____ Date : 7-5-16
Printed Name : Carl Hall
Entered in computer inventory by: _____ Date : _____

Calibration Certificate

Calibration Certificate for 43-37,Serial # PR286836, Bar Code # ,Property # Chase94

Date: 06/30/16 Date Last Cal. Expires: 01/28/17 Technician: Carl Hall

Location: 102624, Reason For Calibration: Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 267113 CAL DUE 06/30/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	20.37 %
Tc-99:	25.37 %
Th-230:	18.51 %
SrY-90:	38.93 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1350 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	0	CPM	0	CPM	
Pu-239:	0	CPM	N/A		0.00%
Tc-99:	N/A		0	CPM	0.00%
Th-230:	0	CPM	N/A		0.00%
SrY-90:	N/A		0	CPM	0.00%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1350 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	6	CPM	870	CPM	
Pu-239:	4926	CPM	N/A		19.07%
Tc-99:	N/A		8445	CPM	23.75%
Th-230:	5959	CPM	N/A		17.06%
SrY-90:	N/A		6705	CPM	34.66%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6671 6729 6692 Average: 6697.3 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:	Pu-239	Tc-99	Th-230	SrY-90
	37.56%	37.88%	33.63%	49.40%

Comments: Married as a set with: Model: 2241-3 Serial #: 267113 Bar Code #:

Replaced damaged mylar.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 06/30/17

Performed by: _____ Reviewed by: _____ Date: 7-5-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-37 **Customer Name :** Chase Environmental

Probe Serial Number : PR286836 **Technician :** Carl Hall

Date of Calibration : 6/30/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	267113	Calibration Due Date:	6/30/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

	Source S/N	Emission Rate	Activity(s) 2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat

High Voltage: 1800

Background: 870

C-14 Count: 9119

2π Efficiency: 31.82%

4π Efficiency: 12.17%

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 267113

Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 6/30/2017

Performed by : _____ Reviewed by: _____ Date : 7-5-16

Printed Name : Carl Hall

Entered in computer inventory by: _____ Date : _____

SEC INSTRUMENTATION SERVICES

10512 Lexington Drive
Suite 200
Knoxville, TN 37932

SEC Corporate
2800 Solway Road
Knoxville, TN 37931

Model 2241-3 CALIBRATION FORM

Serial number :	267138	**Customer Name :**	Chase
Previous due date :	6/5/2016	**P.O Number :**	
Date :	5/4/2016	**Technician :**	Carl Hall
		Reason For Calibration :	Probe needed repair

INSTRUMENT(S) USED DURING CALIBRATION					
Model Number:	500-2	**Serial Number:**	132896	**Calibration Due date:**	6/15/2016
Model Number:		**Serial Number:**		**Calibration Due date:**	

Instrument Condition	
As Found	As Left
OK	OK

Threshold	
As Found	As Left
4.0	4.0

Battery Indicator
SAT

SCA/RATE Switch
SAT

	Set Voltage		High Voltage Range	
Detector #	As Found	As Left	As Found	As Left
1	1674	1675	SAT	SAT
2	1798	1800	SAT	SAT
3	1225	1250	SAT	SAT
4	1275	1275	SAT	SAT

Digital Scaler				
Target	**As Found**	**%Error**	**As Left**	**%Error**
250	250	0.00%	250	0.00%
2,500	2,501	0.04%	2,501	0.04%
25,000	25,013	0.05%	25,013	0.05%
250,000	250,130	0.05%	250,130	0.05%

Reproducability		
x.1 or x1 Scale		
250	250	250
x1 or x10 Scale		
2500	2500	2500
x10 or x100 Scale		
25K	25K	25K
x100 or x1000 Scale		
250K	250K	250K

OK	Is the As Found Data within 20% of the set point?	OK	Audio Response
OK	Are the individual counts within 10% of the average?	OK	Push Buttons
OK	Fast / Slow response switch functions properly?	OK	RESET
OK	Does Instrument meet final Acceptance Criteria?	OK	Audio Switch
OK	Calibration sticker attached?	OK	Light

Married with:						
	1675V	**DET 1**	**Model:**	43-68	**Serial Number:**	PR285699
	1800V	**DET 2**	**Model:**	43-37	**Serial Number:**	PR286832
	1250V	**DET 3**	**Model:**	43-68	**Serial Number:**	PR285699
Comments :	**1275V**	**DET 4**	**Model:**	43-37	**Serial Number:**	PR286832

Instrument calibrated per SEC-IS-423.
5 foot cable used for the 43-68
10 foot cable used for the 43-37

Date instrument is due for next calibration : 5/4/2017

Performed by : _____ Date: 5/4/16 Reviewed by: _____ Date: 5-4-16

Printed name : Carl Hall

Calibration Certificate

Calibration Certificate for 43-68,Serial # PR285699, Bar Code # ,Property # Chase79

Date: 05/04/16 **Date Last Cal. Expires:** 06/05/16 **Technician:** Carl Hall

Location: 102624, **Reason For Calibration:** Due and Repair

EQUIPMENT USED DURING CALIBRATION

MODEL: 2241-3 **SERIAL #:** 267138 **CAL DUE** 05/04/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016

Efficiencies from last calibration

Pu-239:	23.31 %
Tc-99:	27.77 %
Th-230:	22.37 %
SrY-90:	41.06 %

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1225 V **HV (Beta):** 1675 V **Threshold:** 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Back ground:	0	CPM	187	CPM	
Pu-239:	4596	CPM	N/A		17.82%
Tc-99:	N/A		8077	CPM	24.73%
Th-230:	5788	CPM	N/A		16.59%
SrY-90:	N/A		5869	CPM	33.75%

☑ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1250 V **HV (Beta):** 1675 V **Threshold:** 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Back ground:	0	CPM	187	CPM	
Pu-239:	5132	CPM	N/A		19.89%
Tc-99:	N/A		8077	CPM	24.73%
Th-230:	6203	CPM	N/A		17.77%
SrY-90:	N/A		5869	CPM	33.75%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 5888 5842 5857 **Average:** 5862.3 ☑ **Are the individual counts within 10% of the average?**

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:

Pu-239	Tc-99	Th-230	SrY-90
39.18%	39.45%	35.05%	48.11%

Comments: **Married as a set with:** **Model:** 2241-3 **Serial #:** 267138 **Bar Code #:**

Calibrated with plastic spacers attached. DET 1 ß 1675V, DET 3 a 1250V. Replaced damaged mylar and broken string. Increased high voltage due to improve efficiencies.

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

Date Instrument is Due For Next Calibration: 05/04/17

Performed by: _____ **Reviewed by:** _____ **Date:** 5-4-16

Printed Name: Carl Hall

Safety and Ecology Corporation SEC PROCEDURE # SEC-IS-417 Rev 4

2800 Solway Road, Knoxville, TN 37931

5/4/2016

Calibration Certificate

Calibration Certificate for 43-37,Serial # PR286832, Bar Code # ,Property # Chase101

Date: 05/04/16 Date Last Cal. Expires: 06/05/16 Technician: Carl Hall

Location: 999999, Reason For Calibration: Due and Repair

EQUIPMENT USED DURING CALIBRATION MODEL: 2241-3 SERIAL #: 267138 CAL DUE 05/04/17

NIST TRACEABLE SOURCES USED	SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
Efficiencies from last calibration	5744-06	Sr-90	16834 dpm	11,811 cpm	1/1/2016
Pu-239: 20.01 %	5746-06	Tc-99	31900 dpm	20,000 cpm	1/1/2016
Tc-99: 24.49 %	5747-06	Pu-239	25798 dpm	13,099 cpm	1/1/2016
Th-230: 18.02 %	5748-06	Th-230	34899 dpm	17,700 cpm	1/1/2016
SrY-90: 39.42 %					

AS FOUND DATA

AS FOUND Instrument Condition: SAT

Calibration Setpoints

HV (Alpha): 1275 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AF 4 πEfficiencies
Background:	6	CPM	512	CPM	
Pu-239:	4011	CPM	N/A		15.52%
Tc-99:	N/A		6815	CPM	19.76%
Th-230:	5128	CPM	N/A		14.68%
SrY-90:	N/A		5944	CPM	32.27%

☐ Is the As Found Data within 20% of the efficiency from the last cal.?

AS LEFT Instrument Condition: SAT

AS LEFT DATA after repair, HV adjust or Plateau

HV (Alpha): 1275 V HV (Beta): 1800 V Threshold: 4 mV

	Alpha		Beta		AL 4 π Efficiencies
Background:	8	CPM	704	CPM	
Pu-239:	4996	CPM	N/A		19.33%
Tc-99:	N/A		8129	CPM	23.28%
Th-230:	6016	CPM	N/A		17.22%
SrY-90:	N/A		6393	CPM	33.79%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

Reproducibility : Isotope: Sr-90 6340 6418 6375 Average: 6377.7 ☑ Are the individual counts within 10% of the average?

If the As Found data (even after repair) is within 10% of the last calibration, then the technician may N/A Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

PLATEAU DATA

Alpha Source: Th-230

HV (Alpha)	Response CPM A ch.	Background CPM A ch.	Net 4π Eff.
N/A			

Beta Source: Tc-99

HV (Beta)	Response CPM B ch.	Background CPM B ch.	Net 4π Eff.
N/A			

2 Pi Efficiencies:	Pu-239	Tc-99	Th-230	SrY-90
	38.08%	37.13%	33.94%	48.17%

Comments: Married as a set with: Model: 2241-3 Serial #: 267138 Bar Code #:

Calibrated with plastic spacers attached. DET 2 ß 1800V, DET 4 a 1275V. Replaced damaged mylar.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument Is Due For Next Calibration: 05/04/17

Performed by: _____ Reviewed by: _____ Date: 5-4-16

Printed Name: Carl Hall

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-68 **Customer Name :** Chase Environmental
Probe Serial Number : PR285699 **Technician :** Carl Hall
Date of Calibration : 5/4/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	267138	Calibration Due Date:	5/4/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

		Activity(s)				
	Source S/N	Emission Rate	2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1675

Background: 187

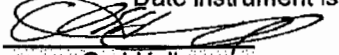
C-14 Count: 8243

2π Efficiency: **31.08%**
4π Efficiency: **11.88%**

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 267138
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 5/4/2017

Performed by : 
Printed Name : Carl Hall
Reviewed by : _____ Date : 5-4-16

Entered in computer inventory by: _____ Date : _____

SEC INSTRUMENTATION SERVICES
10512 Lexington Drive
Suite 200
Knoxville, TN 37932

C-14 SOURCE CALIBRATION FORM

Probe Model Number : 43-37 **Customer Name :** Chase Environmental
Probe Serial Number : PR286832 **Technician :** Carl Hall
Date of Calibration : 5/4/2016

Instruments used during calibration					
Model Number:	2241-3	Serial Number:	267138	Calibration Due Date:	5/4/2017
Model Number:		Serial Number:		Calibration Due Date:	

NIST Traceable Source(s) used :

		Activity(s)				
	Source S/N	Emission Rate	2 Pi (cpm)	uCi	4Pi (dpm)	Assay Date
1> C-14	DX 295	432	25,920	0.0305405	67,800	5/3/1994

Data

Instrument condition : Sat
High Voltage: 1800

Background: 704

C-14 Count: 9379

2π Efficiency: **33.47%**
4π Efficiency: **12.79%**

Calibration sticker attached? Yes

Comments : **Married as a set with :** **Model :** 2241-3 **Serial # :** 267138
Calibrated with plastic standoffs attached.

Date instrument is due for next calibration : 5/4/2017

Performed by : [signature] Reviewed by : [signature] Date : 5-4-16
Printed Name : Carl Hall
Entered in computer inventory by: _____ Date : _____

Calibration Certificate

Calibration Certificate for 2241,Serial # 196627, Bar Code # ,Property # Chase23

Date: 11/04/16 **Date Last Cal. Expires:** 07/07/17 **Technician:** Jeffrey Knight

Location: 999999, **Reason For Calibration:** Other (See Comments)

EQUIPMENT USED DURING CALIBRATION

MODEL: 500-2	**SERIAL #:** 153622	**CAL. DUE:** 06/27/17
MODEL:	**SERIAL #:**	**CAL DUE:**

AS FOUND DATA

AS FOUND Instrument Condition: SAT **AS LEFT Instrument Condition:** SAT

☐ **New Batteries?**

Battery Check: SAT

High Voltage (+/- 10% tolerance)	AS FOUND High Voltage	AS LEFT High Voltage
500 V:	N/A	N/A
1000 V:	N/A	N/A
1500 V:	N/A	N/A

AS FOUND HV Setting: 1044 V **AS LEFT HV Setting:** 950 V

AS FOUND THRESHOLD: 10.5 mV **AS LEFT THRESHOLD:** 10.0 mV

REPRODUCIBILITY

x.1 or x1 Scale:	250	250	250
x1 or x10 Scale:	2500	2500	2500
x10 or x100 Scale:	25 K	25 K	25 K
x100 or x1000 Scale:	250 K	250 K	250 K

☑ **Are the Individual Counts Within 10% of the Average?**

☑ **Fast / Slow Response Switch Functions Properly?**

Audio Response: SAT

DIGITAL SCALER

AF 250:	250	**% ERR:** 0.00%	**AL 250:**	AF	**% ERR:** 0.00%
AF 2500:	2500	**% ERR:** 0.00%	**AL 2500:**	AF	**% ERR:** 0.00%
AF 25K:	24.99 K	**% ERR:** 0.04%	**AL 25K:**	AF K	**% ERR:** 0.04%
AF 250K:	249.9 K	**% ERR:** 0.04%	**AL 250K:**	AF K	**% ERR:** 0.04%

☑ **Is the As Found Data Within 20% of the Set Point?**

Push Buttons: SAT **Lamp:** SAT **Audio/Divide:** N/A

Comments: **Married as a set with:** **Model:** 44-10 **Serial #:** PR360170 **Bar Code #:**

Meter married to new 44-10 probe. Note: no audio - speaker is missing.

☑ **Does Instrument Meet Final Acceptance Criteria?**

☑ **Calibration Sticker Attached?**

Date Instrument is Due For Next Calibration: 11/04/17

Performed by: _____ **Reviewed by:** _____ **Date:** 11/4/16

Printed Name: Jeffrey Knight

Calibration Certificate for 44-10,Serial # PR360170, Bar Code # ,Property # Chase169

Date: 11/04/16 Date Last Cal. Expires: Technician: Jeffrey Knight
Location: 999999, Reason For Calibration: Initial Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: 2241 SERIAL #: 196627 CAL DUE: 11/04/17
MODEL: SERIAL #: CAL DUE:

NIST TRACEABLE SOURCES USED

SOURCE	ISOTOPE	ACTIVITY	2π	ASSAY DATE
99CS250-0287	Cs-137	6.2641 uCi		1/1/2016

Efficiency from Last Calibration: 0.00 % HV From Last Calibration: V Calibration Threshold: 10 mV

AS FOUND DATA — **1 MINUTE COUNTS (CPM)** — **AS LEFT DATA after repair of HV adjust**

AS FOUND Instrument Condition: SAT
HV: V
Center: 0
Background: 0
4 π Probe Efficiency: Cs-137 0.00%

AS LEFT Instrument Condition: SAT
HV: 950 V
Center: 101462
Background: 3922
4 π Probe Efficiency: Cs-137 0.70%

"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section

☐ Is the As Found Efficiency Within 20% of the efficiency from the last cal.?

Reproducibility: Isotope:Cs-137 99940 101015 100144 Average: 100366 ☑ Are the individual counts within 10% of the average?

* If As Found Efficiency (even after repair) is within 10% of the last calibration and uniformity is <10%, the technician may N/A the Plateau Data and proceed to Comments. Geometry = Nal probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

PLATEAU AND SET POINT DATA (CPM)

High Voltage	Source Response	Background
800	97801	3910
850	99391	3707
900	99428	3970
950	100138	3987
1000	99591	3829
1050	103387	4112

HV	CENTER	Background	4 π Efficiency
950 V	101462	3922	Cs-137 0.70%

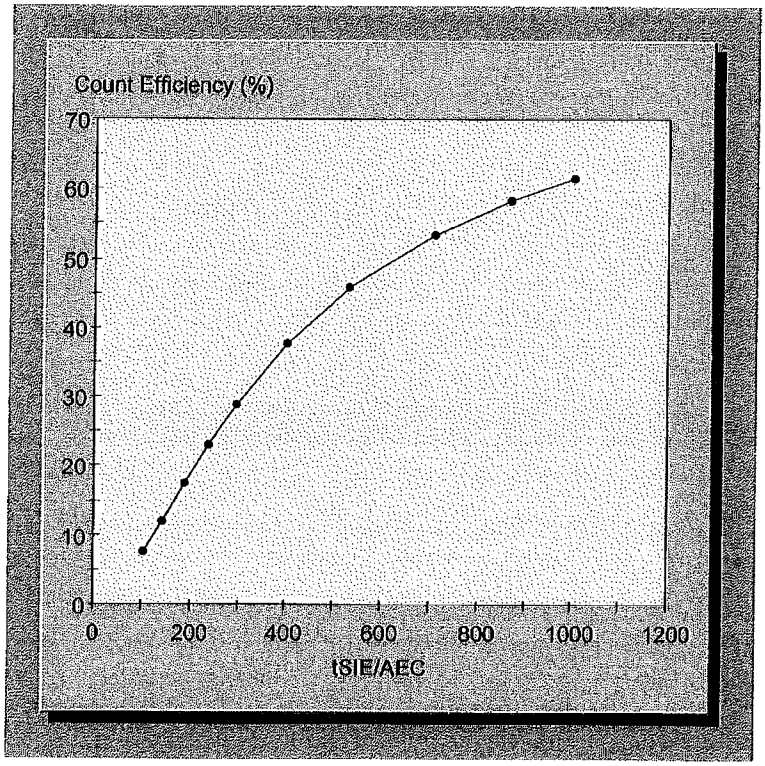
Comments: Married as a set with: Model: 2241 Serial #: 196627 Bar Code #:
New probe married to 2241 #196627.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 11/04/17

Performed by: Reviewed by: Date: 11/4/16
Printed Name: Jeffrey Knight

Quench Curve - 3H-3-30-12

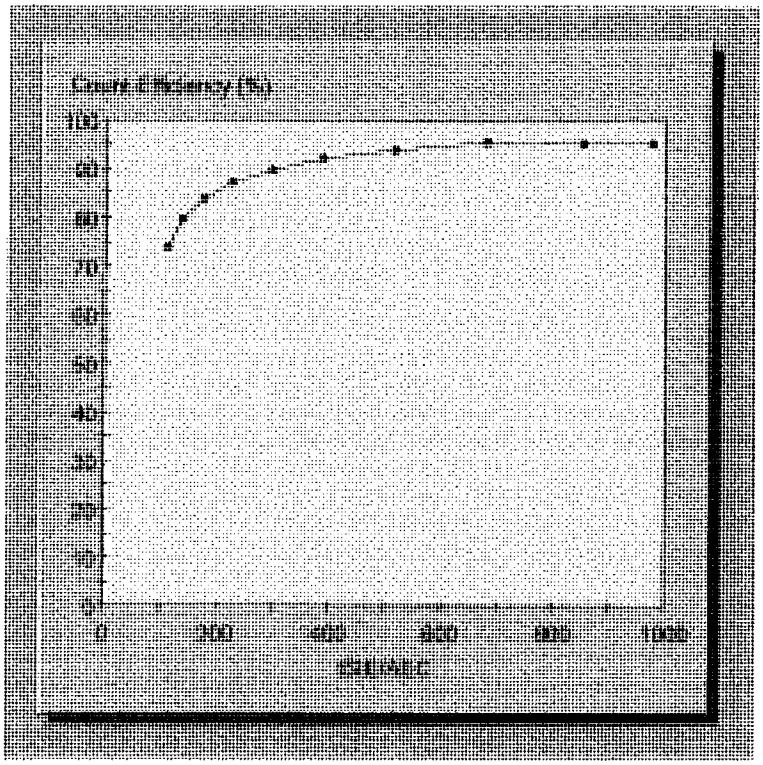


Last Edit Date:

Quench Indicator: tSIE/AEC

Included	tSIE/AEC	Count Efficiency (%)
Yes	105.25	7.59
Yes	141.96	11.99
Yes	189.32	17.45
Yes	239.45	22.93
Yes	297.84	28.93
Yes	403.85	37.71
Yes	534.42	45.85
Yes	707.27	53.49
Yes	867.88	58.35
Yes	1003.82	61.62

Quench Curve - 14C 3-14-12

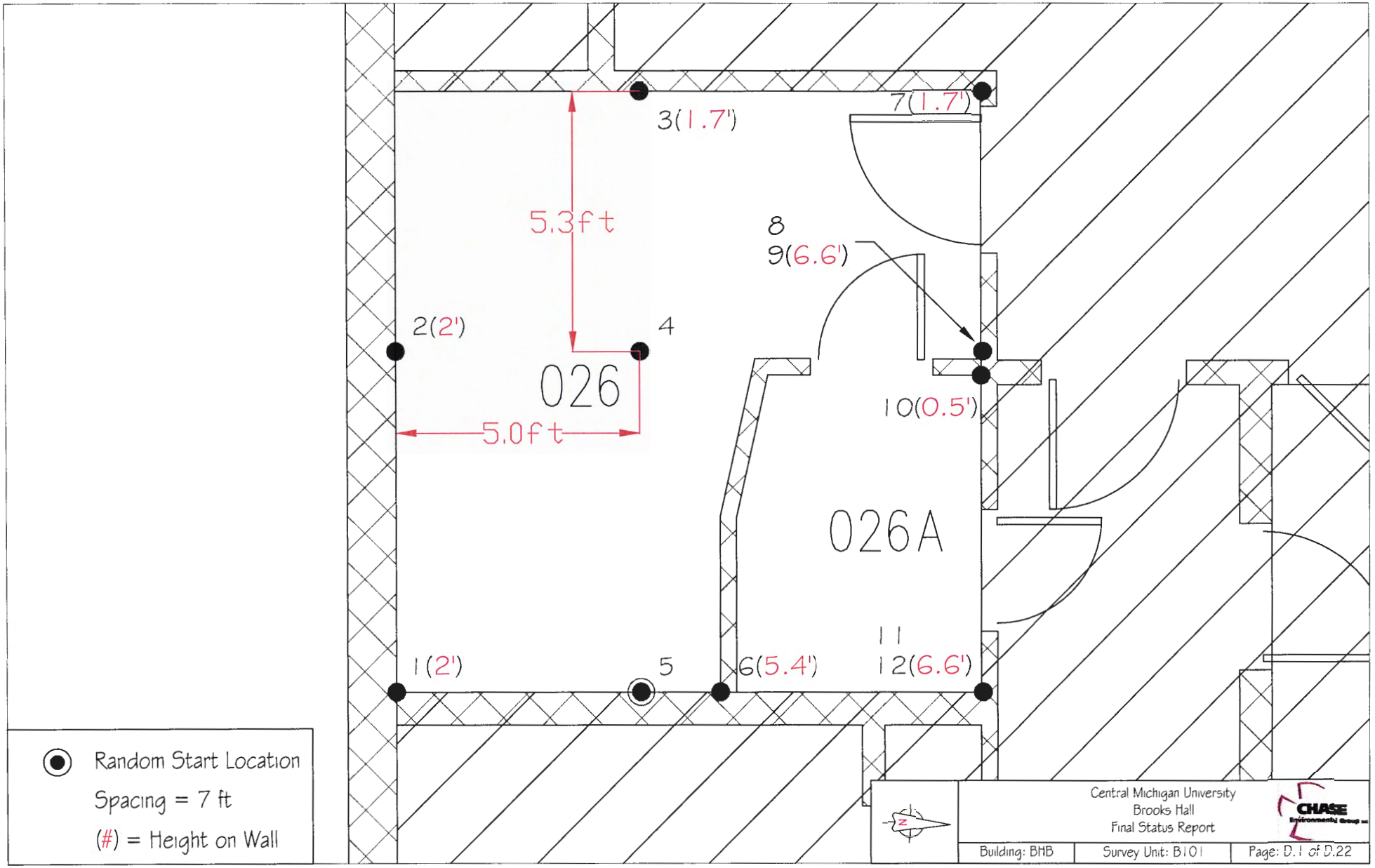


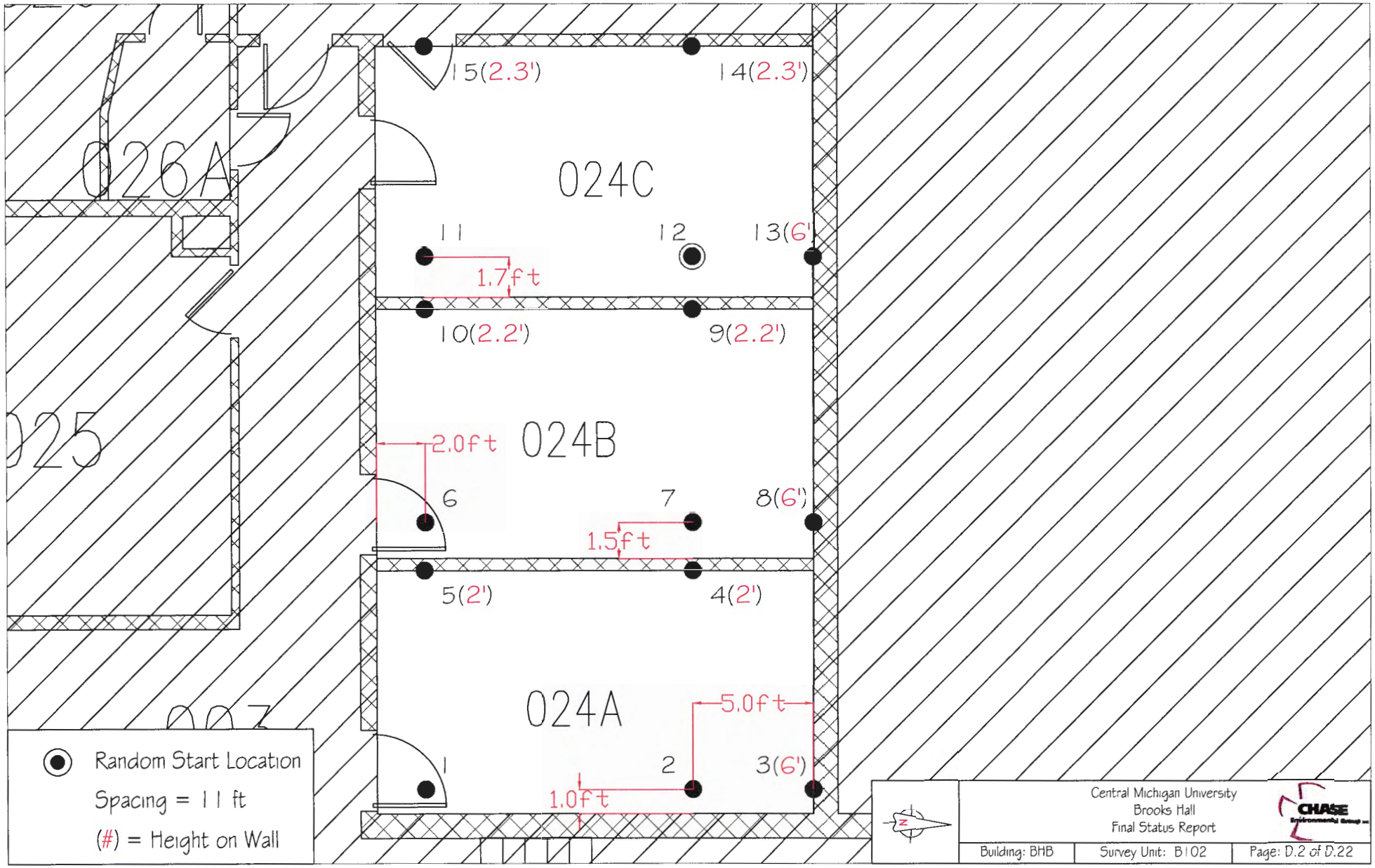
Last Edit Date:

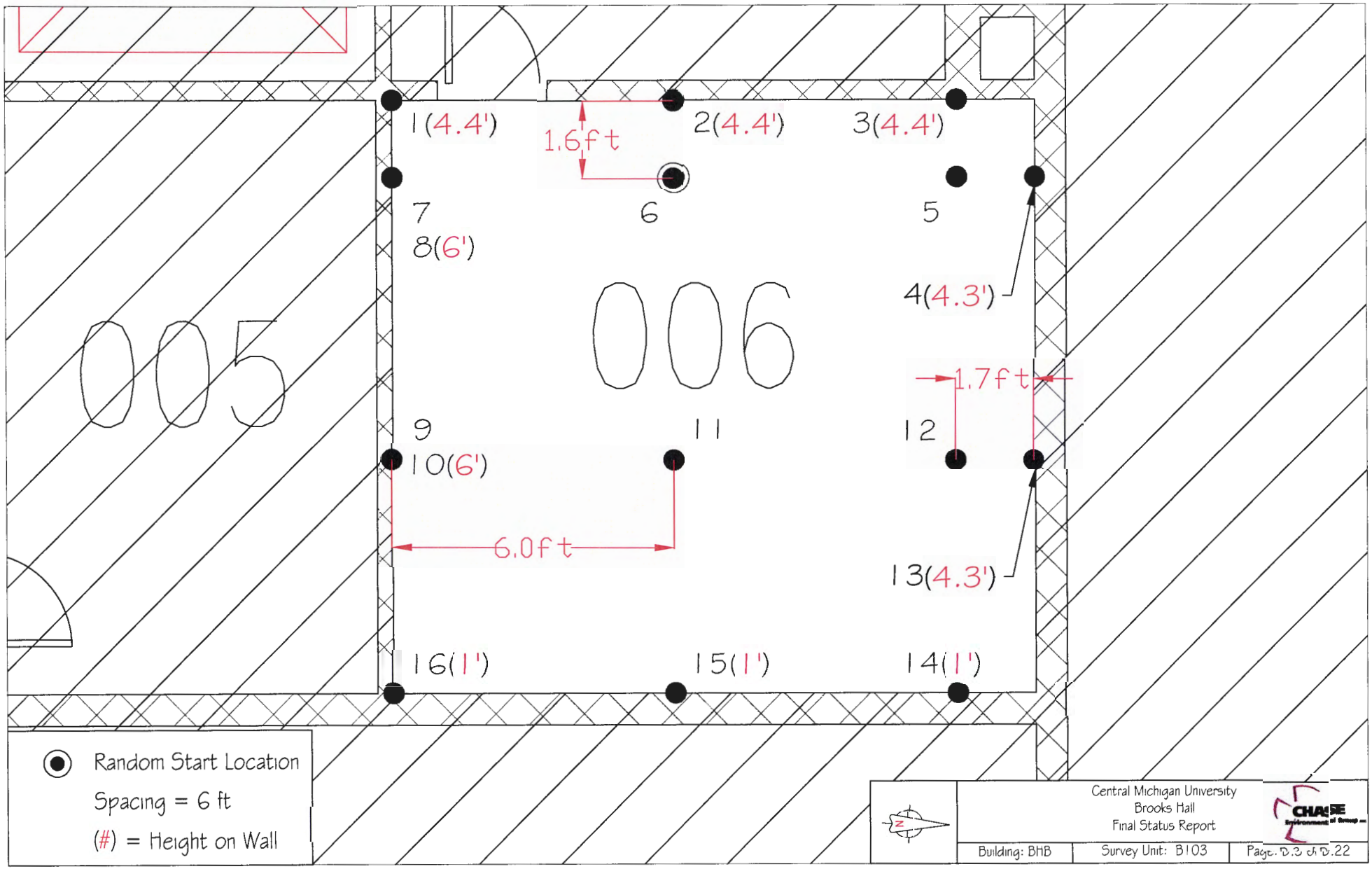
Quench Indicator: tSIE/AEC

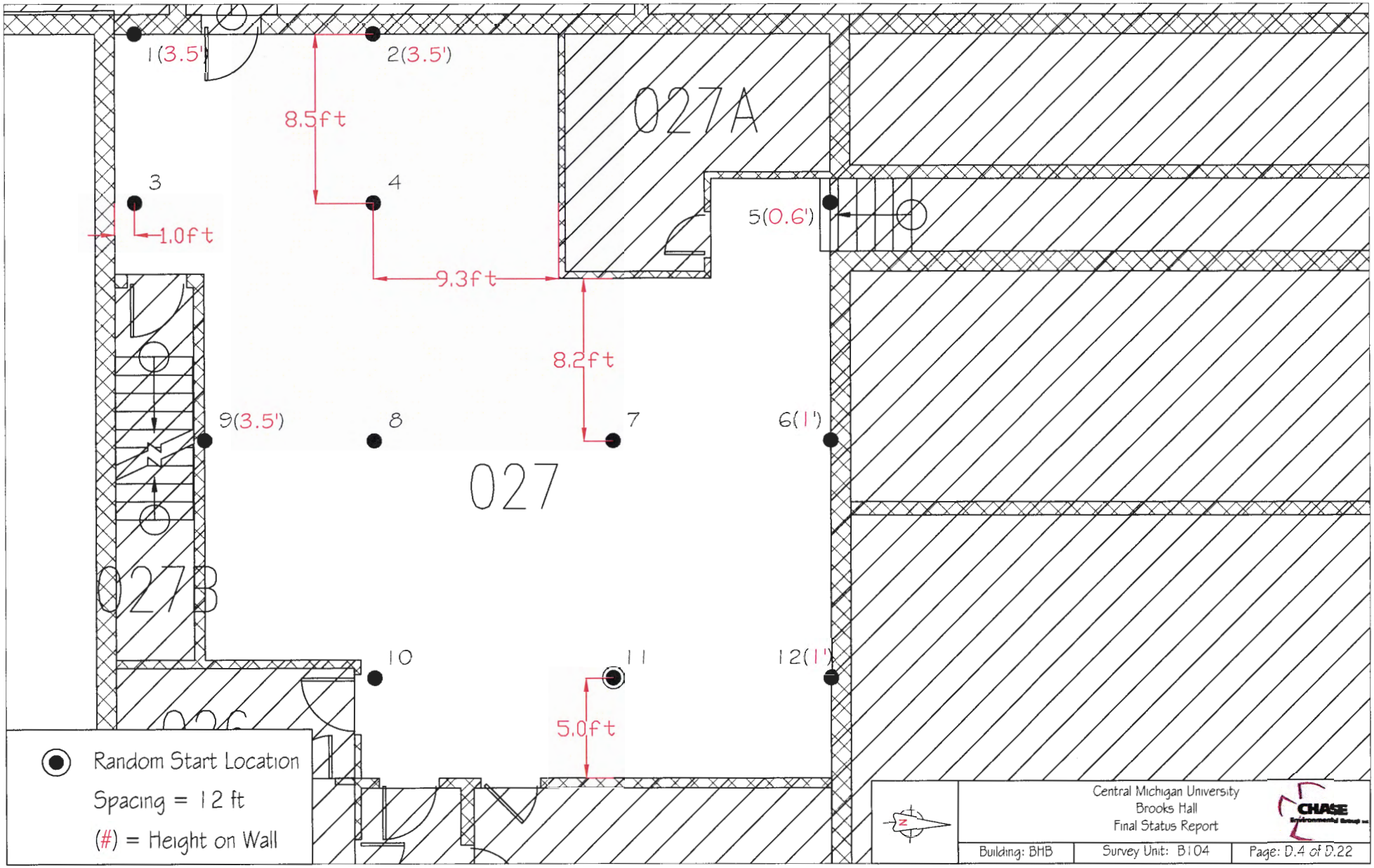
Included	tSIE/AEC	Count Efficiency (%)
Yes	109.27	73.93
Yes	137.35	79.51
Yes	176.57	83.73
Yes	225.50	87.24
Yes	297.83	89.69
Yes	386.91	91.95
Yes	513.39	93.71
Yes	676.92	95.23
Yes	850.85	94.81
Yes	973.22	95.14

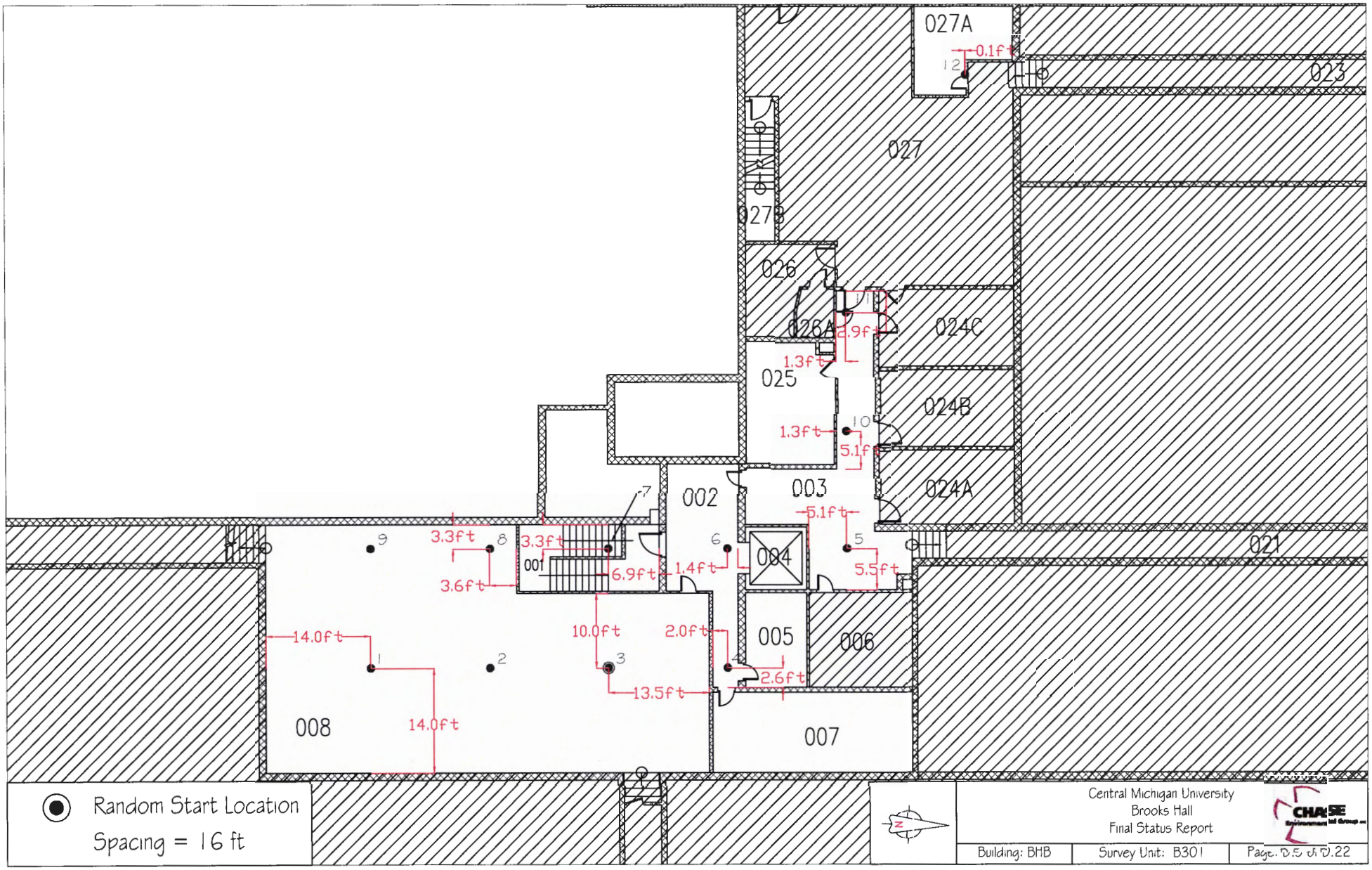
Appendix D
Final Status Survey Location Maps

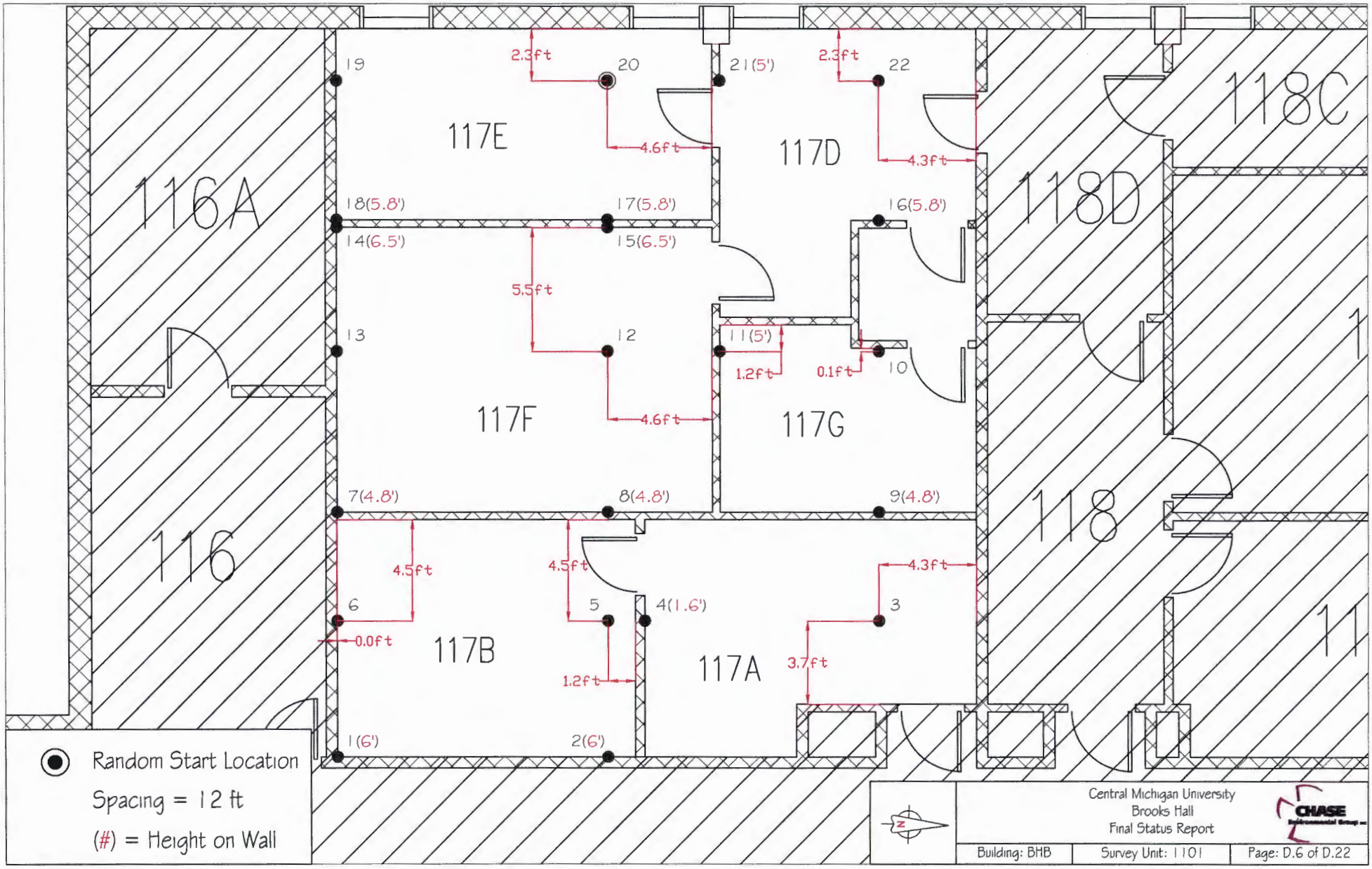

3(1.7')
7(1.7')
5.3ft
8
9(6.6')
2(2')
4
026
5.0ft
10(0.5')
026A
11
1(2')
5
6(5.4')
12(6.6')
Random Start Location
Spacing = 7 ft
(#) = Height on Wall
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: B101
Page: D.1 of D.22

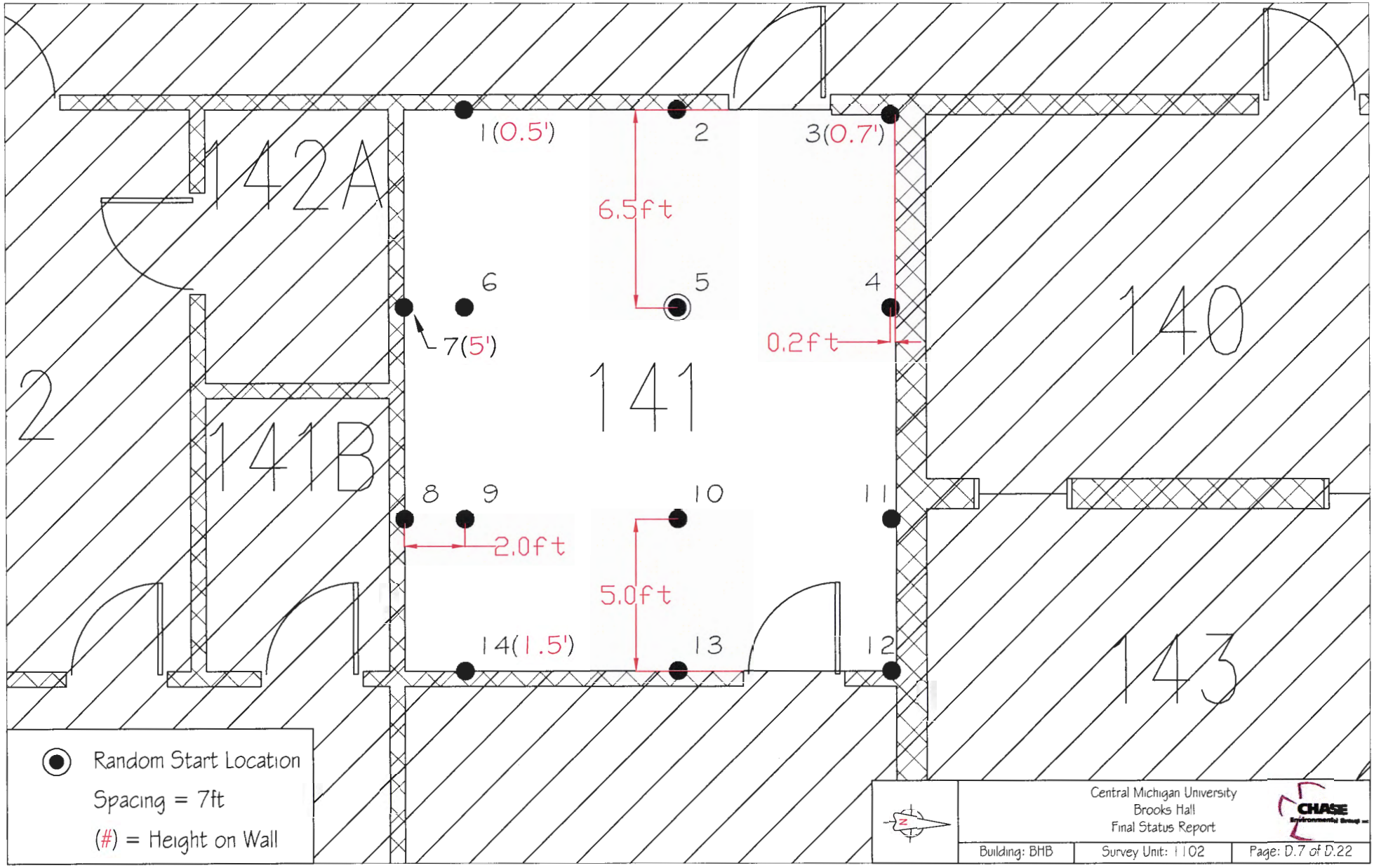

026A
025
007
024C
024B
024A
15(2.3')
14(2.3')
11
12
13(6')
1.7ft
10(2.2')
9(2.2')
2.0ft
6
7
8(6')
1.5ft
5(2')
4(2')
5.0ft
1
2
3(6')
1.0ft
Random Start Location
Spacing = 11 ft
(#) = Height on Wall
N
Central Michigan University
Brooks Hall
Final Status Report
CHASE Environmental Group Inc.
Building: BHB
Survey Unit: B102
Page: D.2 of D.22

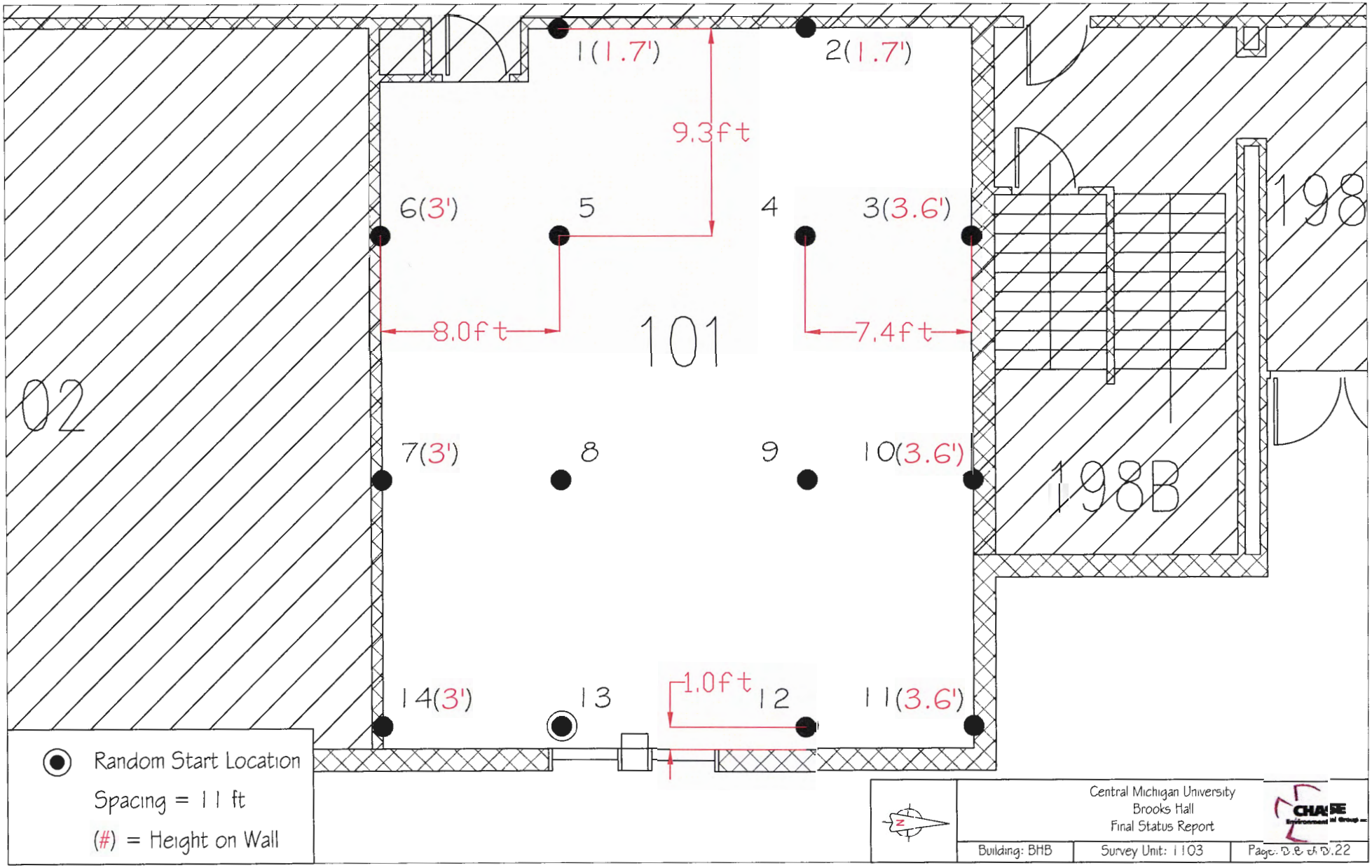

1(4.4')
2(4.4')
3(4.4')
1.6ft
6
7
8(6')
5
4(4.3')
005
006
1.7ft
9
11
12
10(6')
6.0ft
13(4.3')
16(1')
15(1')
14(1')
Random Start Location
Spacing = 6 ft
(#) = Height on Wall
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: B103
Page D.3 of D.22

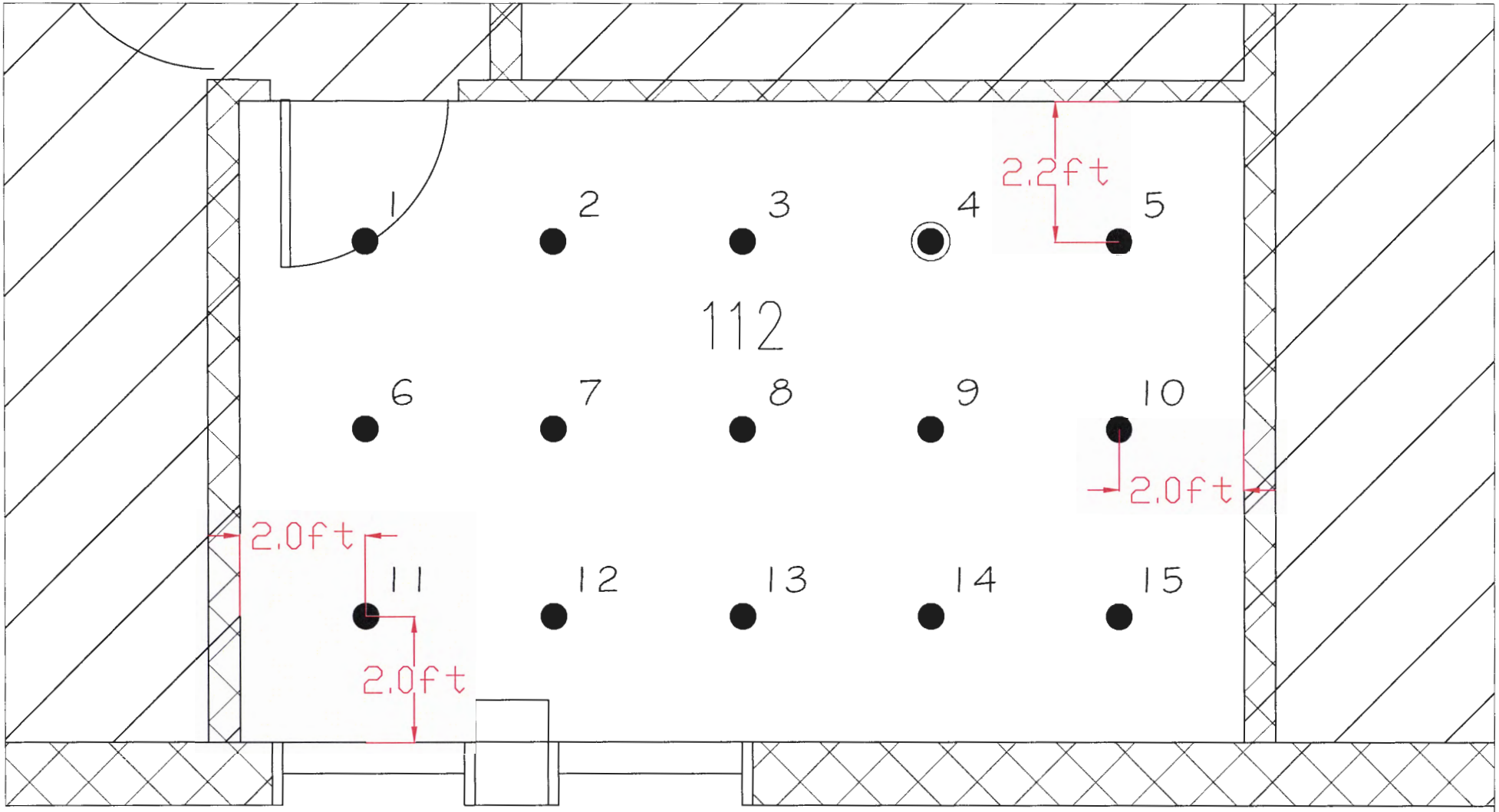

1(3.5')
2(3.5')
8.5ft
027A
3
4
1.0ft
9.3ft
5(0.6')
8.2ft
9(3.5')
8
7
6(1')
027
027B
10
11
12(1')
5.0ft
Random Start Location
Spacing = 12 ft
(#) = Height on Wall
N
Central Michigan University
Brooks Hall
Final Status Report
CHASE
Building: BHB
Survey Unit: B104
Page: D.4 of D.22


027A
0.1ft
12
023
027
027B
026
026A
2.9ft
1.3ft
024C
025
024B
1.3ft
10
5.1ft
002
003
024A
5.1ft
7
9
3.3ft
8
3.3ft
001
6.9ft
1.4ft
6
004
5
5.5ft
021
3.6ft
14.0ft
10.0ft
2.0ft
005
006
1
2
3
4
2.6ft
13.5ft
008
14.0ft
007
Random Start Location
Spacing = 16 ft
N
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: B301
Page: D.5 of D.22


19
20
21(5')
22
2.3ft
2.3ft
117E
117D
4.6ft
4.3ft
116A
118C
118D
18(5.8')
17(5.8')
16(5.8')
14(6.5')
15(6.5')
5.5ft
13
12
11(5')
10
1.2ft
0.1ft
117F
117G
4.6ft
7(4.8')
8(4.8')
9(4.8')
116
118
4.5ft
4.5ft
4.3ft
6
5
4(1.6')
3
0.0ft
117B
117A
3.7ft
1.2ft
1(6')
2(6')
Random Start Location
Spacing = 12 ft
(#) = Height on Wall
Central Michigan University
Brooks Hall
Final Status Report
CHASE
Building: BHB
Survey Unit: 1101
Page: D.6 of D.22


142A
141B
141
140
143
2
1(0.5')
2
3(0.7')
6.5ft
6
5
4
7(5')
0.2ft
8
9
10
11
2.0ft
5.0ft
14(1.5')
13
12
Random Start Location
Spacing = 7ft
(#) = Height on Wall
N
Central Michigan University
Brooks Hall
Final Status Report
CHASE Environmental Group Inc.
Building: BHB
Survey Unit: 1102
Page: D.7 of D.22

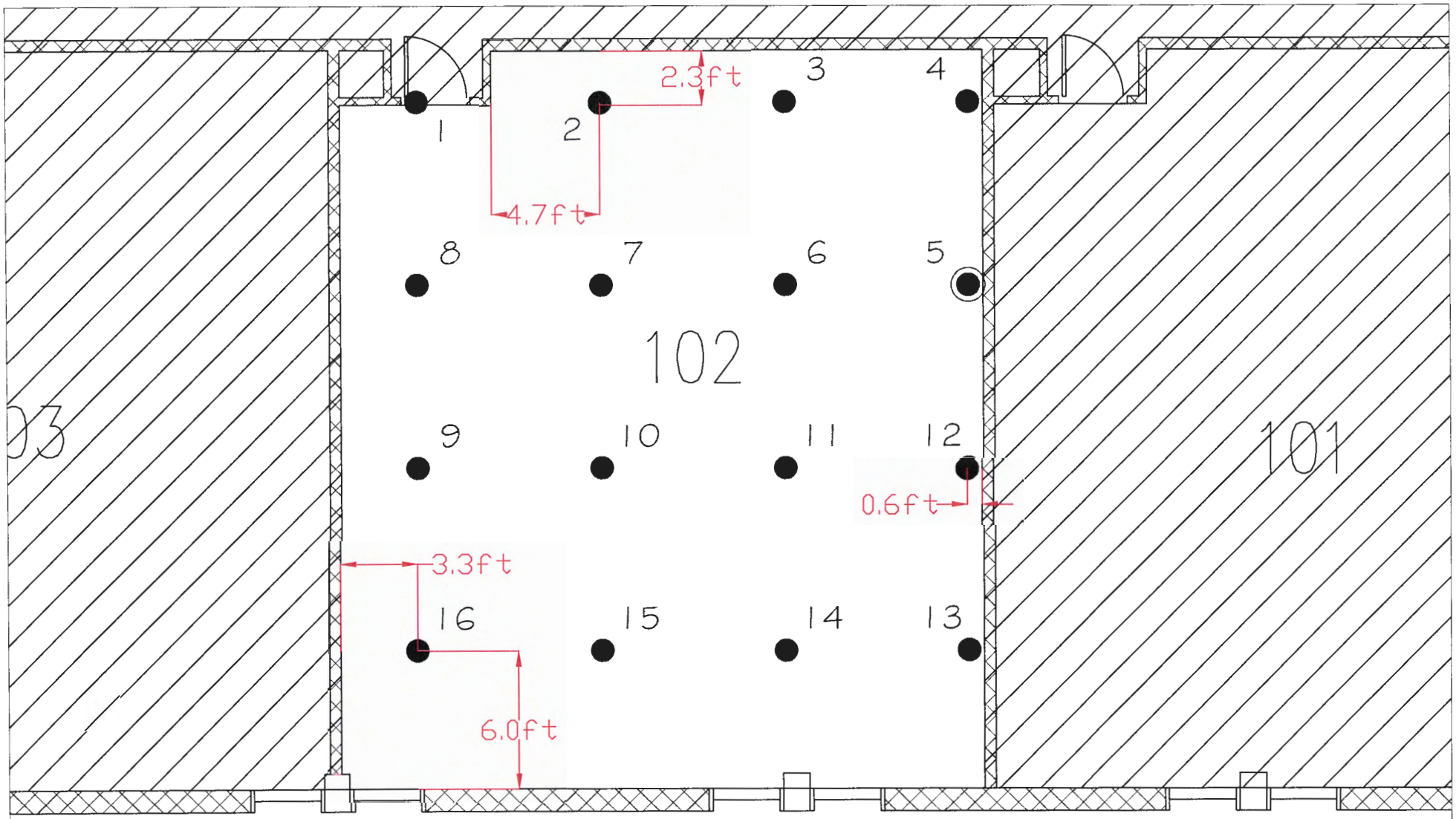

1(1.7')
2(1.7')
9.3ft
6(3')
5
4
3(3.6')
198
8.0ft
101
7.4ft
02
7(3')
8
9
10(3.6')
198B
14(3')
13
1.0ft
12
11(3.6')
Random Start Location
Spacing = 11 ft
(#) = Height on Wall
N
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: 1103
Page: D & D.22

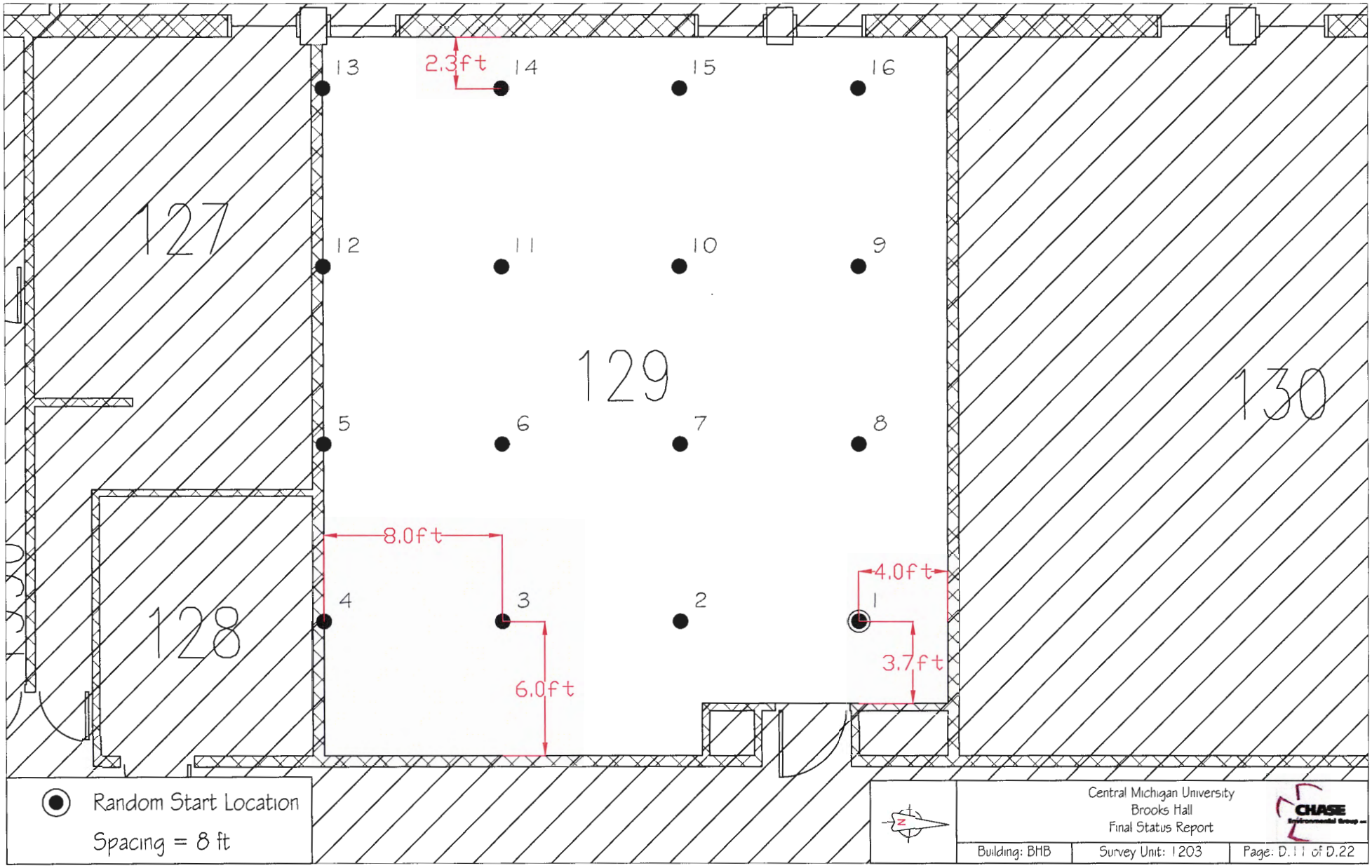


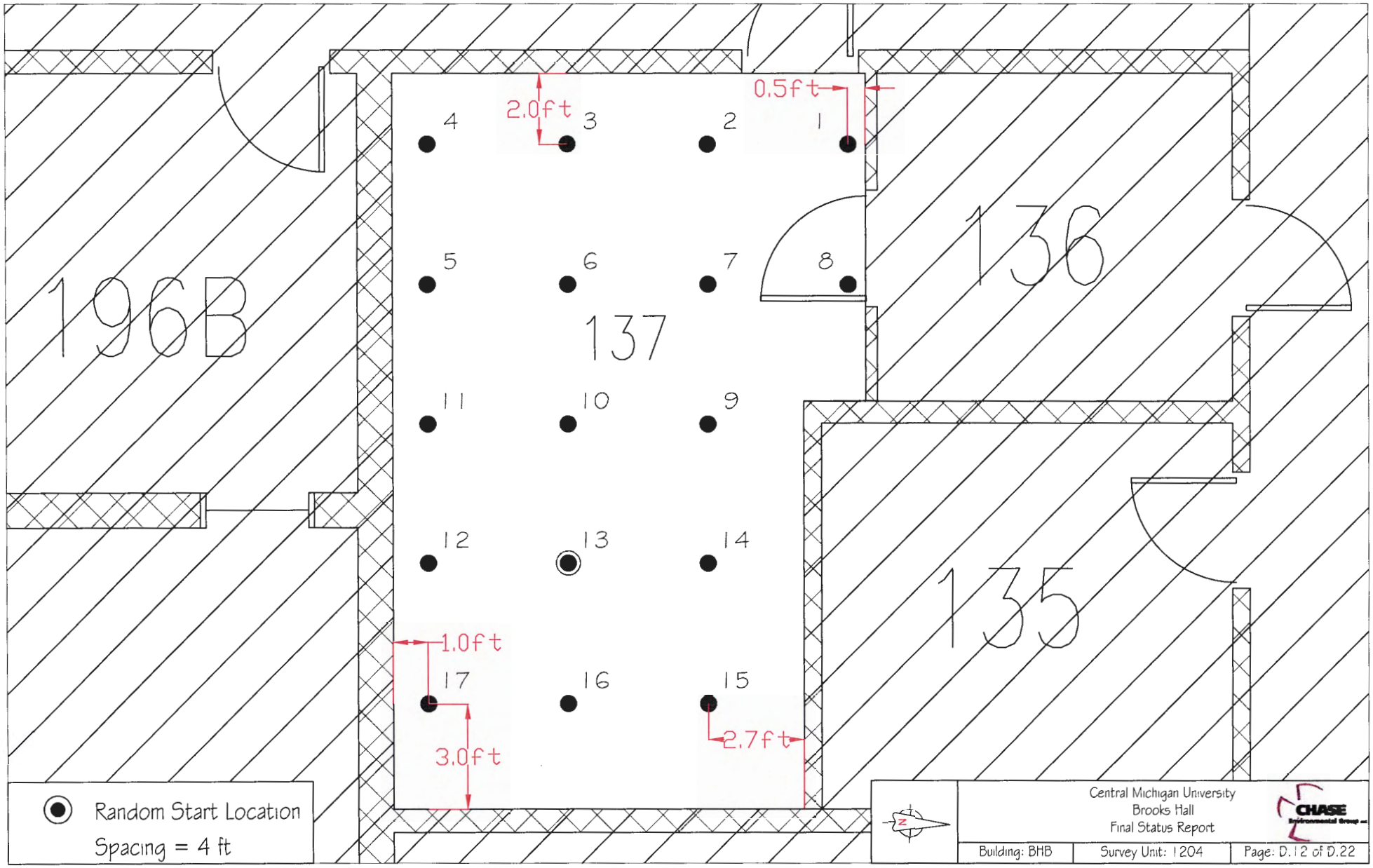
Random Start Location
Spacing = 3ft

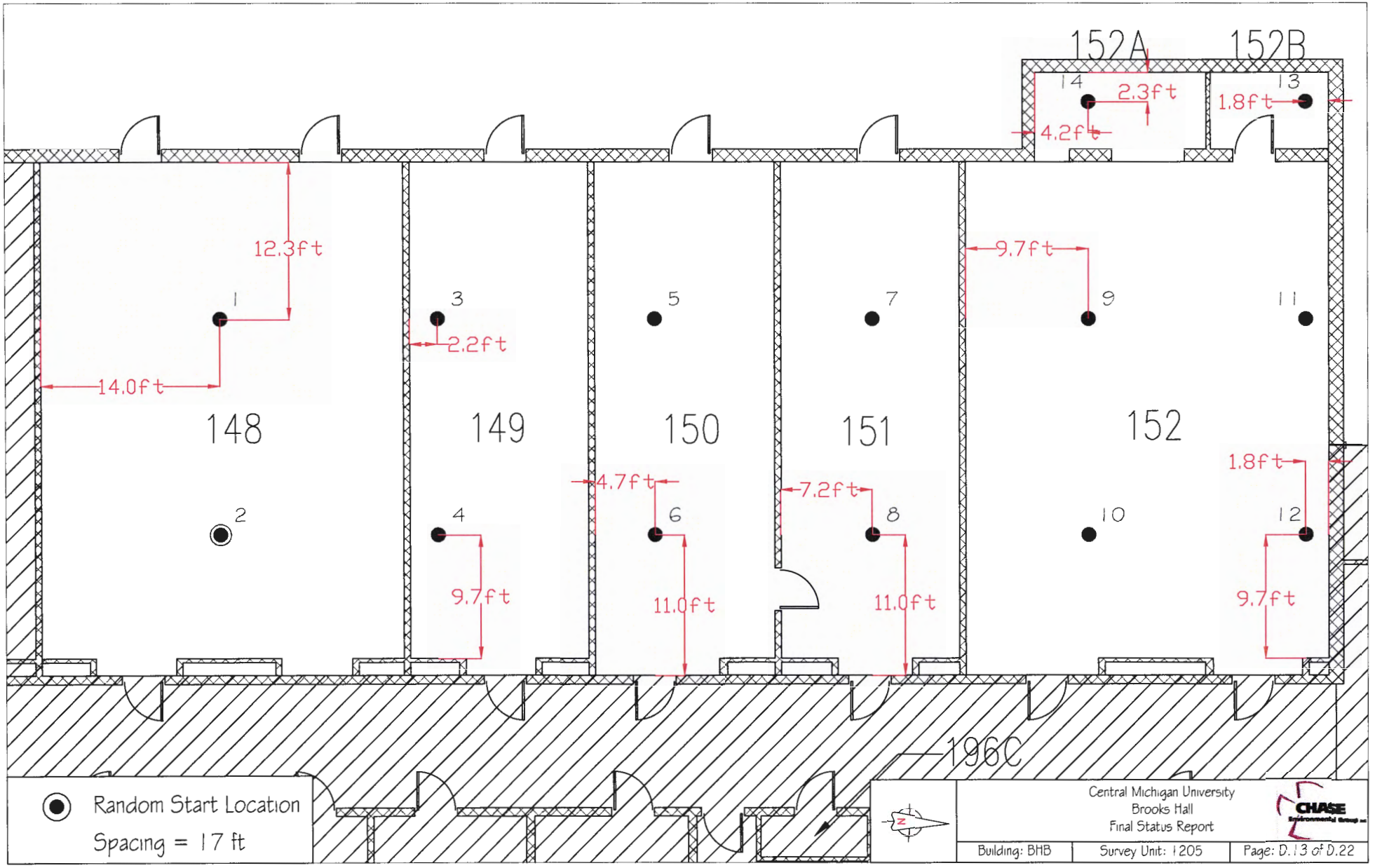
Central Michigan University
Brooks Hall
Final Status Report

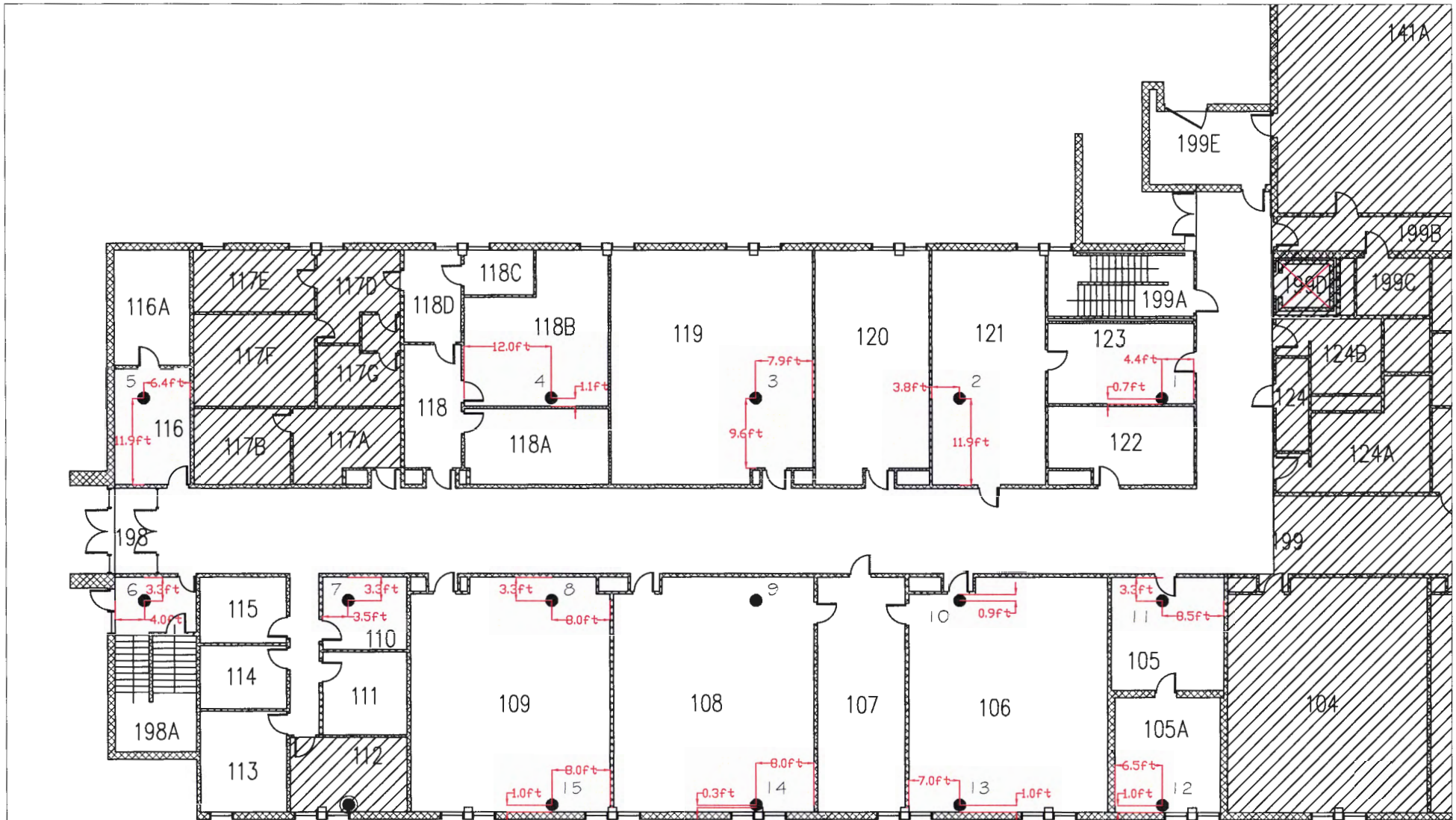
Building: BHB	Survey Unit: 1201	Page: D.9 of D.22


2.3ft
4.7ft
1
2
3
4
8
7
6
5
102
03
101
9
10
11
12
0.6ft
3.3ft
16
15
14
13
6.0ft
Random Start Location
Spacing = 8 ft
N
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: 1202
Page D.10 of D.22


13
2.3ft
14
15
16
127
12
11
10
9
129
130
5
6
7
8
8.0ft
4.0ft
4
3
2
1
128
3.7ft
6.0ft
Random Start Location
Spacing = 8 ft
N
Central Michigan University
Brooks Hall
Final Status Report
CHASE
Building: BHB
Survey Unit: 1203
Page: D.11 of D.22


196B
137
136
135
4
3
2
1
5
6
7
8
11
10
9
12
13
14
17
16
15
2.0ft
0.5ft
1.0ft
3.0ft
2.7ft
Random Start Location
Spacing = 4 ft
N
Central Michigan University
Brooks Hall
Final Status Report
CHASE Environmental Group
Building: BHB
Survey Unit: 1204
Page: D.12 of D.22


152A
152B
14
13
2.3ft
1.8ft
4.2ft
12.3ft
9.7ft
1
3
5
7
9
11
2.2ft
14.0ft
148
149
150
151
152
4.7ft
7.2ft
1.8ft
2
4
6
8
10
12
9.7ft
11.0ft
11.0ft
9.7ft
196C
Random Start Location
Spacing = 17 ft
N
Central Michigan University
Brooks Hall
Final Status Report
CHASE Environmental Group
Building: BHB
Survey Unit: 1205
Page: D.13 of D.22

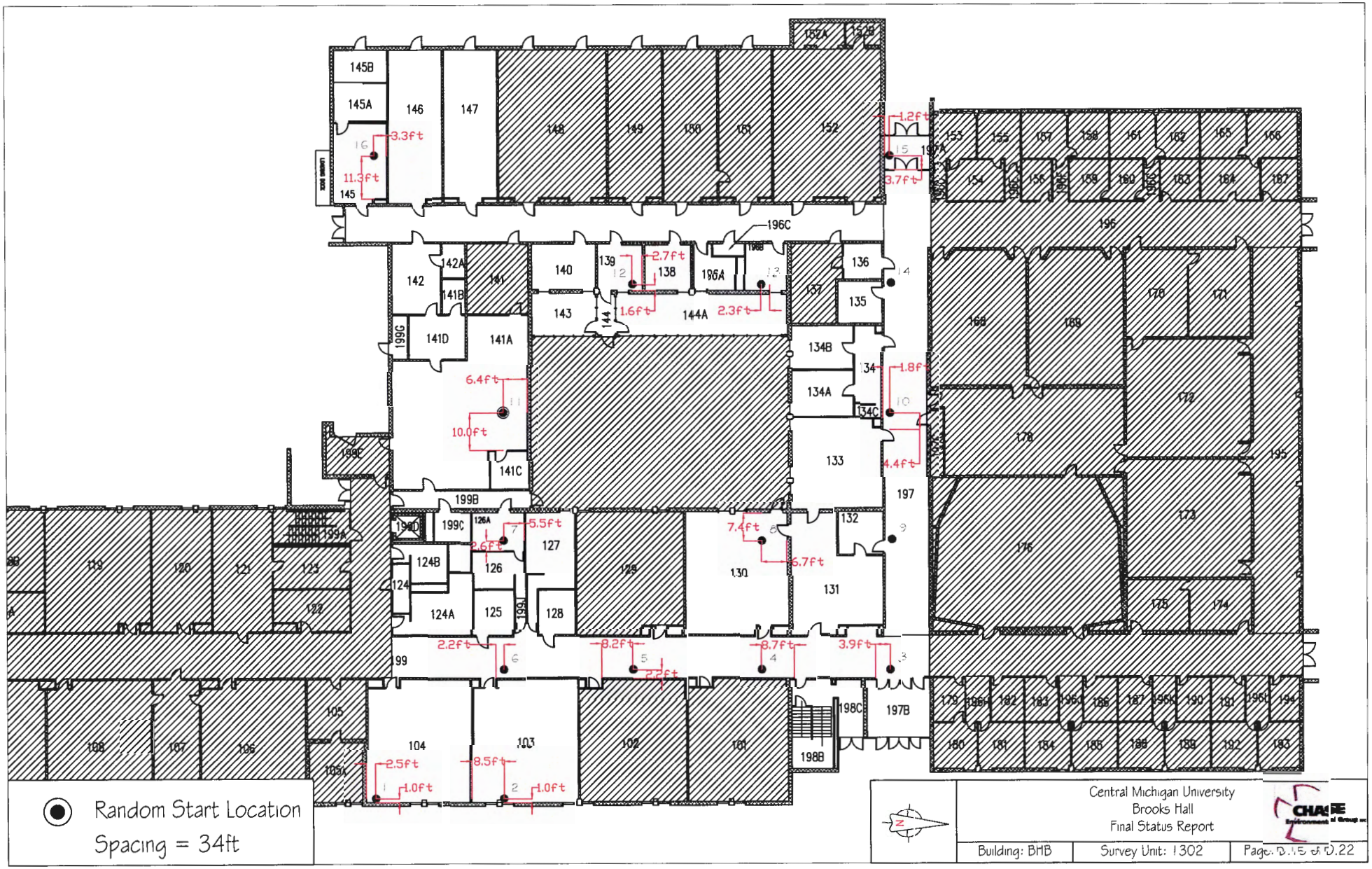


Random Start Location
Spacing = 28 ft

Central Michigan University
Brooks Hall
Final Status Report

CHASE Environmental Group

Building: BHB	Survey Unit: 1301	Page: D.14 of D.22

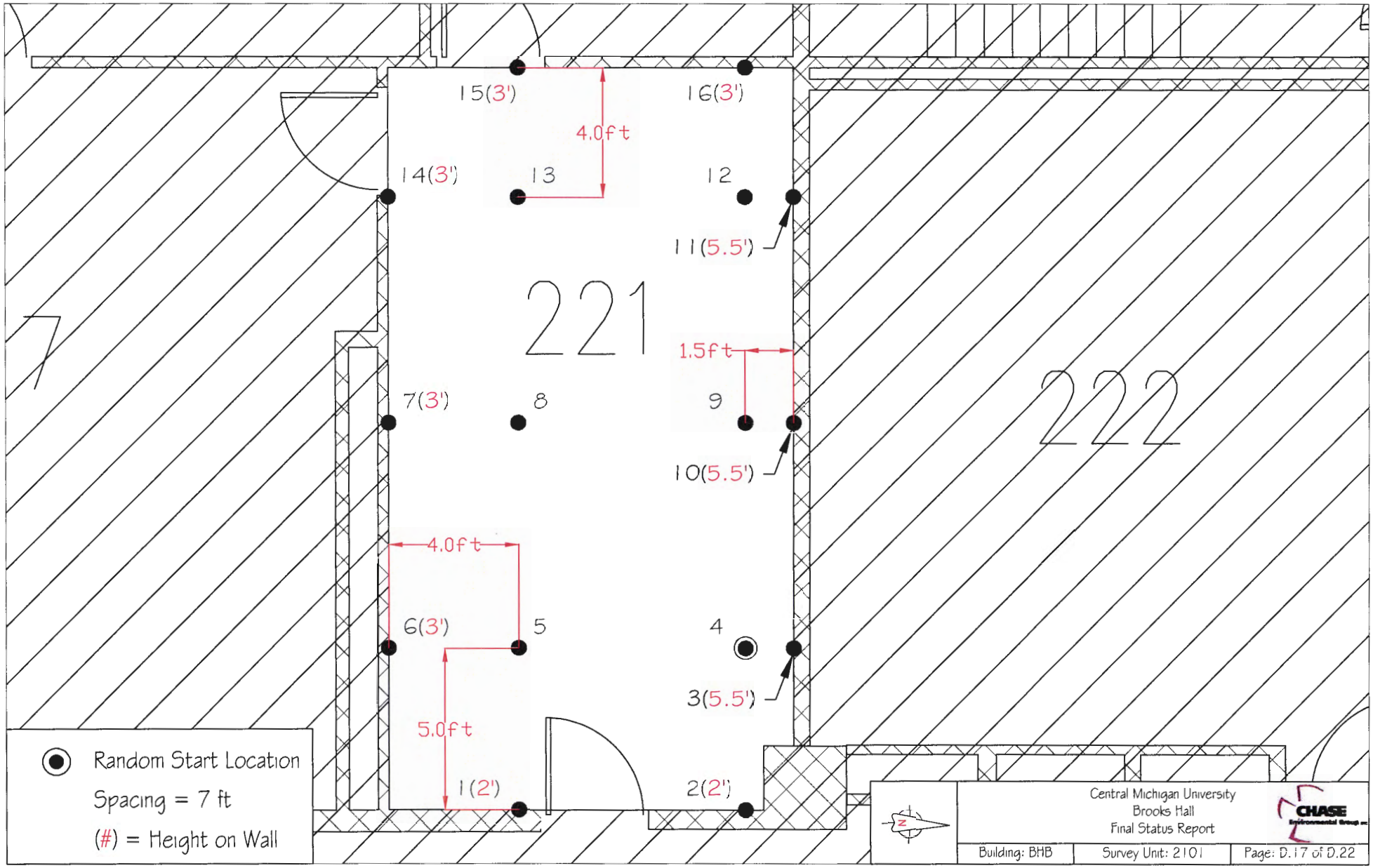

Random Start Location
Spacing = 34ft
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: 1302
Page D.15 of D.22

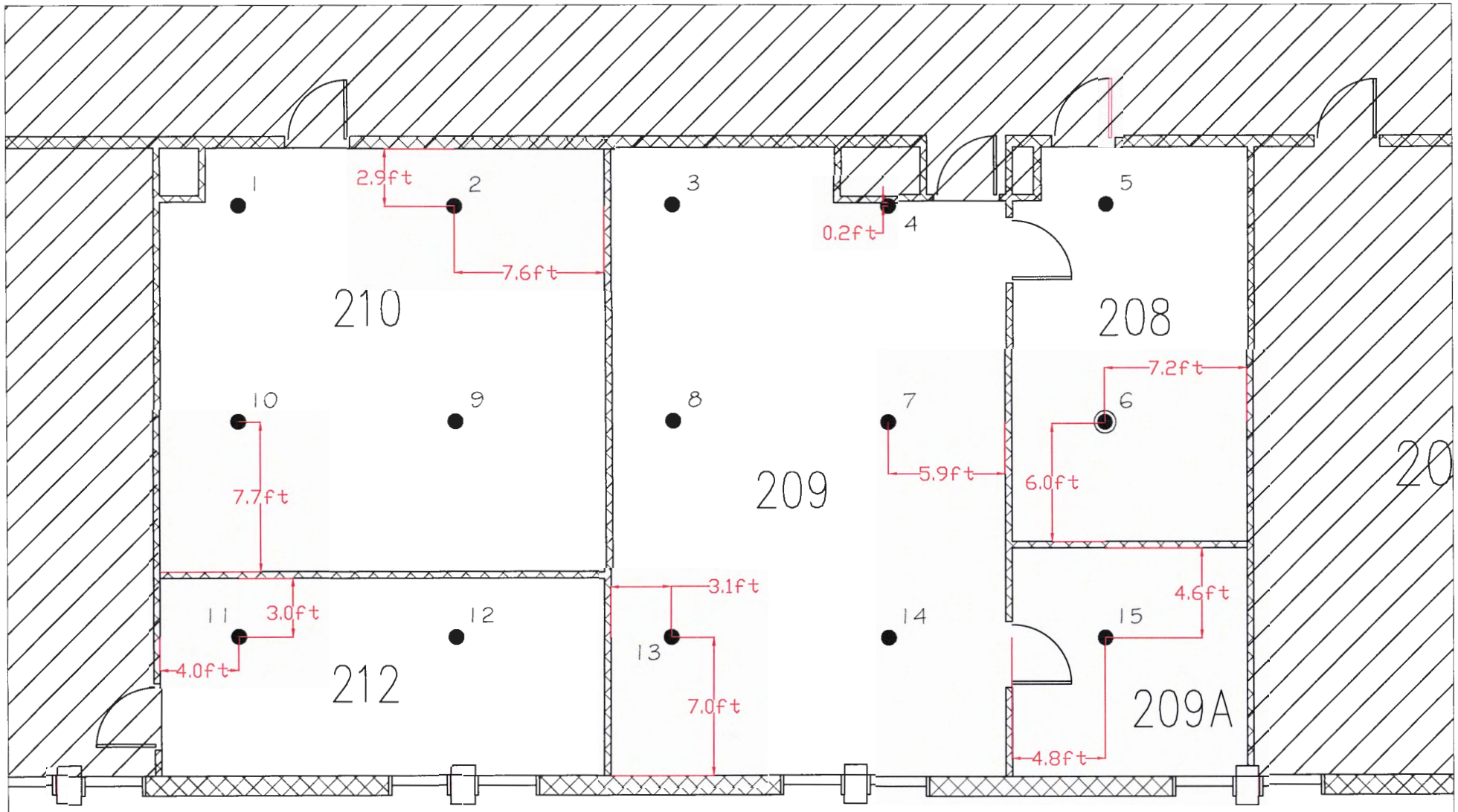


Central Michigan University
Brooks Hall
Final Status Report

CHASE Environmental Group

Building: BHB	Survey Unit: 1303	Page: D.16 of D.22

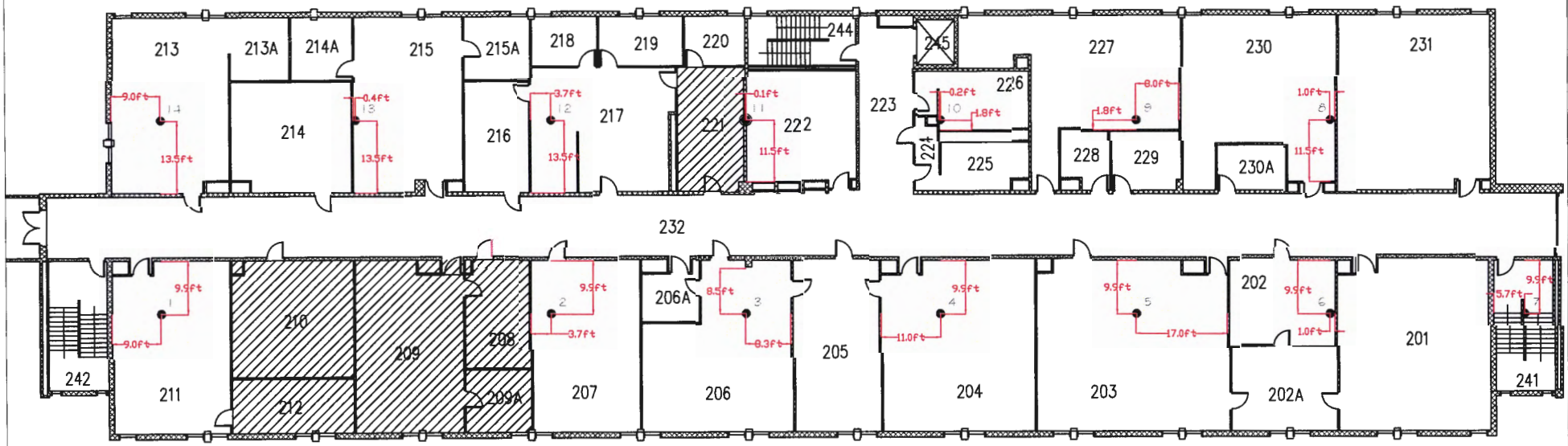

15(3')
16(3')
4.0ft
14(3')
13
12
11(5.5')
221
1.5ft
7(3')
8
9
222
10(5.5')
4.0ft
6(3')
5
4
3(5.5')
5.0ft
1(2')
2(2')
Random Start Location
Spacing = 7 ft
(#) = Height on Wall
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: 2101
Page: D.17 of D.22



Random Start Location
Spacing = 11 ft

Central Michigan University
Brooks Hall
Final Status Report

Building: BHB	Survey Unit: 2201	Page: D.18 of D.22

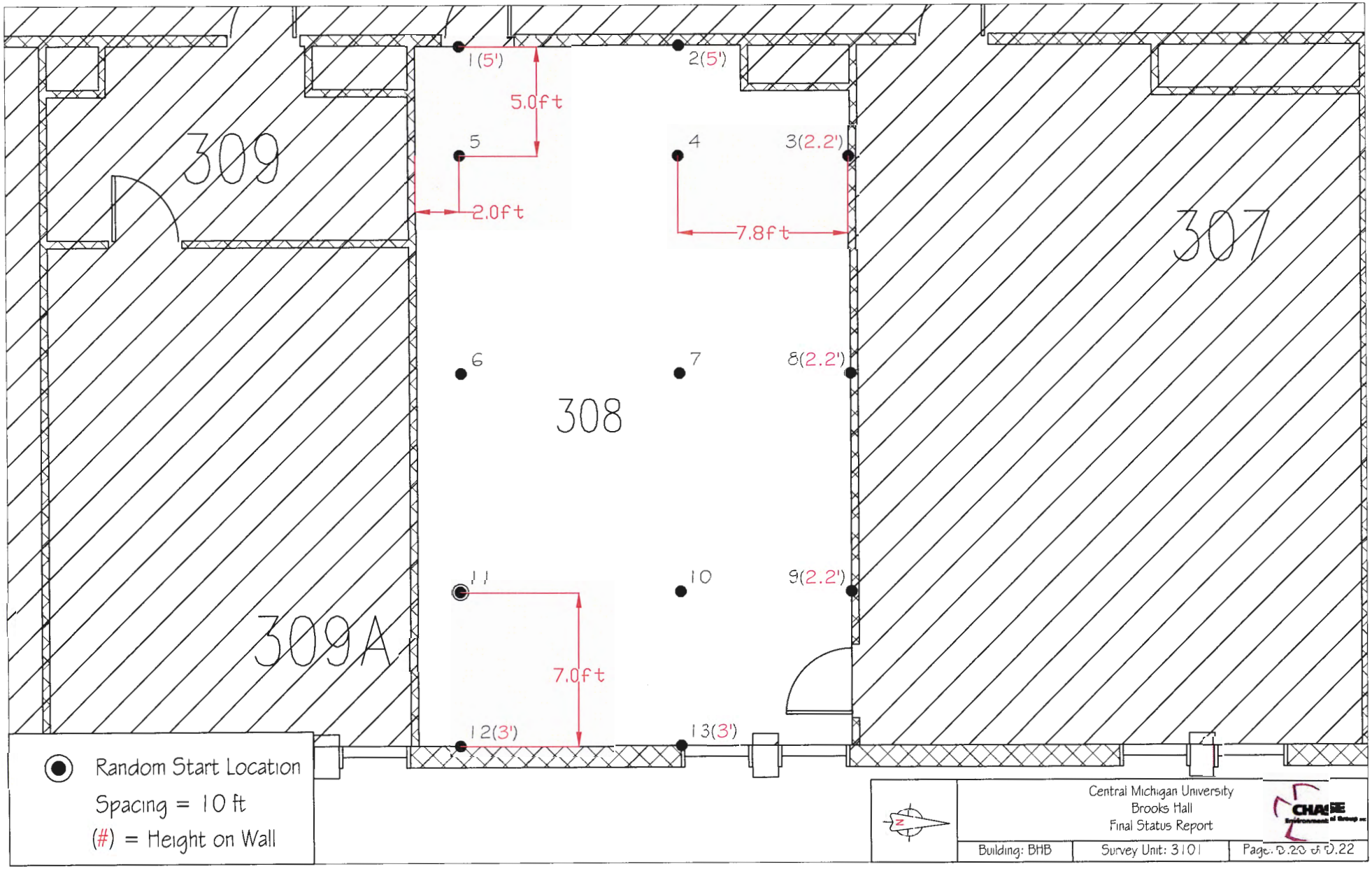


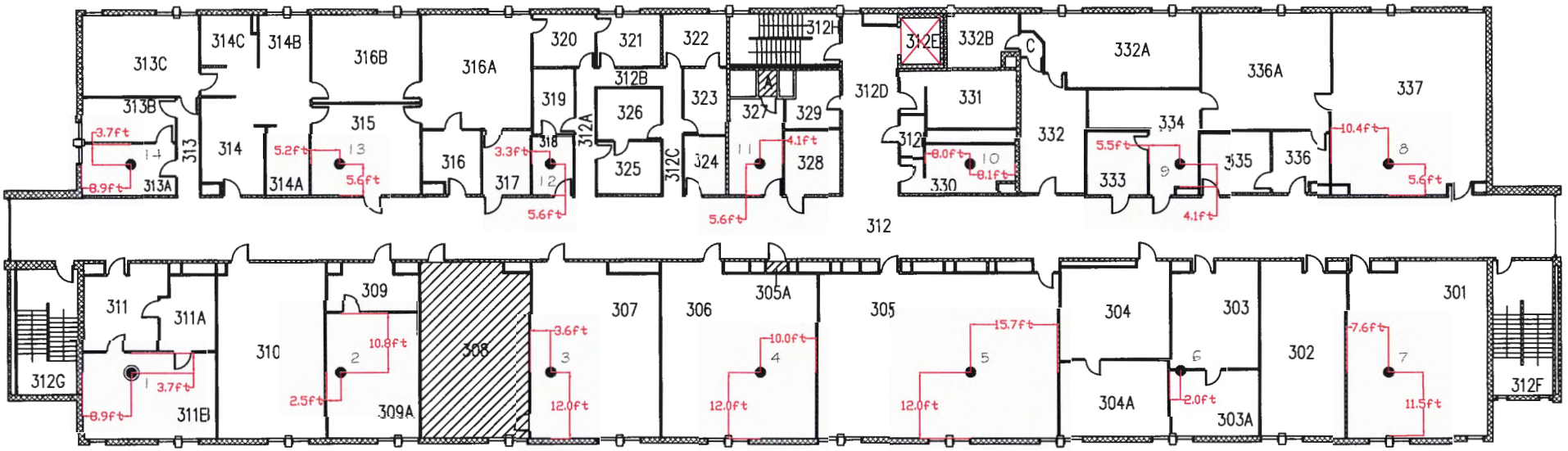
Random Start Location

Spacing = 36 ft

Central Michigan University
Brooks Hall
Final Status Report

Building: BHB	Survey Unit: 2301	Page: D.19 of D.22

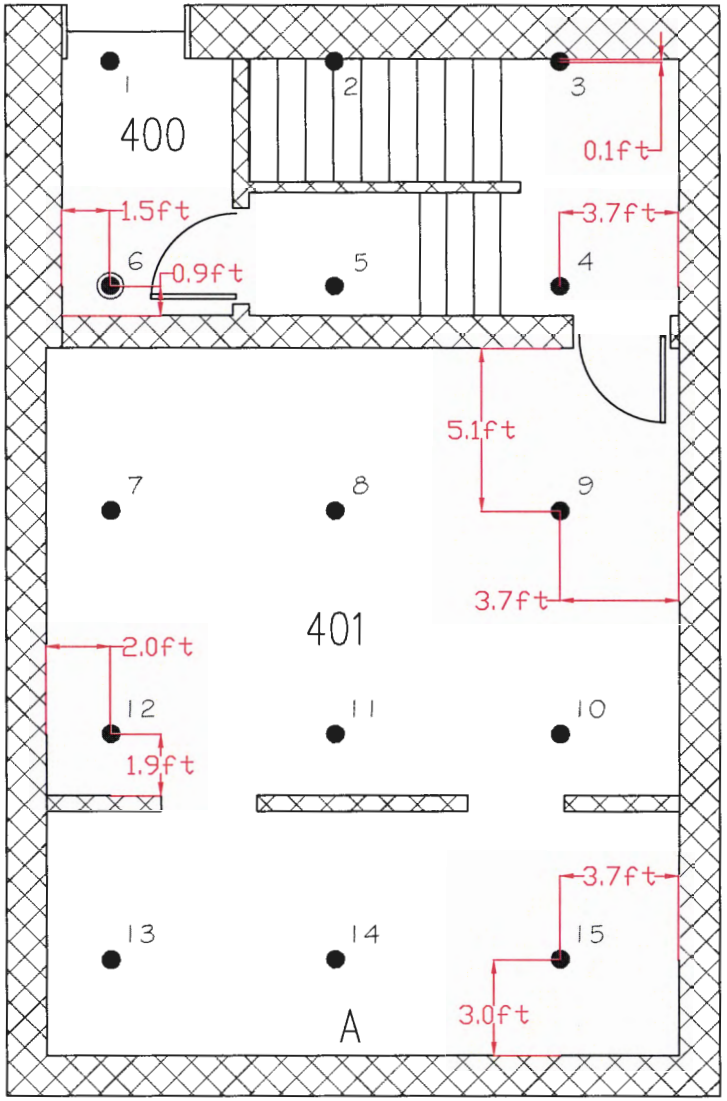

1(5')
2(5')
5.0ft
309
5
4
3(2.2')
2.0ft
7.8ft
307
6
7
8(2.2')
308
11
10
9(2.2')
309A
7.0ft
12(3')
13(3')
Random Start Location
Spacing = 10 ft
(#) = Height on Wall
Central Michigan University
Brooks Hall
Final Status Report
Building: BHB
Survey Unit: 3101
Page D.20 of D.22



Random Start Location
Spacing = 38ft

Central Michigan University
Brooks Hall
Final Status Report

Building: BHB	Survey Unit: 3301	Page: D.21 of D.22



● Random Start Location
Spacing = 7 ft

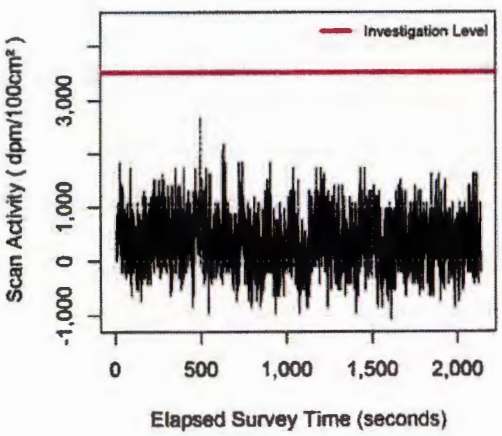
Central Michigan University
Brooks Hall
Final Status Report

Building: BHB	Survey Unit: 4301	Page: D.22 of D.22

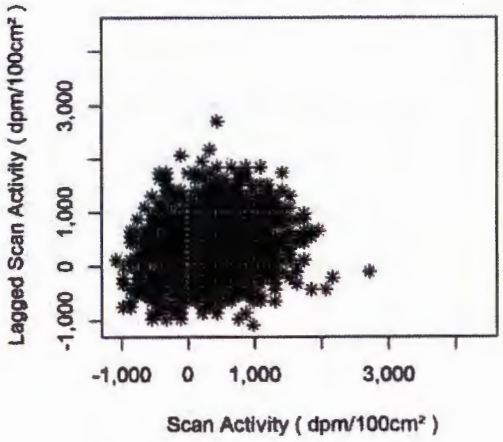
Appendix E
4-Plot Graphs

Survey Unit: BHB-B101 Probe: PR286836_Beta_Scans (43-37)

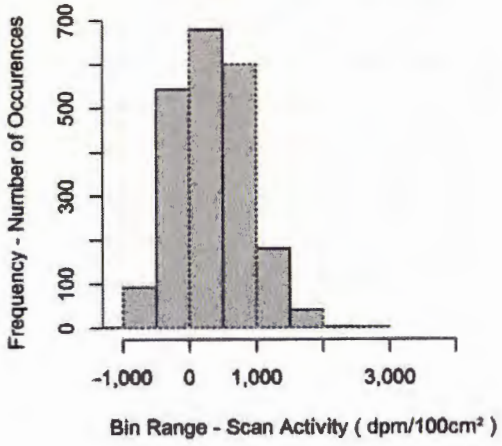
Scan Data



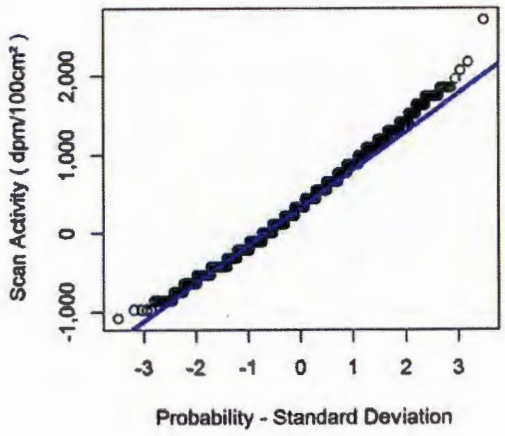
Lagged Scan Data



Histogram of Scan Data

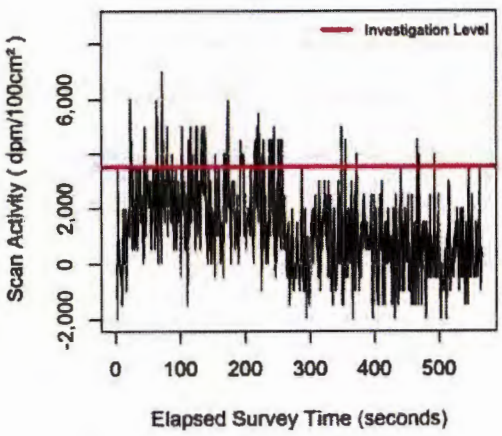


Normal Probability Plot of Data

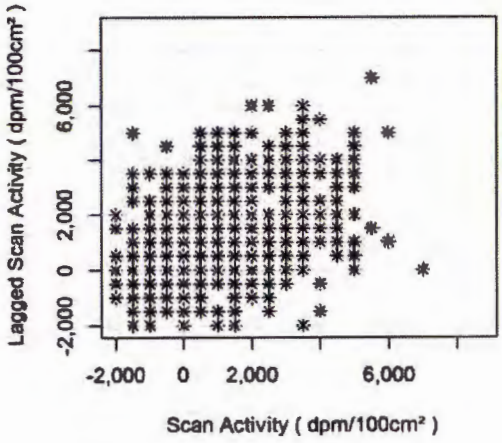


Survey Unit: BHB-B101 Probe: PR285700_Beta_Scans (43-68)

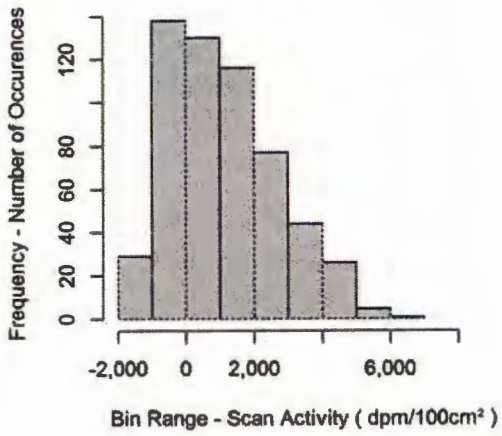
Scan Data



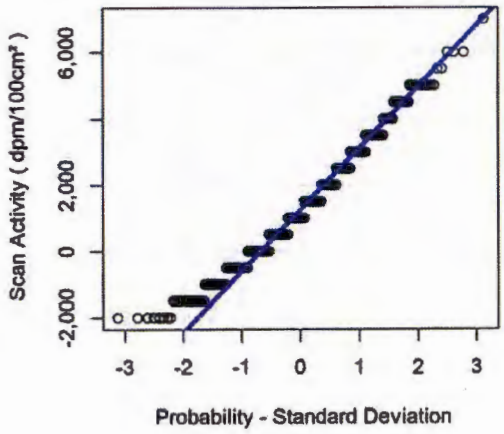
Lagged Scan Data



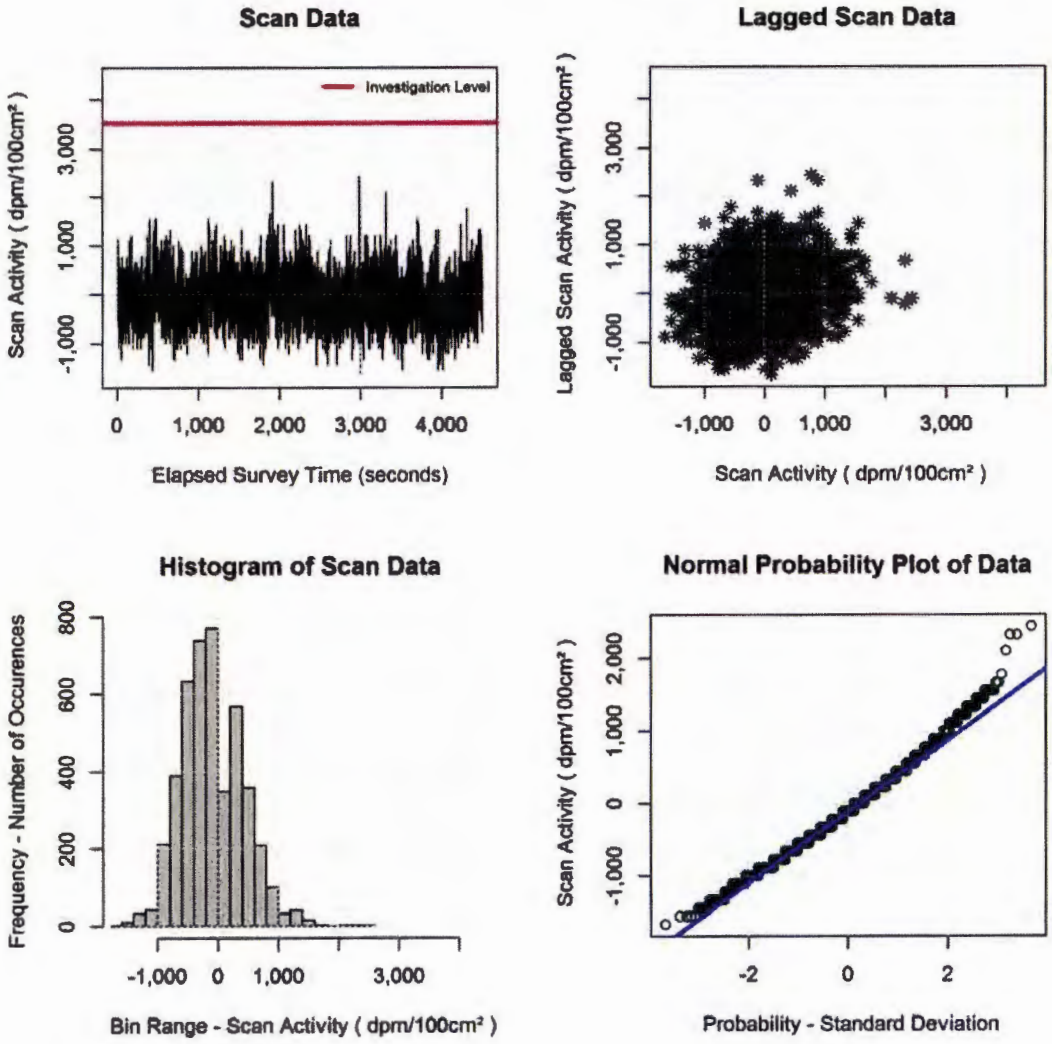
Histogram of Scan Data



Normal Probability Plot of Data

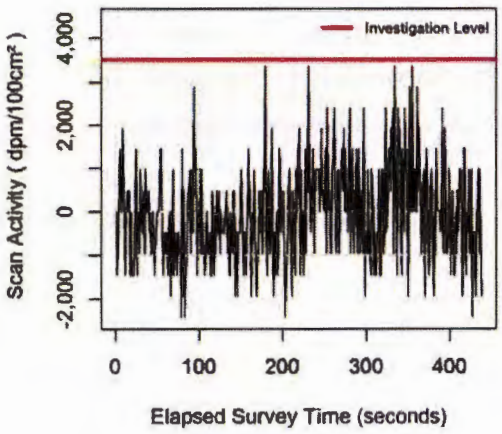


Survey Unit: BHB-B102 Probe: PR286832_Beta_Scans (43-37)

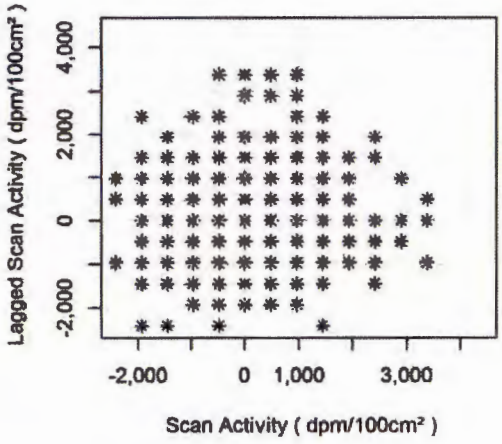


Survey Unit: BHB-B102 Probe: PR285699_Beta_Scans (43-68)

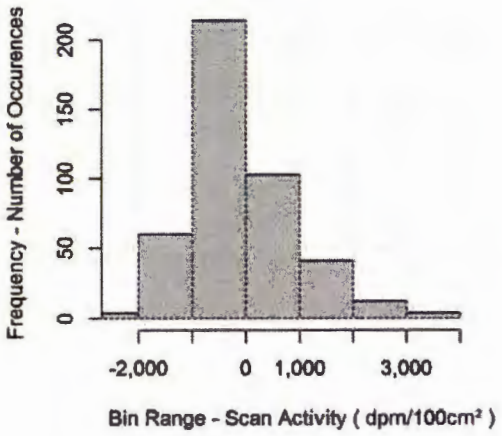
Scan Data



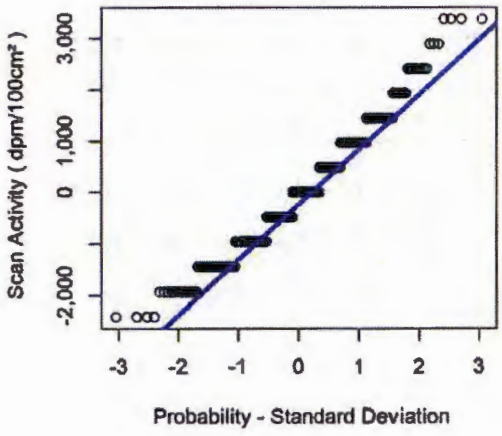
Lagged Scan Data



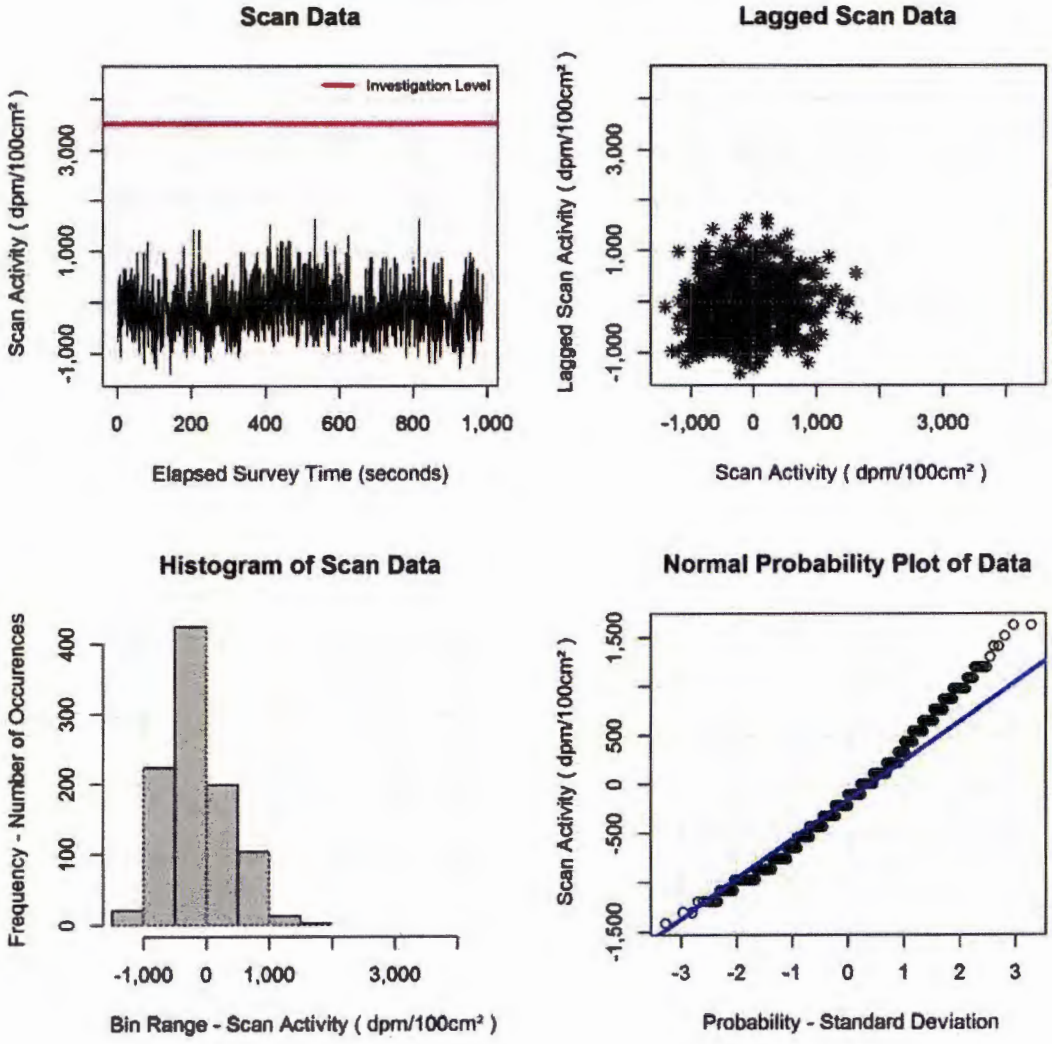
Histogram of Scan Data



Normal Probability Plot of Data

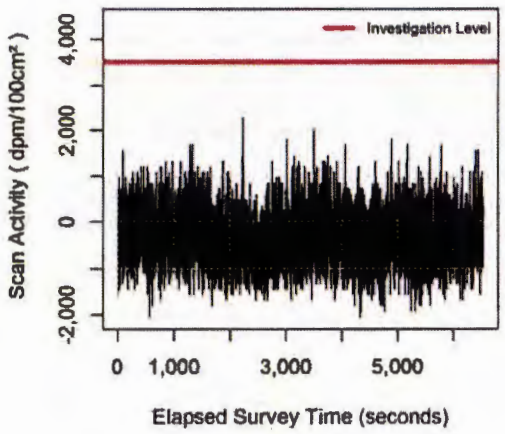


Survey Unit: BHB-B103 Probe: PR286836_Beta_Scans (43-37)

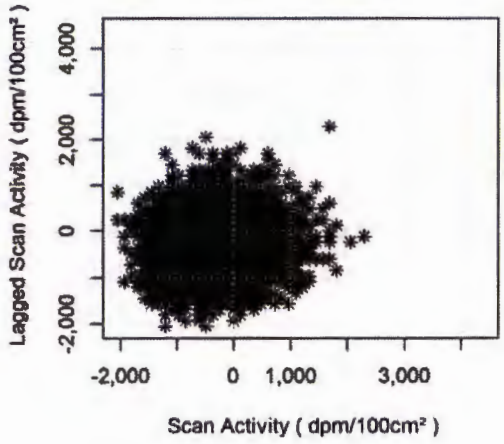


Survey Unit: BHB-B104 Probe: PR178300_Beta_Scans (43-37)

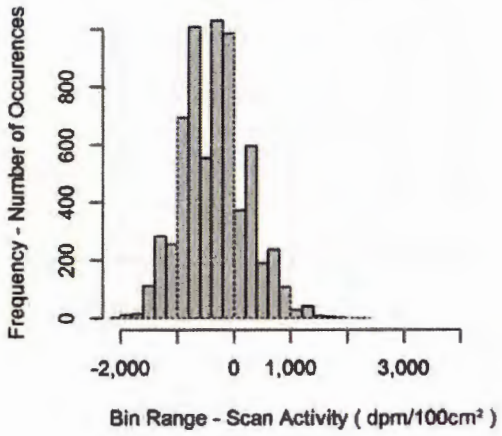
Scan Data



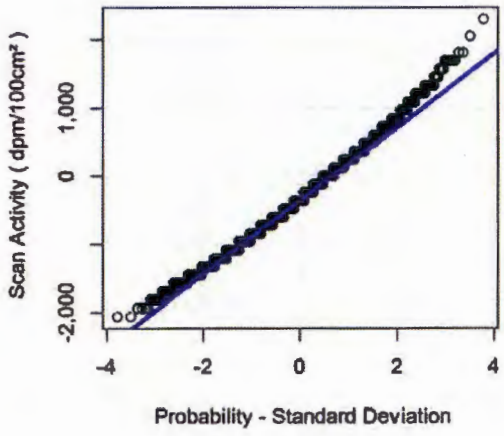
Lagged Scan Data



Histogram of Scan Data

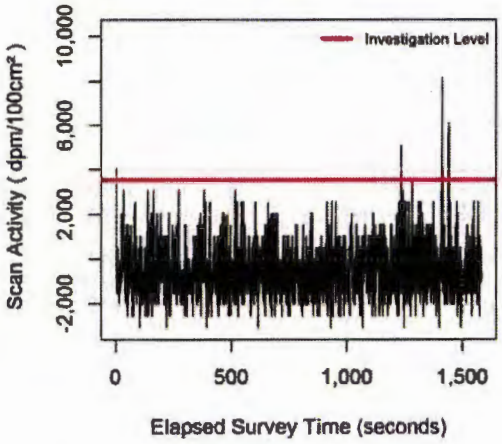


Normal Probability Plot of Data

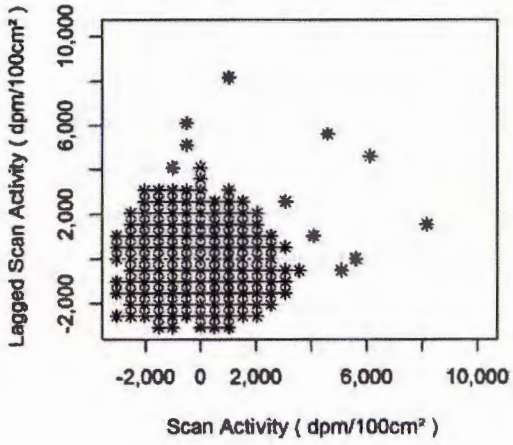


Survey Unit: BHB-B104 Probe: PR216394_Beta_Scans (43-68)

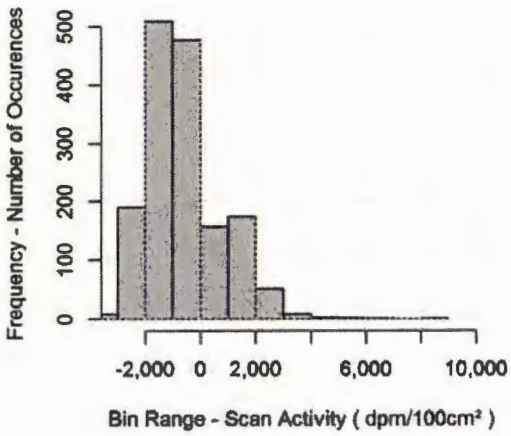
Scan Data



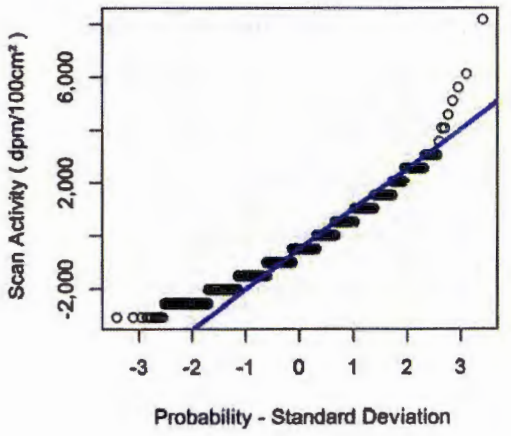
Lagged Scan Data



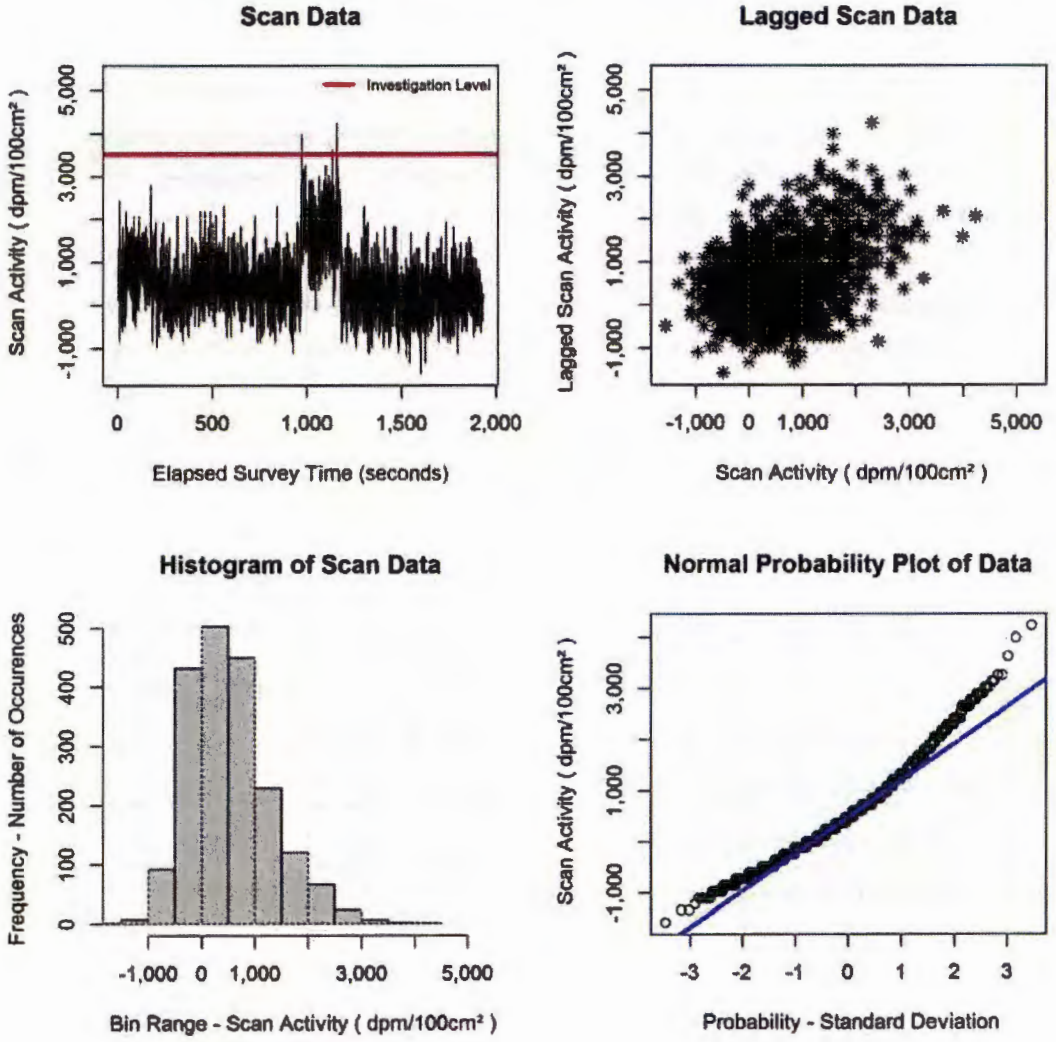
Histogram of Scan Data



Normal Probability Plot of Data

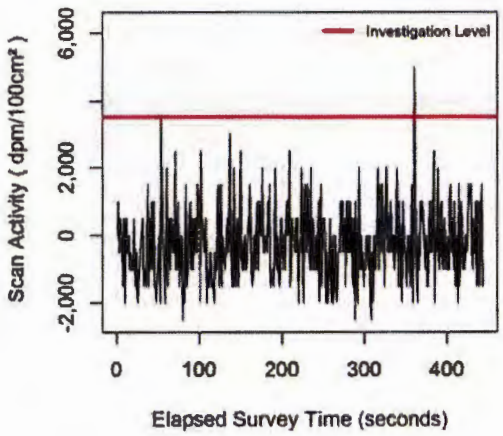


Survey Unit: BHB-B301 Probe: PR178300_Beta_Scans (43-37)

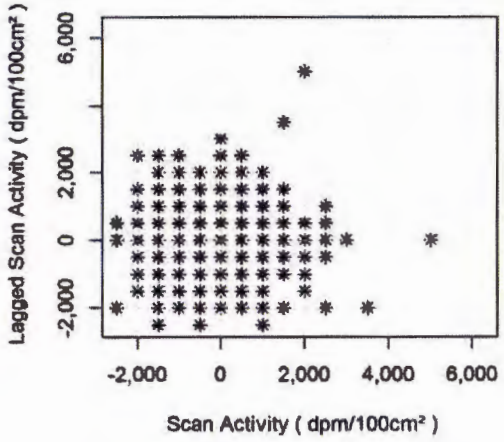


Survey Unit: BHB-1101 Probe: PR289347_Beta_Scans (43-68)

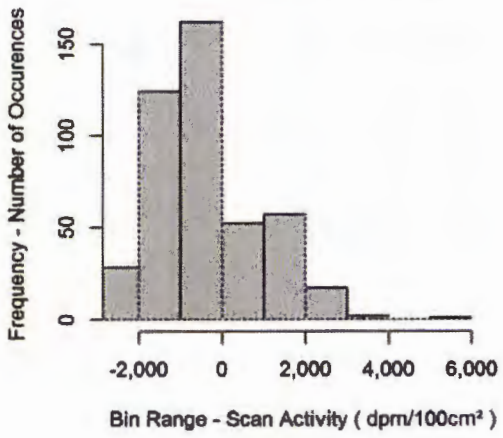
Scan Data



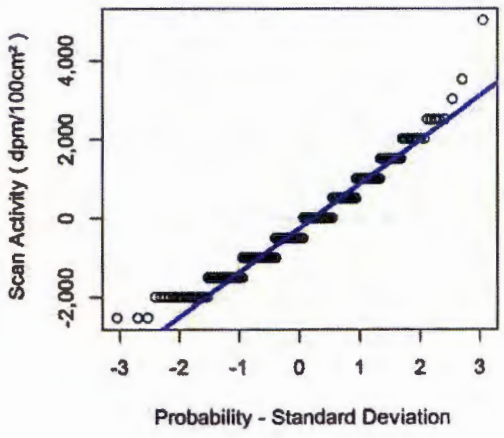
Lagged Scan Data



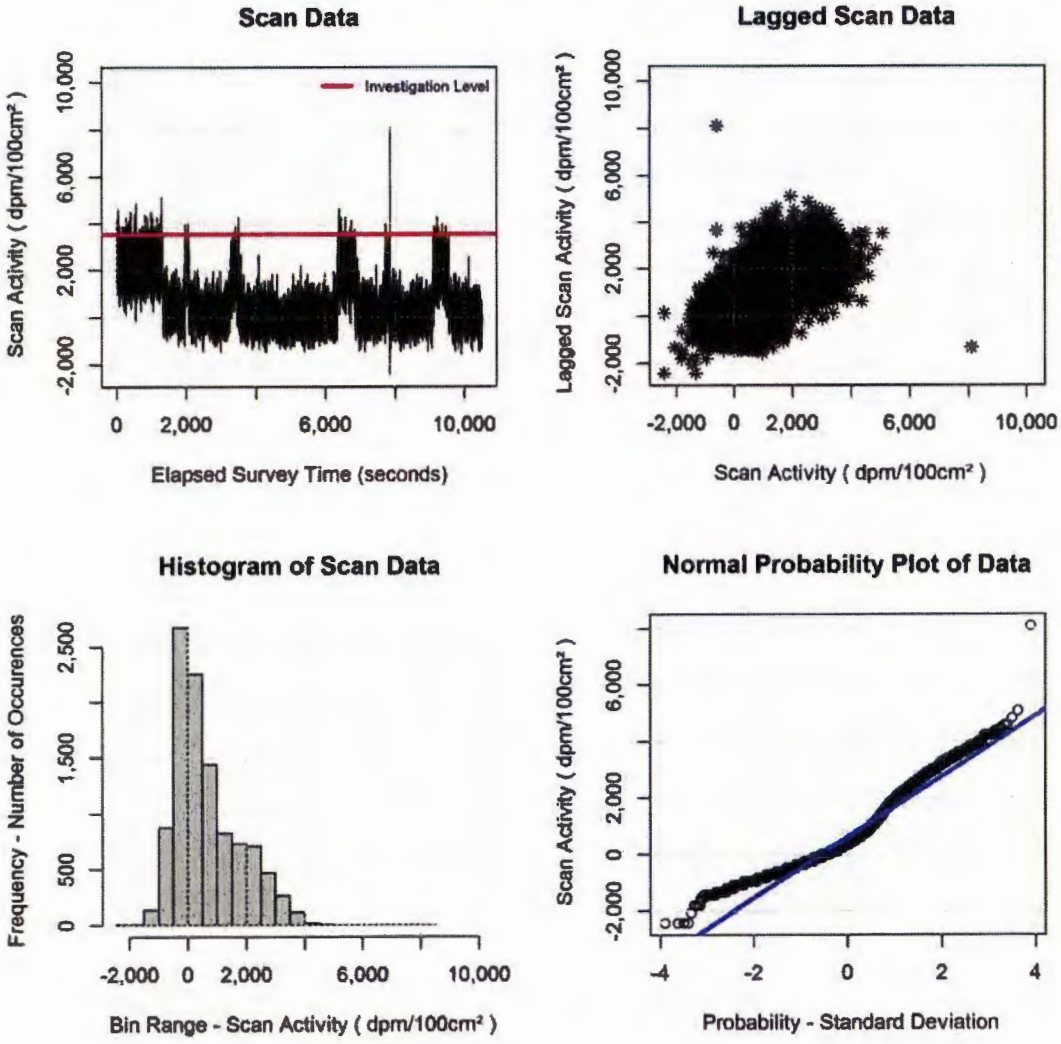
Histogram of Scan Data



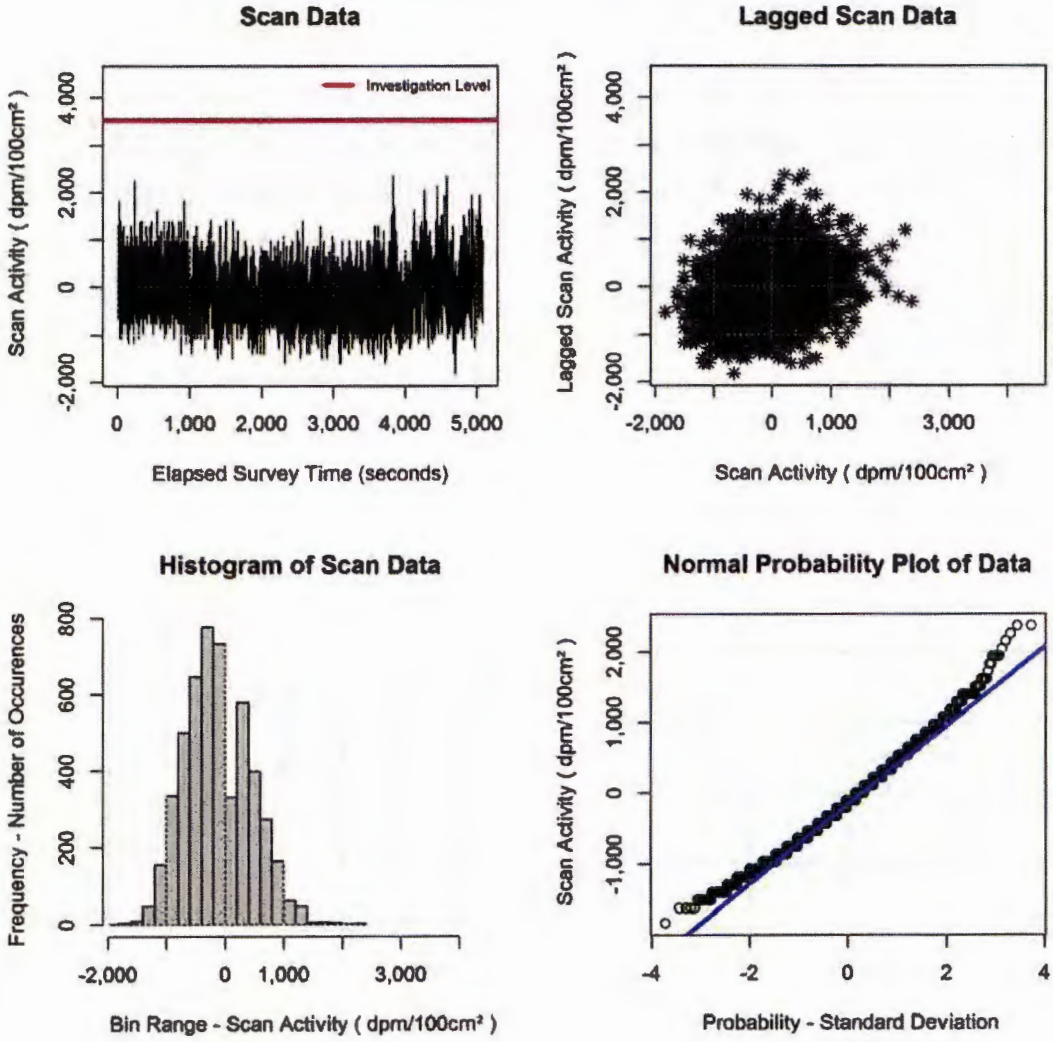
Normal Probability Plot of Data



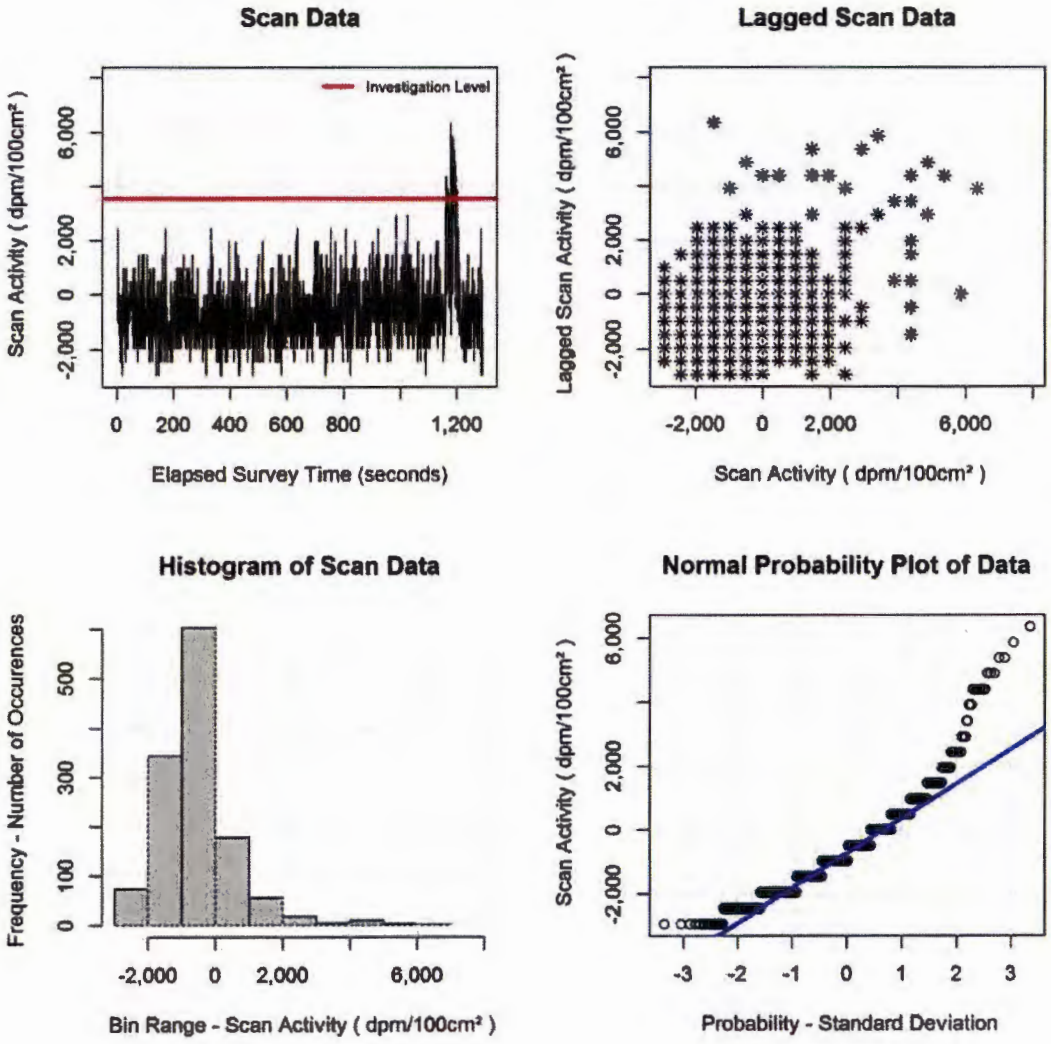
Survey Unit: BHB-1101 Probe: PR178300_Beta_Scans (43-37)



Survey Unit: BHB-1102 Probe: PR281040_Beta_Scans (43-37)

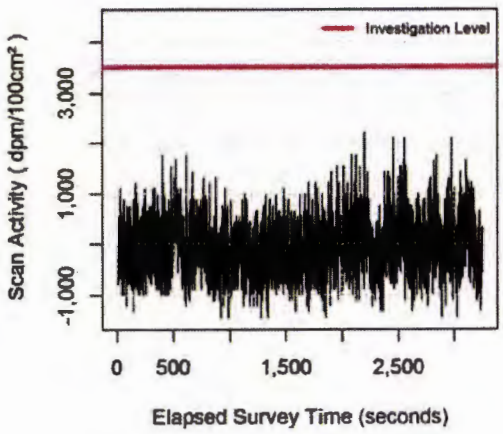


Survey Unit: BHB-1102 Probe: PR285701_Beta_Scans (43-68)

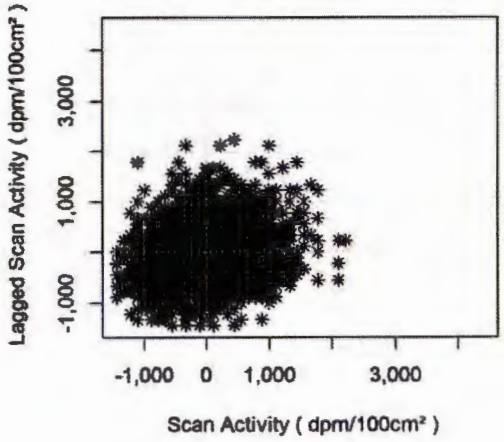


Survey Unit: BHB-1103 Probe: PR286832_Beta_Scans (43-37)

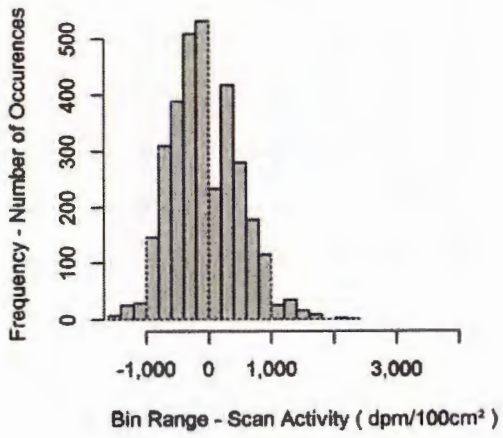
Scan Data



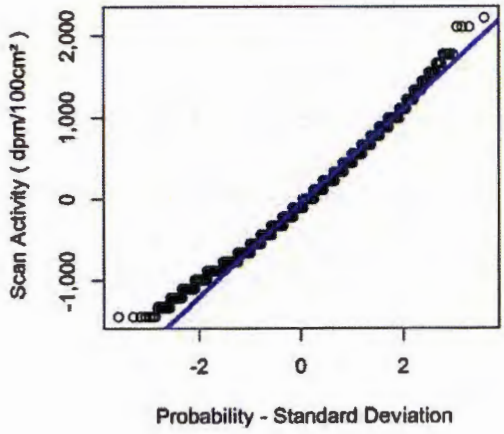
Lagged Scan Data



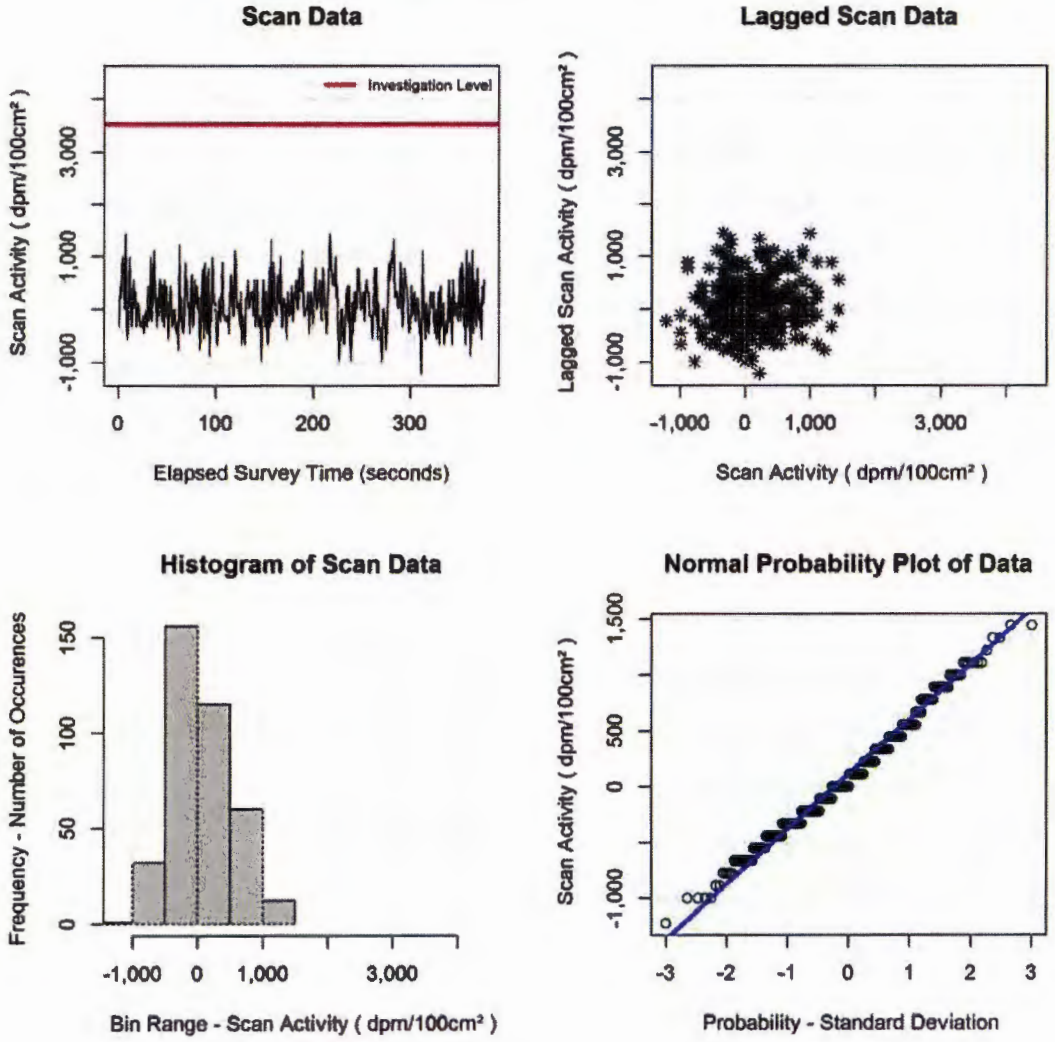
Histogram of Scan Data



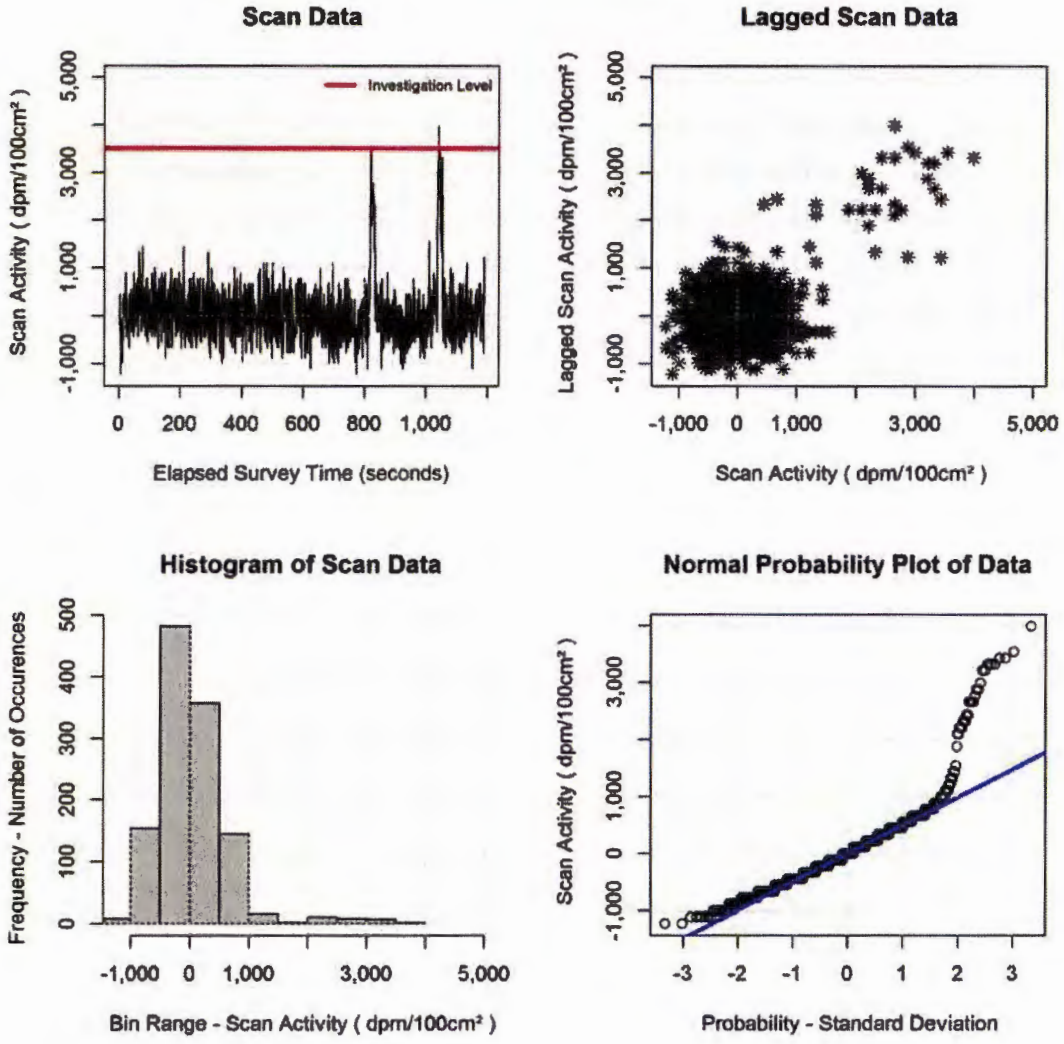
Normal Probability Plot of Data



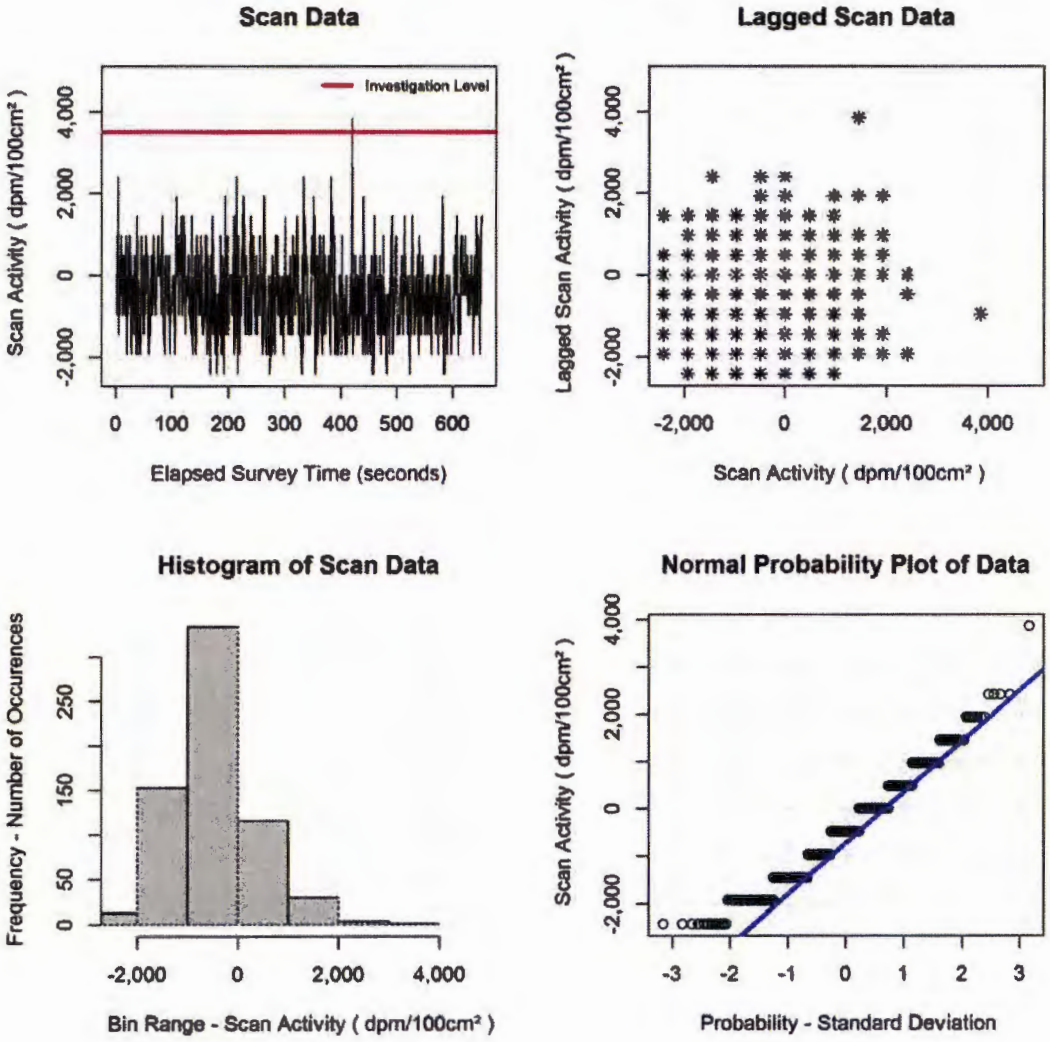
Survey Unit: BHB-1201 Probe: PR286832_Beta_Scans (43-37)



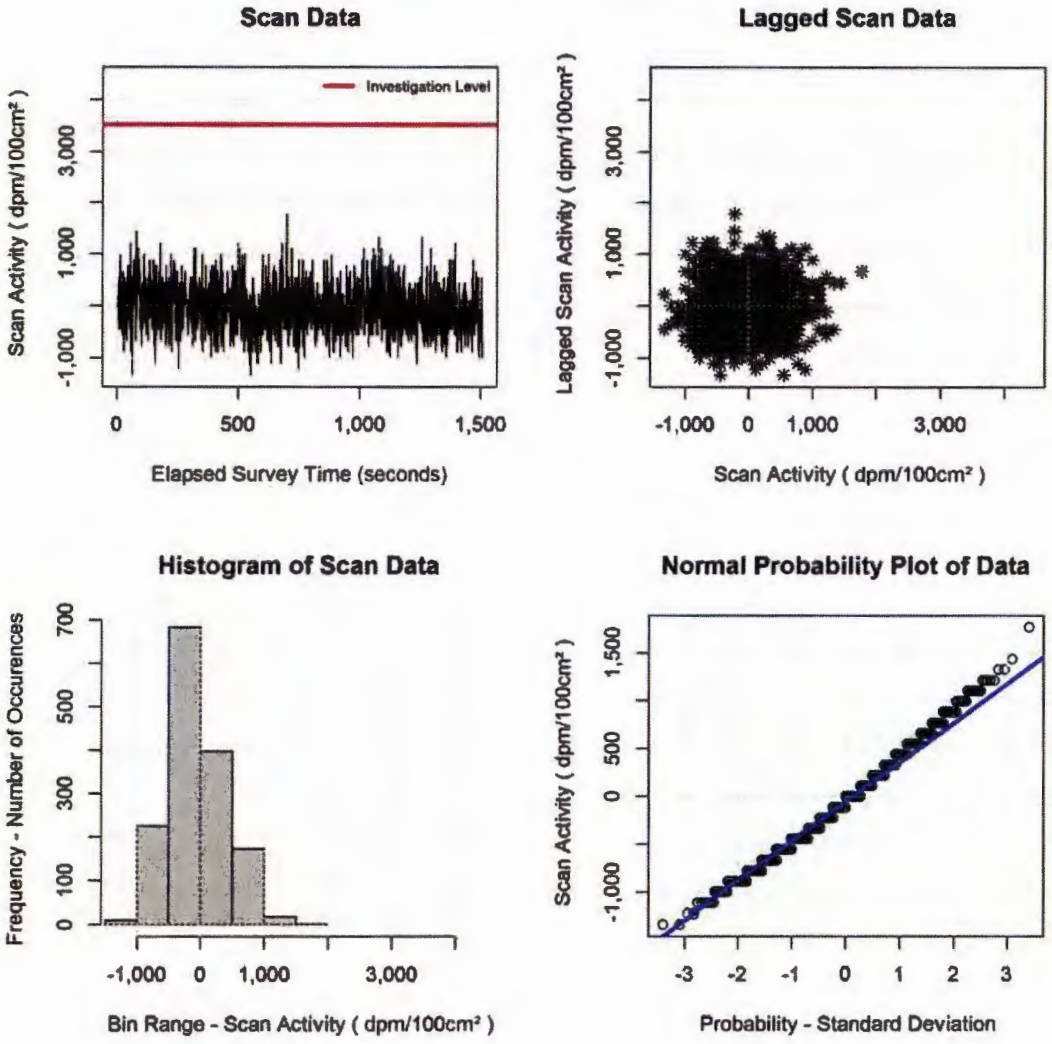
Survey Unit: BHB-1202 Probe: PR286832_Beta_Scans (43-37)



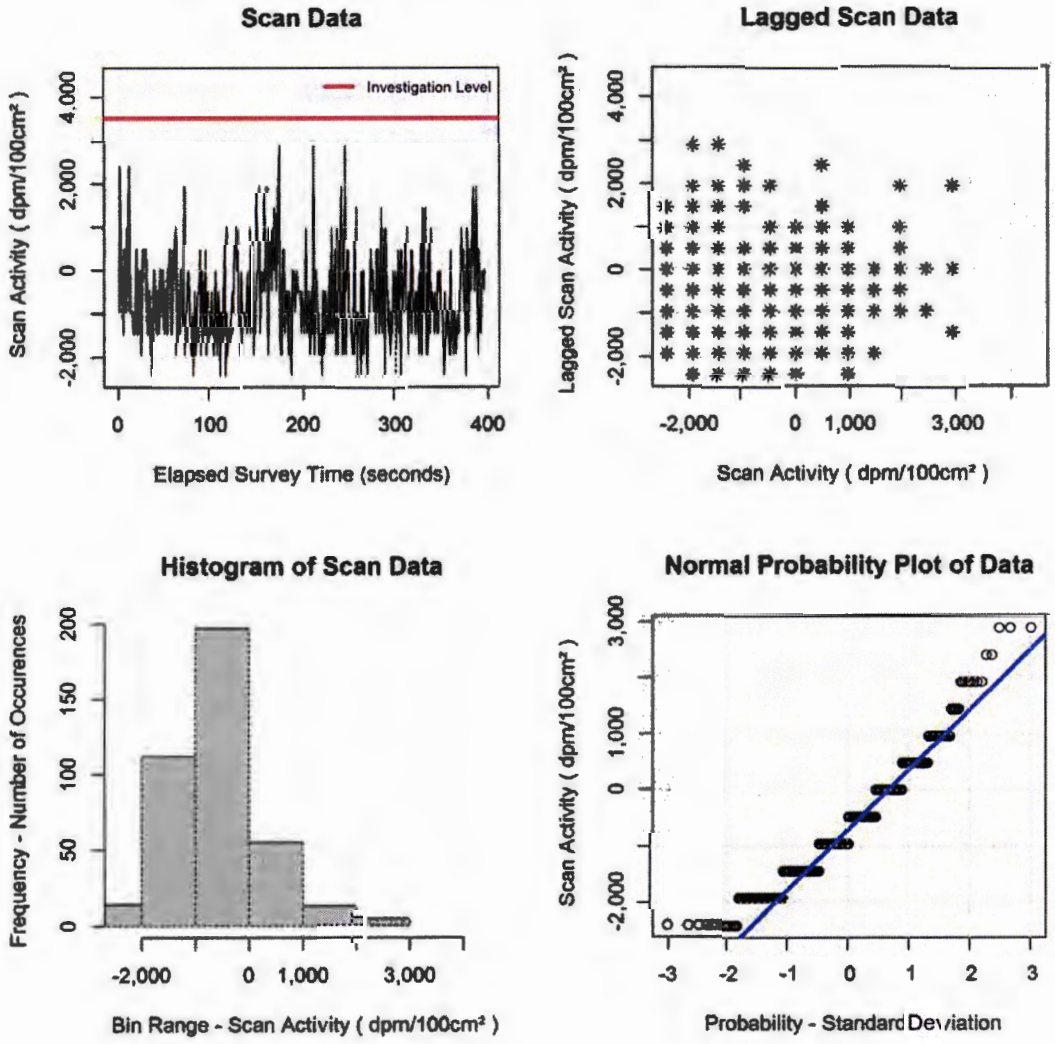
Survey Unit: BHB-1202 Probe: PR285699_Beta_Scans (43-68)



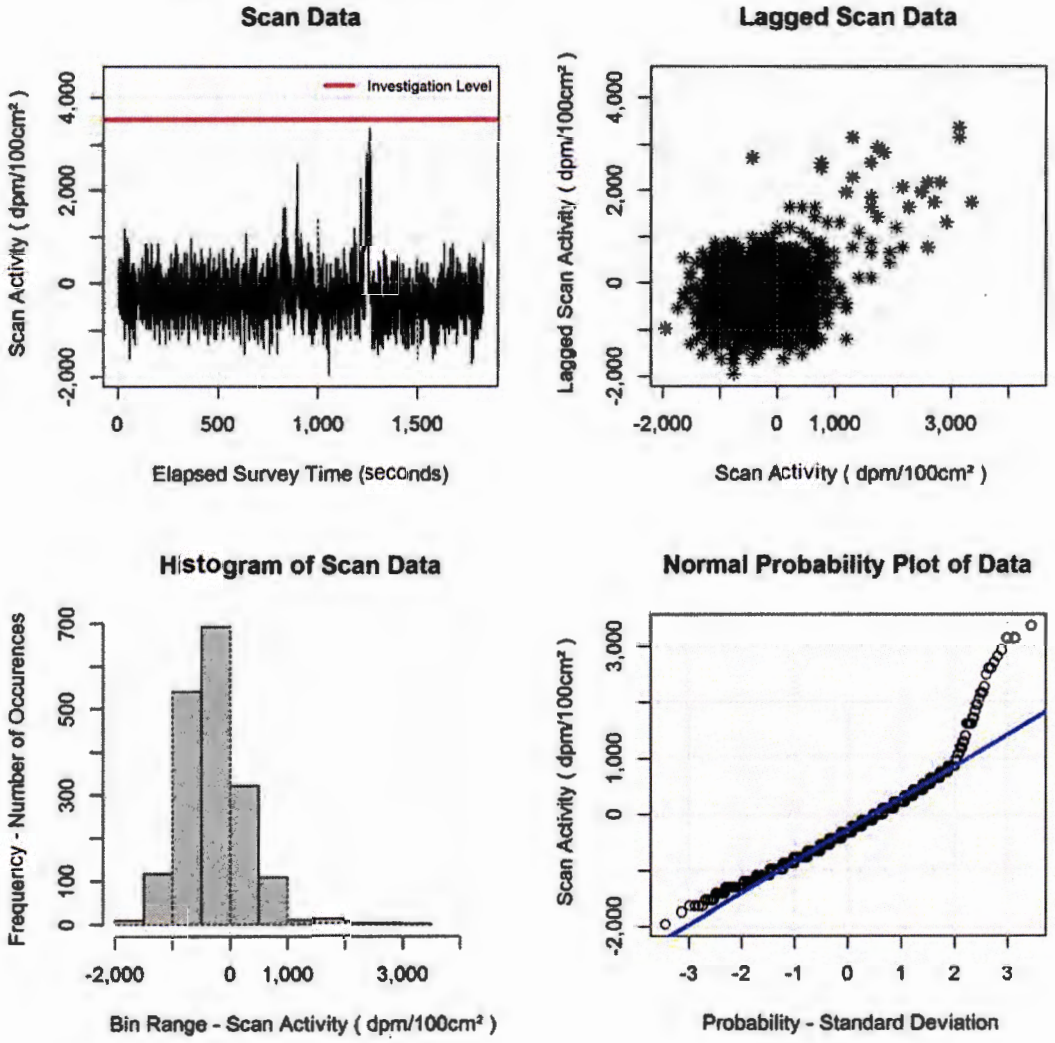
Survey Unit: BHB-1203 Probe: PR286832_Beta_Scans (43-37)



Survey Unit: BHB-1203 Probe: PR285699_Beta_Scans (43-68)

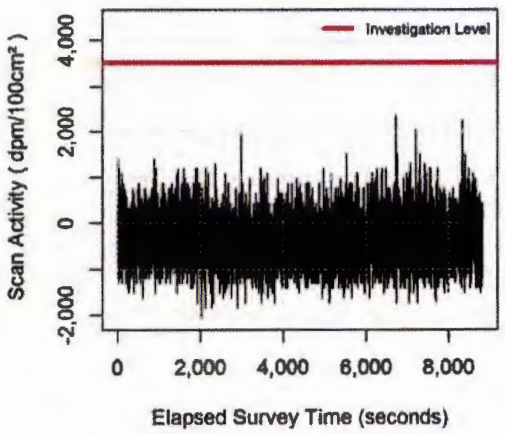


Survey Unit: BHB-1204 Probe: PR286836_Beta_Scans (43-37)

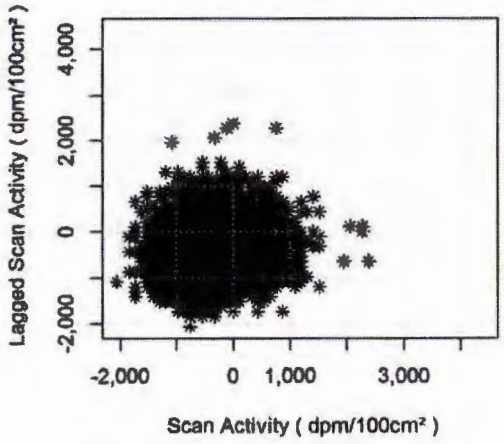


Survey Unit: BHB-1205 Probe: PR286836_Beta_Scans (43-37)

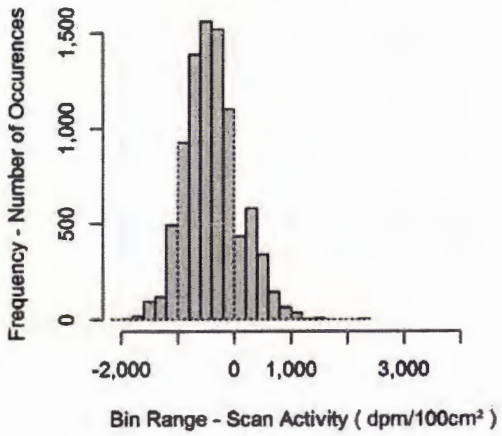
Scan Data



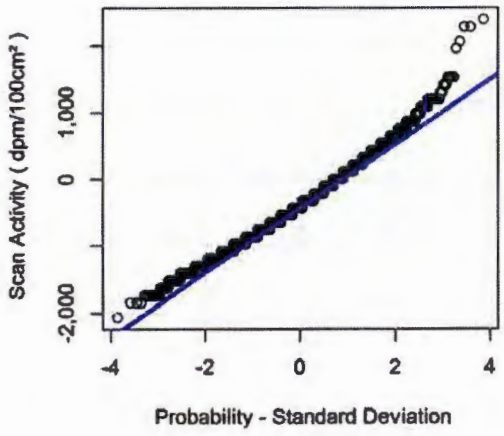
Lagged Scan Data



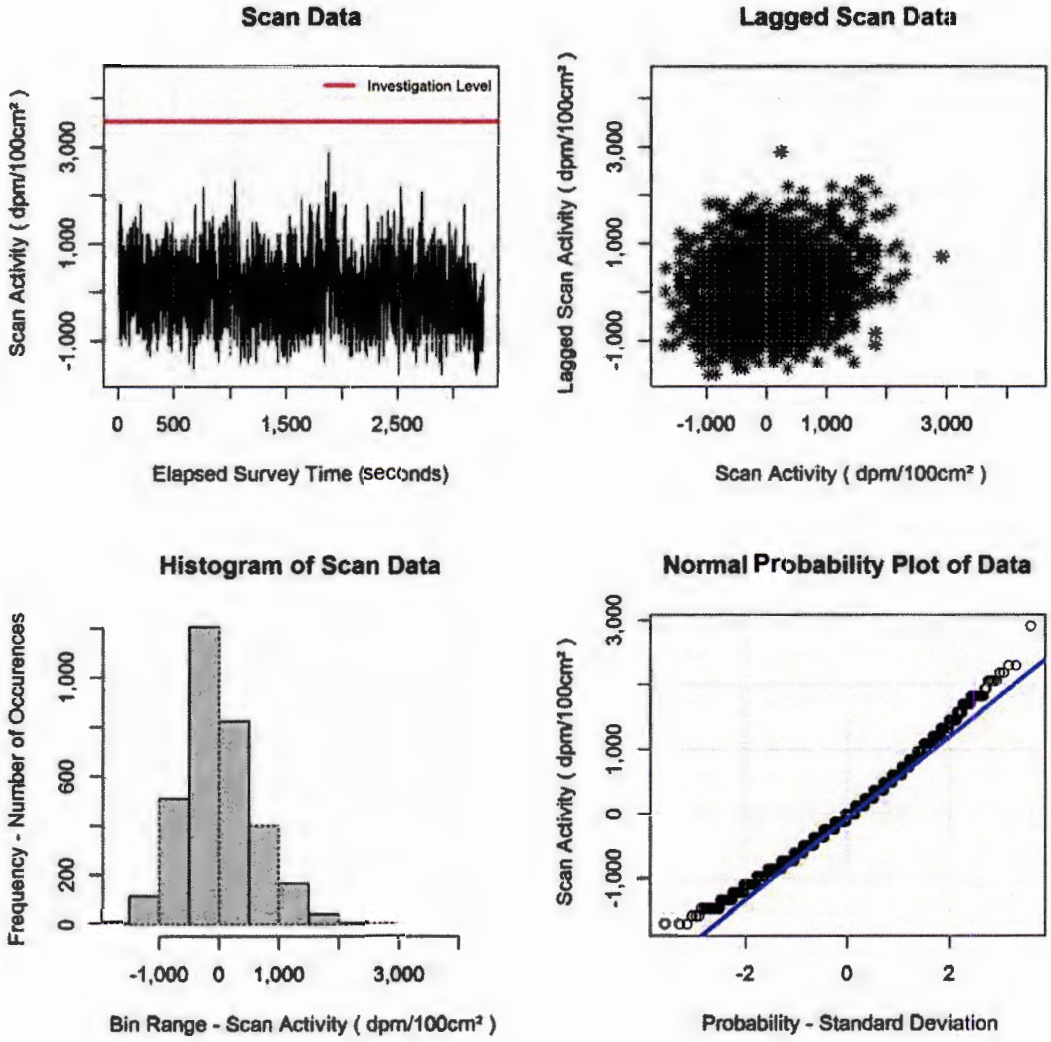
Histogram of Scan Data



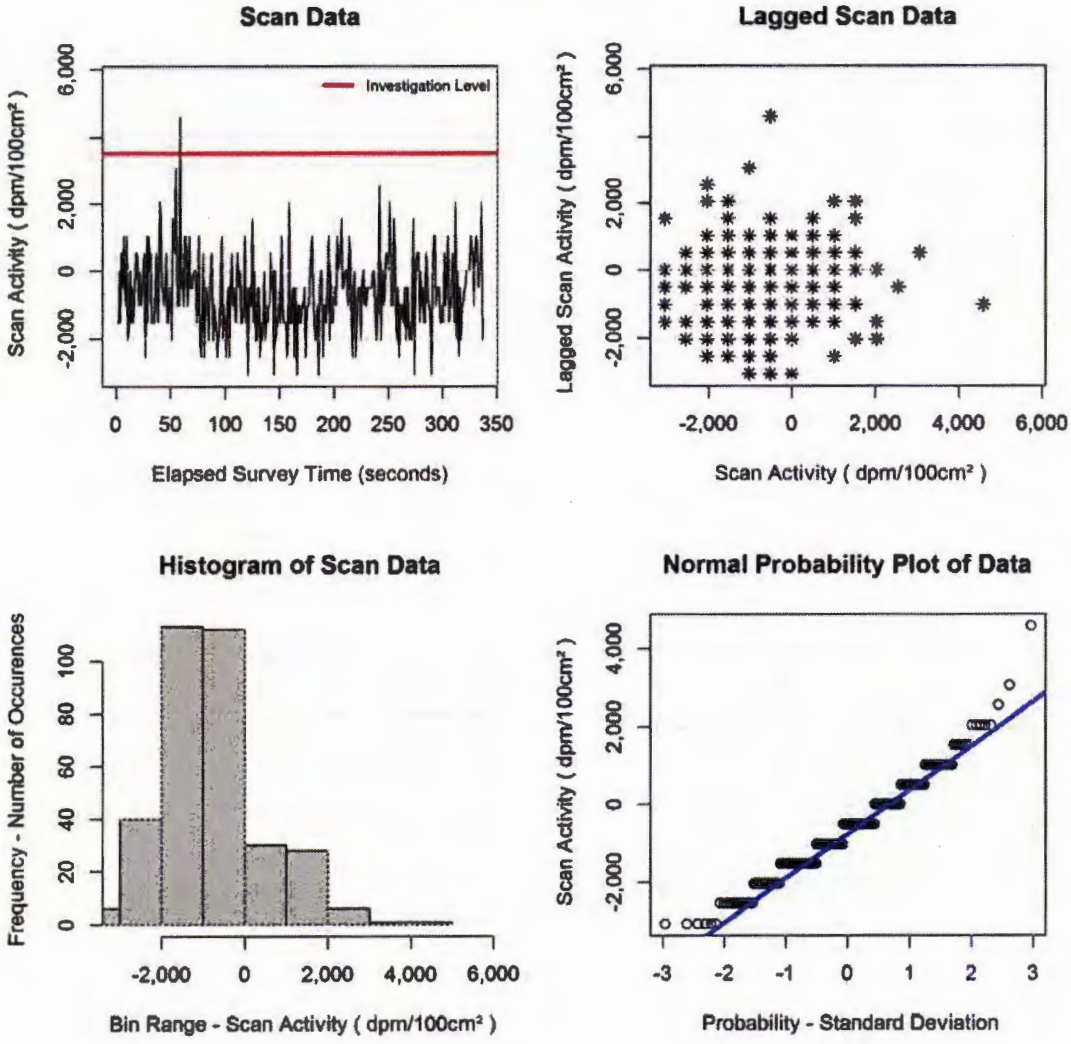
Normal Probability Plot of Data



Survey Unit: BHB-1205 Probe: PR178300_Beta_Scans (43-37)

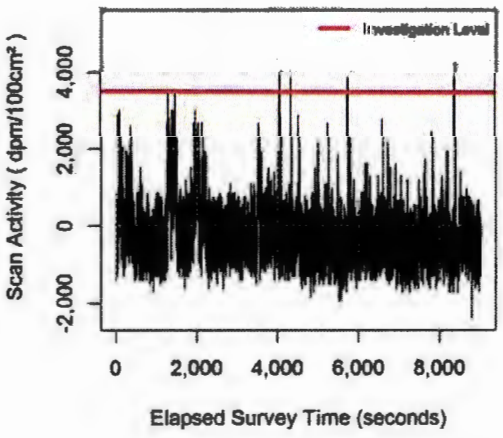


Survey Unit: BHB-1205 Probe: PR216394_Beta_Scans (43-68)

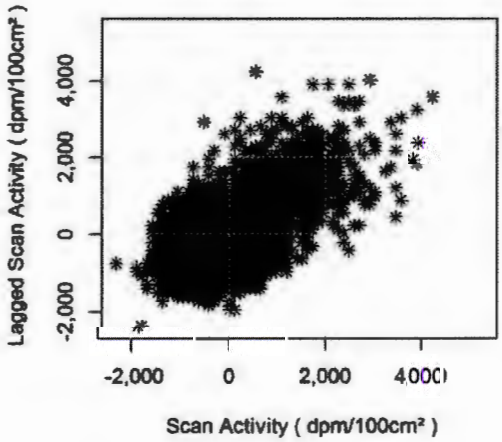


Survey Unit: BHB-1301 Probe: PR286836_Beta_Scans (43-37)

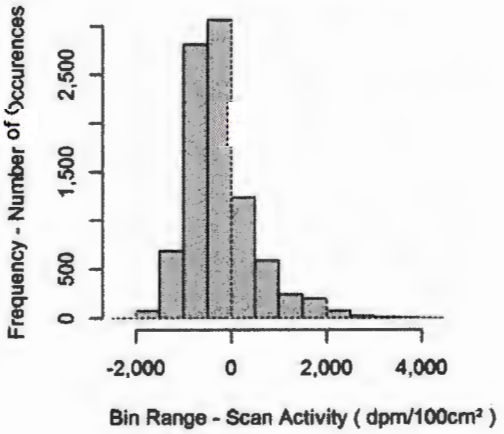
Scan Data



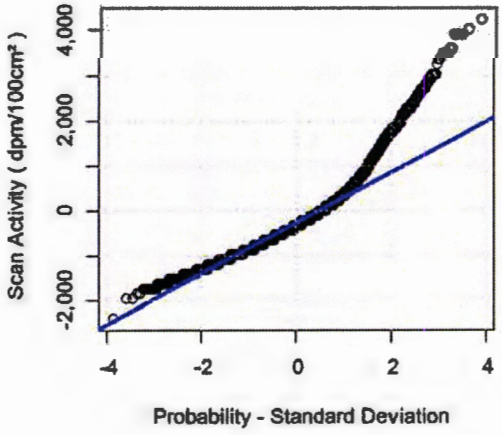
Lagged Scan Data



Histogram of Scan Data



Normal Probability Plot of Data



Survey Unit: BHB-1301 Probe: PR216394_Beta_Scans (43-68)

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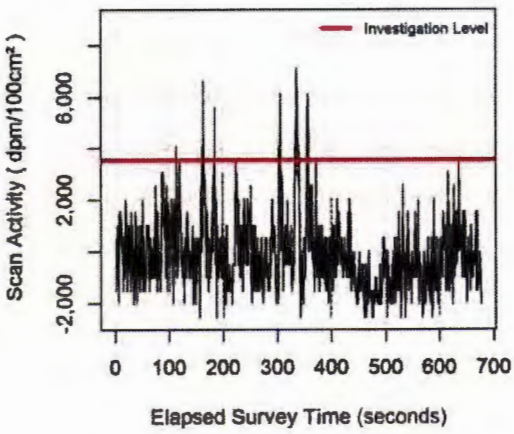
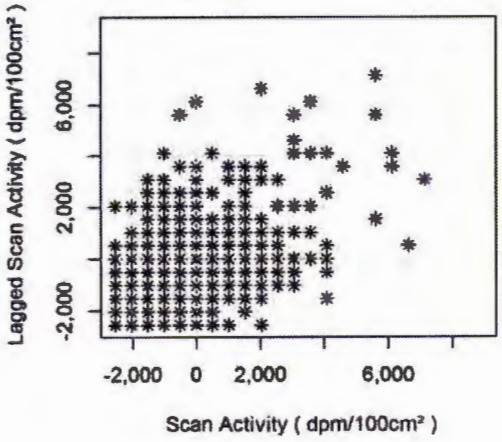
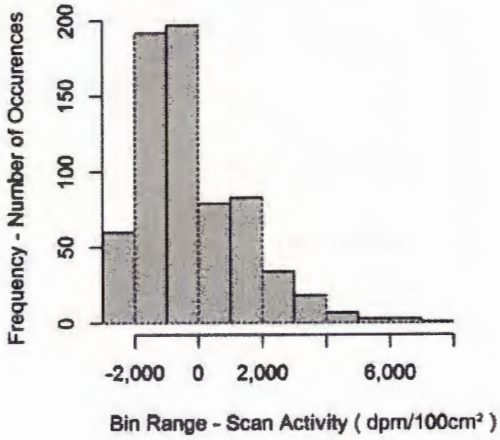


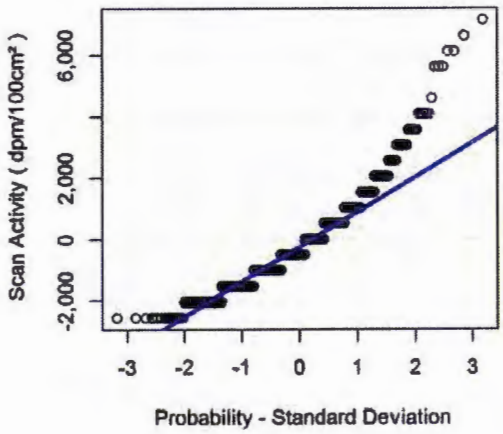
Lagged Scan Data



Histogram of Scan Data

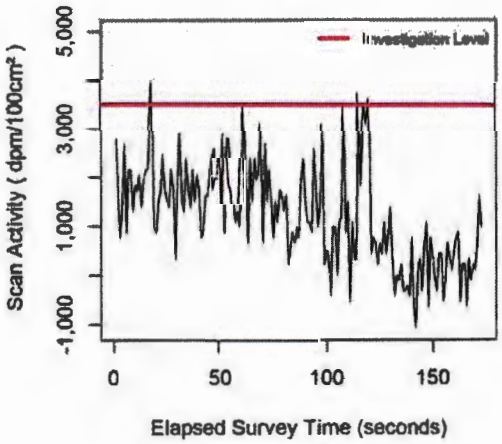


Normal Probability Plot of Data

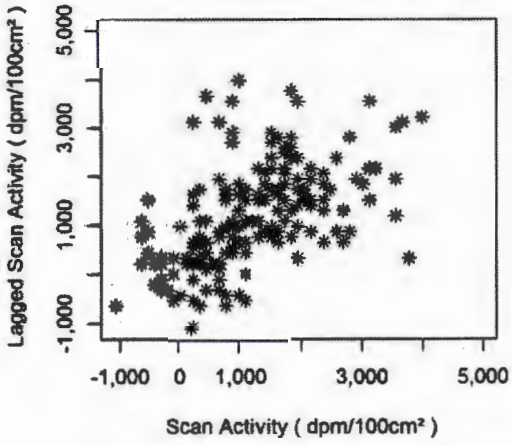


Survey Unit: BHB-1301 Probe: PR281040_Beta_Scans (43-37)

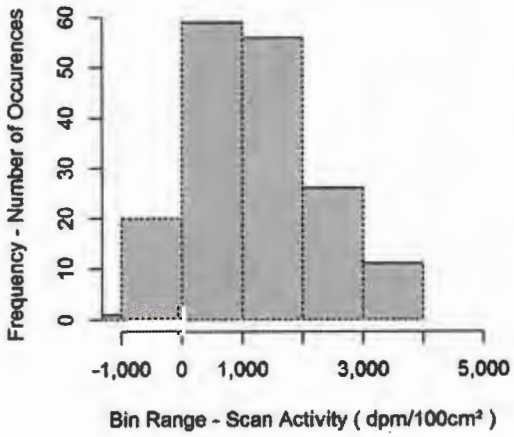
Scan Data



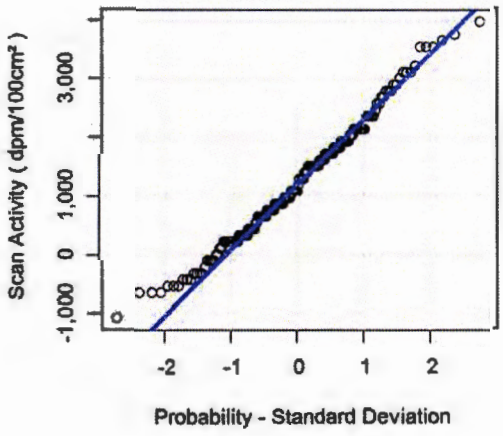
Lagged Scan Data



Histogram of Scan Data

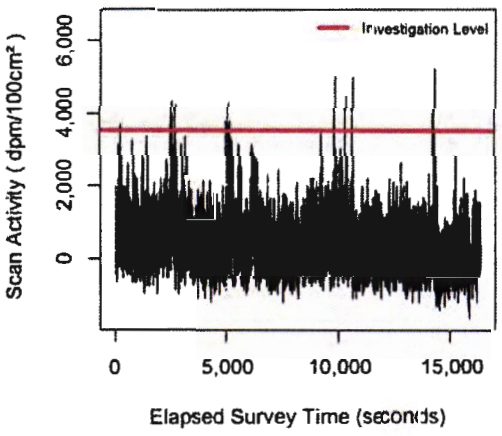


Normal Probability Plot of Data

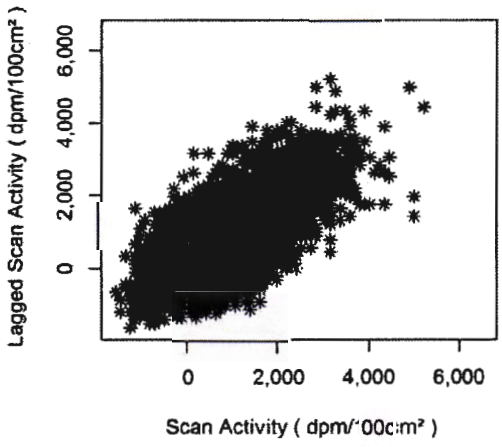


Survey Unit: BHB-1302 Probe: PR286836_Beta_Scans (43-37)

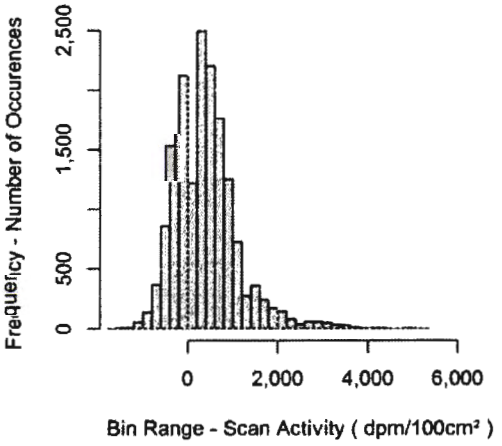
Scan Data



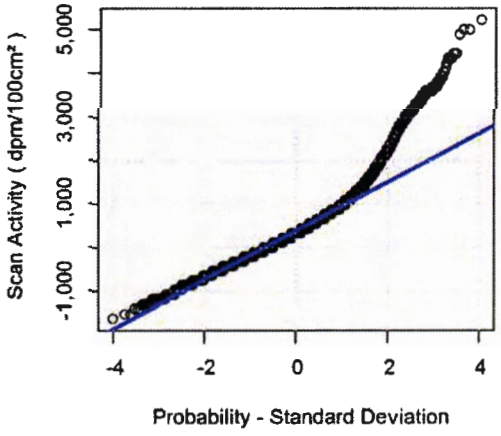
Lagged Scan Data



Histogram of Scan Data

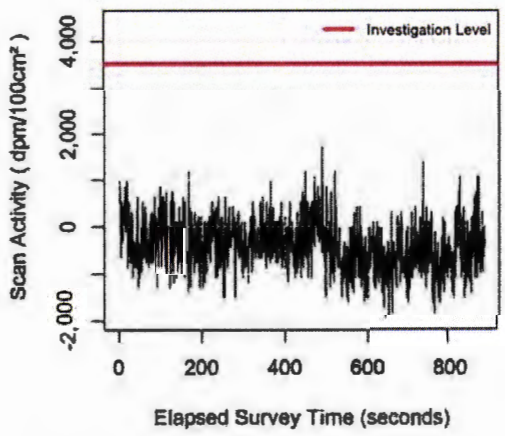


Normal Probability Plot of Data

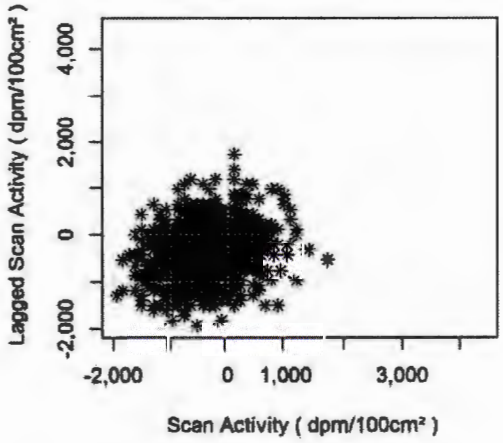


Survey Unit: BHB-1302 Probe: PR281040_Beta_Scans (43-37)

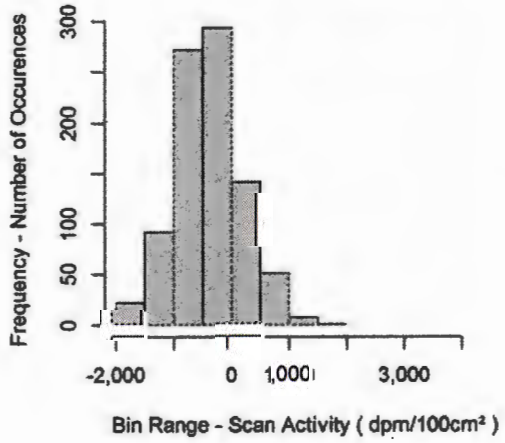
Scan Data



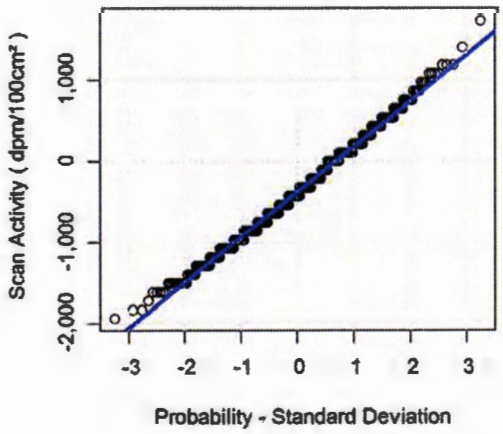
Lagged Scan Data



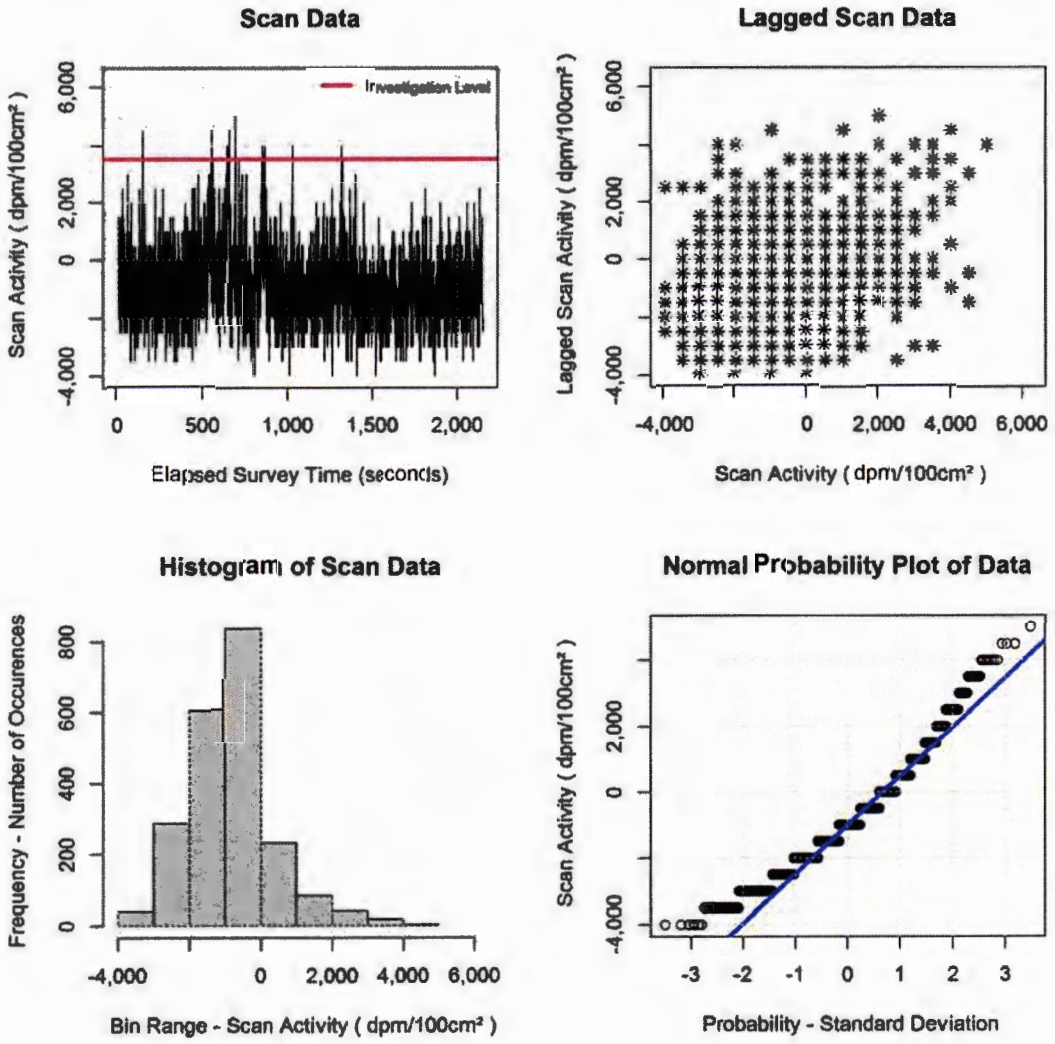
Histogram of Scan Data



Normal Probability Plot of Data

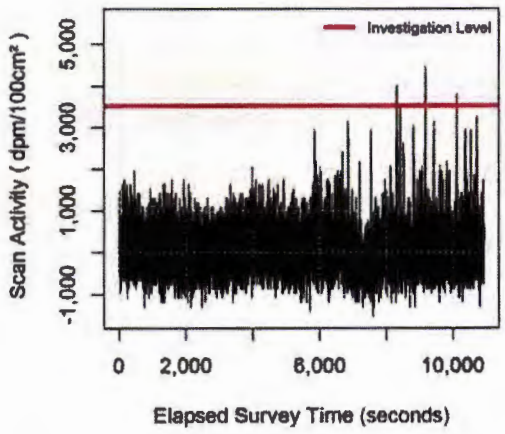


Survey Unit: BHB-1302 Probe: PR285700_Beta_Scans (43-68)

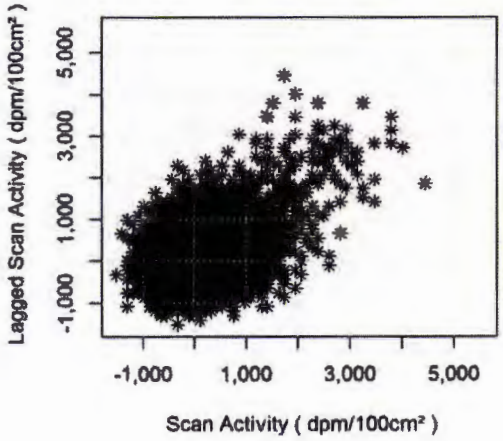


Survey Unit: BHB-1303 Probe: PR286836_Beta_Scans (43-37)

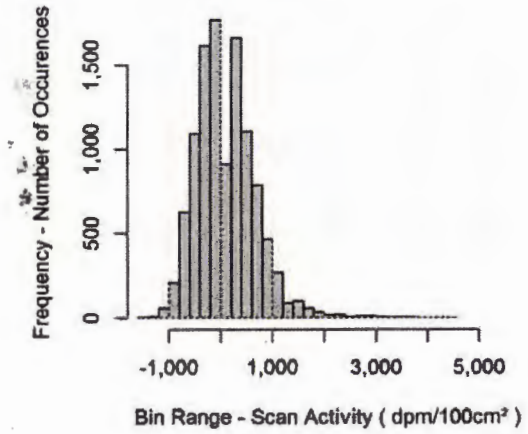
Scan Data



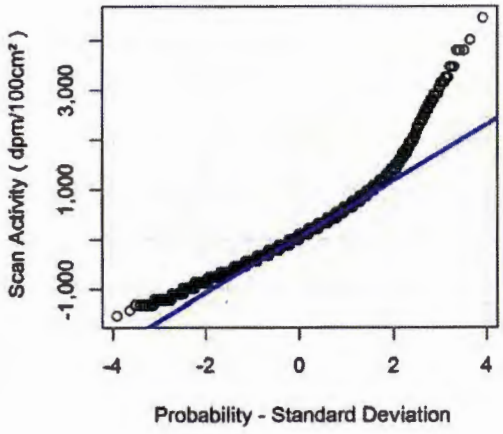
Lagged Scan Data



Histogram of Scan Data

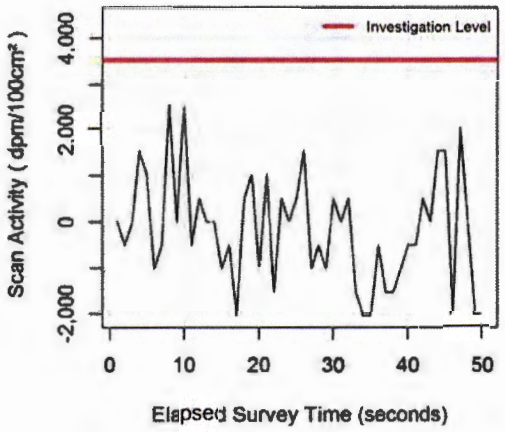


Normal Probability Plot of Data

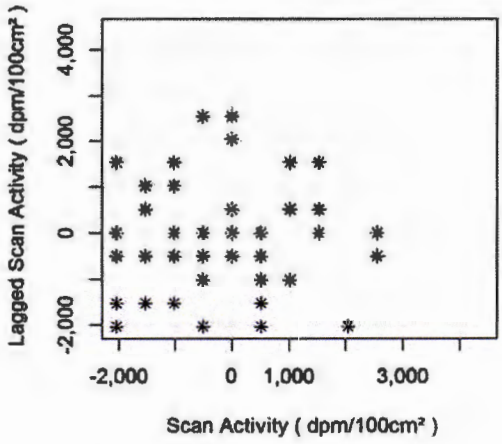


Survey Unit: BHB-2101 Probe: PR216394_Beta_Scans (43-68)

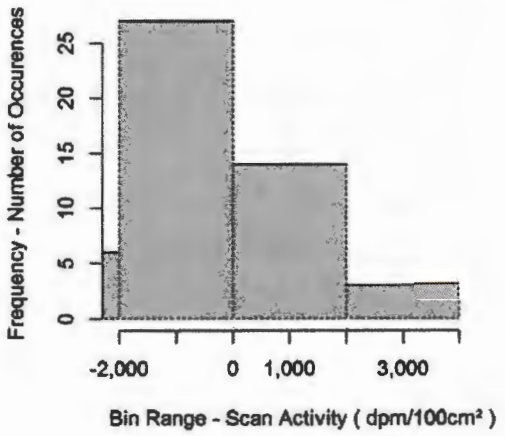
Scan Data



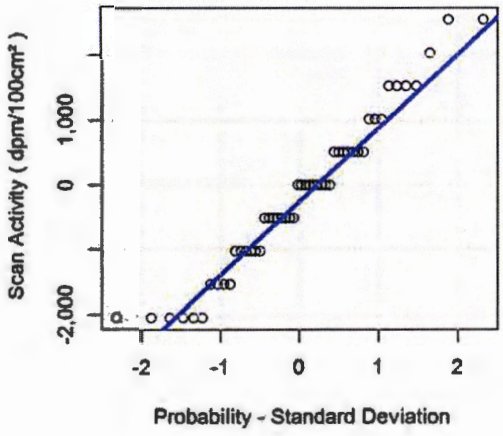
Lagged Scan Data



Histogram of Scan Data

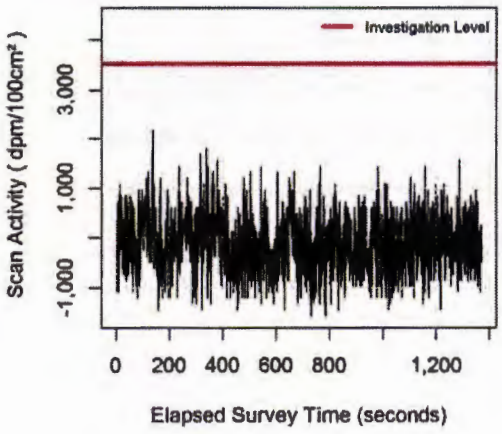


Normal Probability Plot of Data

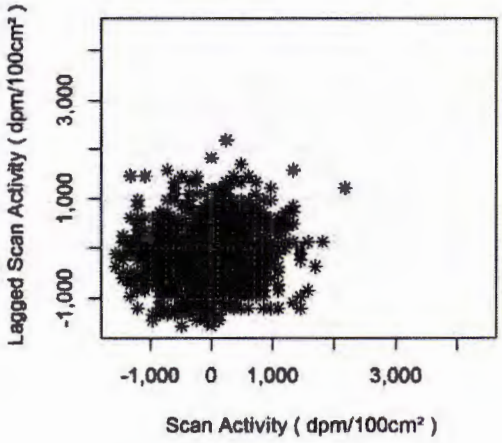


Survey Unit: BHB-2101 Probe: PR178300_Beta_Scans (43-37)

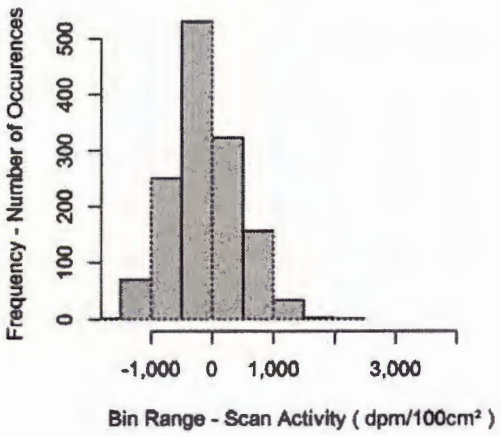
Scan Data



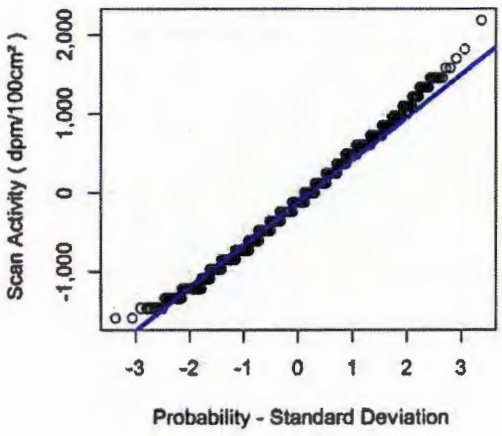
Lagged Scan Data



Histogram of Scan Data

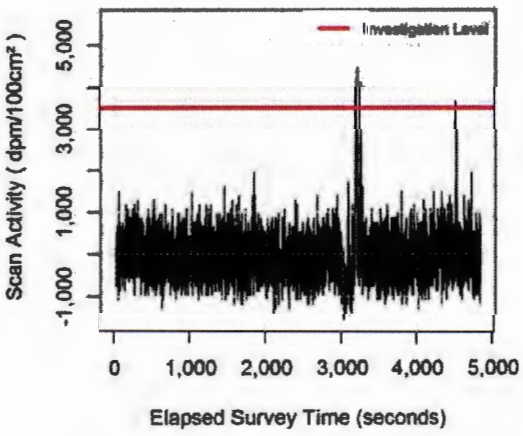


Normal Probability Plot of Data

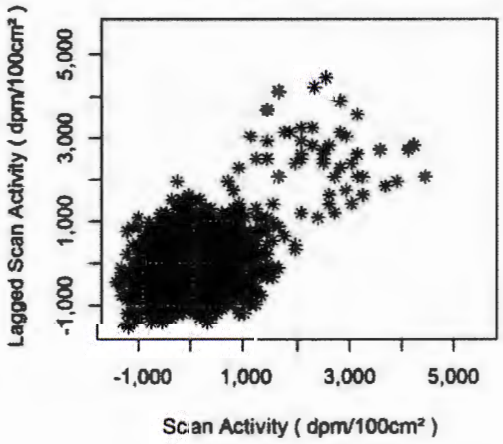


Survey Unit: BHB-2201 Probe: PR286836_Beta_Scans (43-37)

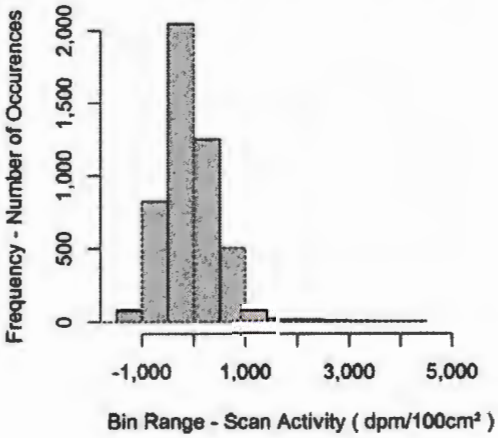
Scan Data



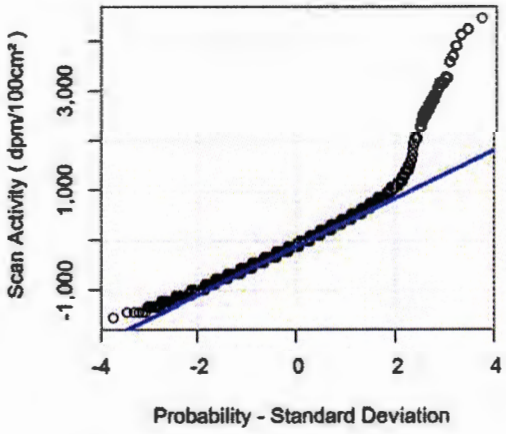
Lagged Scan Data



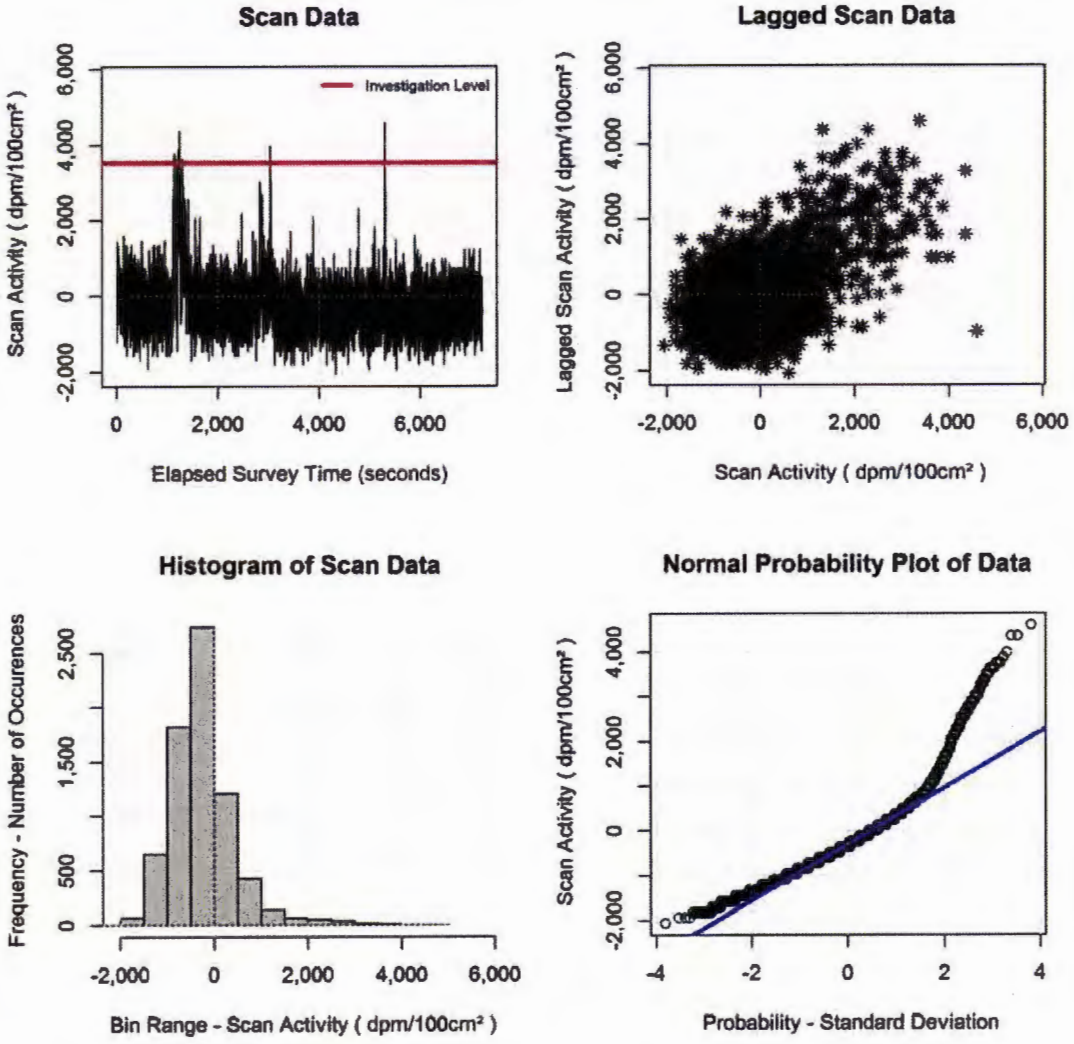
Histogram of Scan Data



Normal Probability Plot of Data

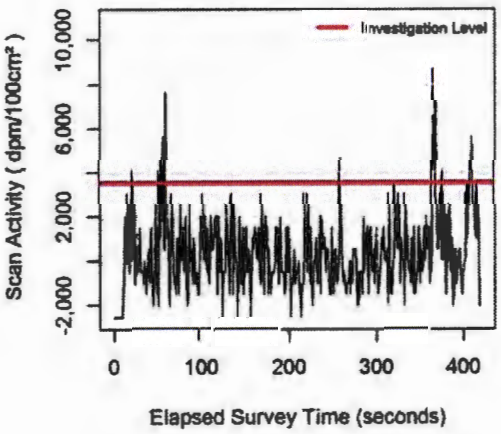


Survey Unit: BHB-2301 Probe: PR178300_Beta_Scans (43-37)

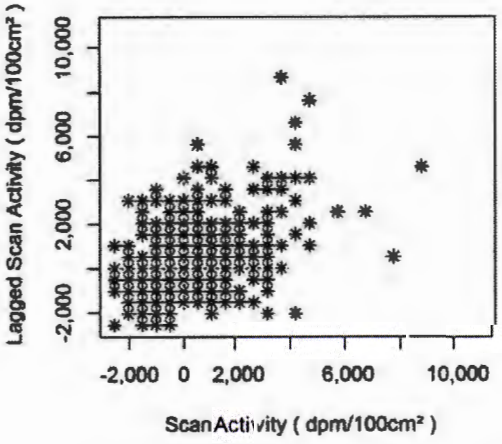


Survey Unit: BHB-2301 Probe: PR216394_Beta_Scans (43-68)

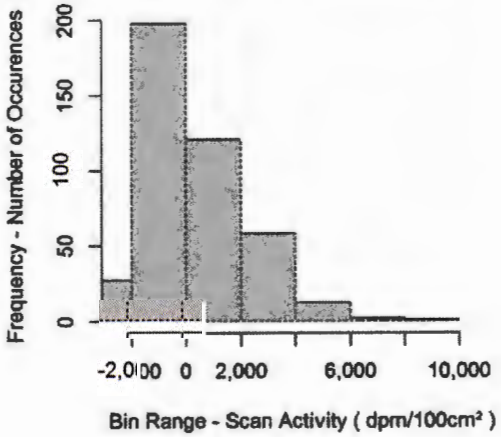
Scan Data



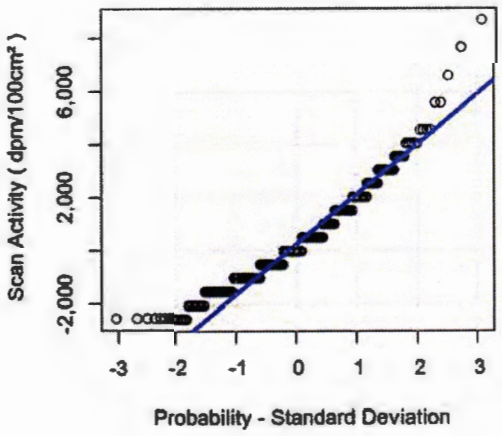
Lagged Scan Data



Histogram of Scan Data

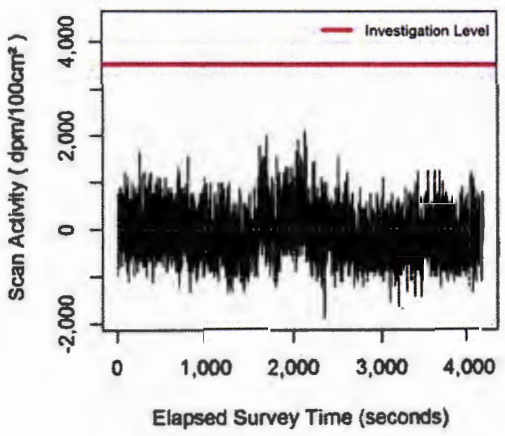


Normal Probability Plot of Data

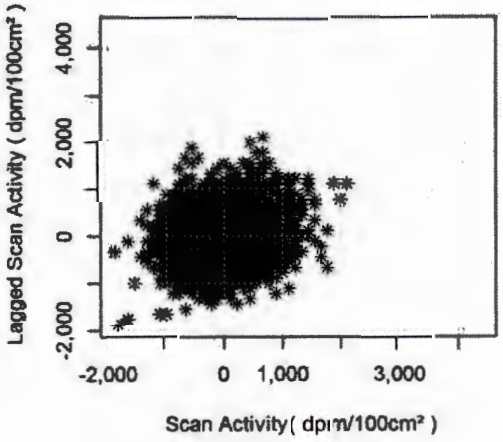


Survey Unit: BHB-3101 Probe: PR286832_Beta_Scans (43-37)

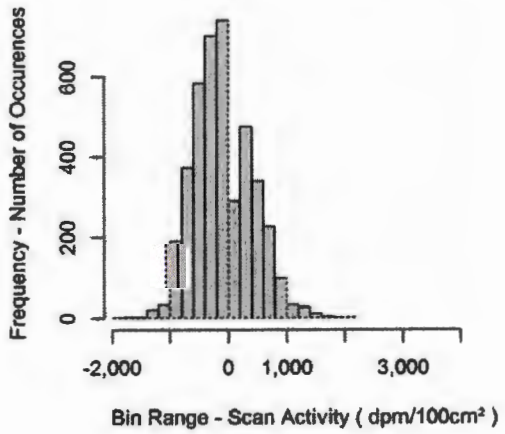
Scan Data



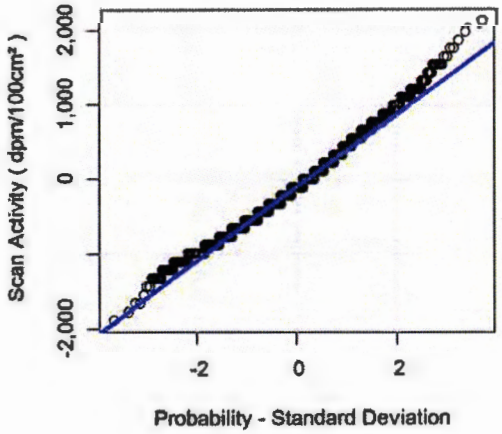
Lagged Scan Data



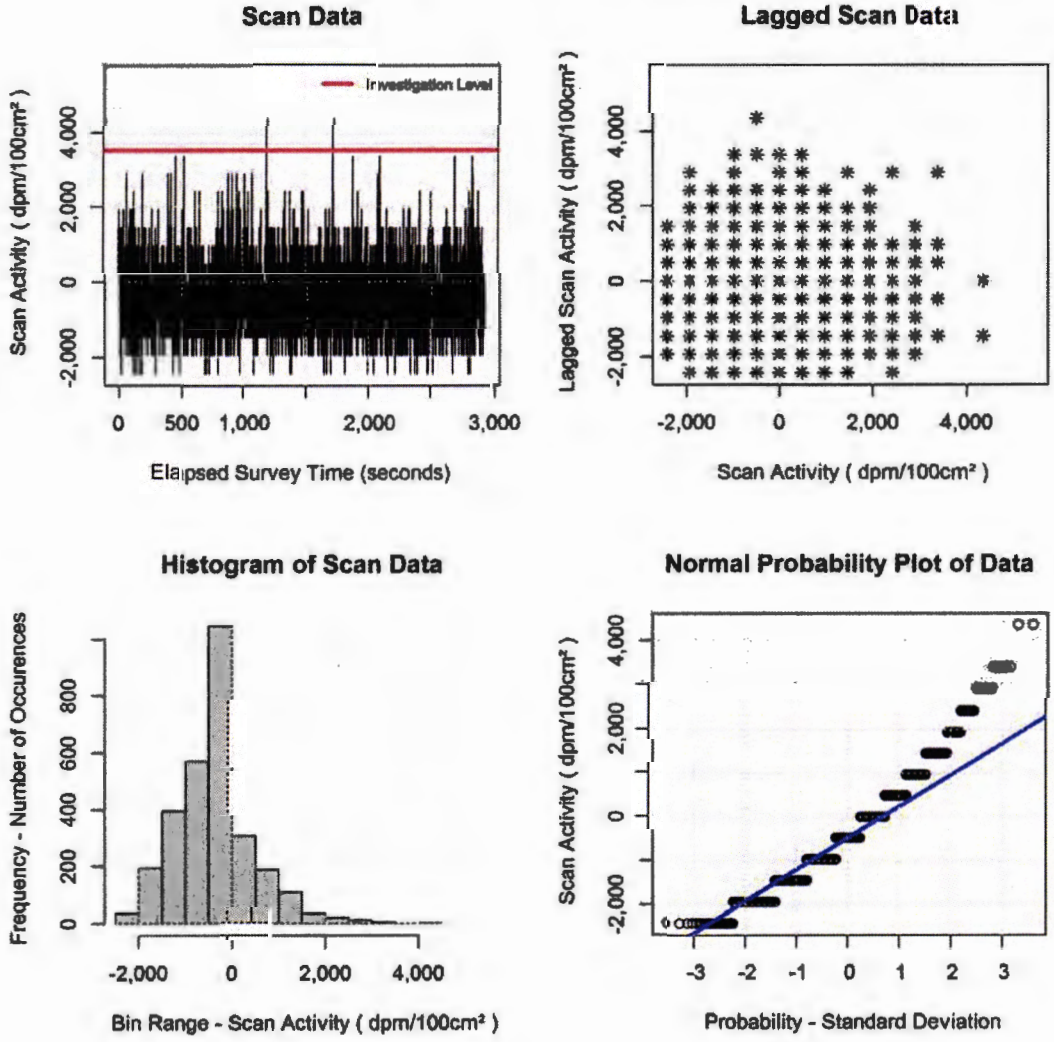
Histogram of Scan Data



Normal Probability Plot of Data

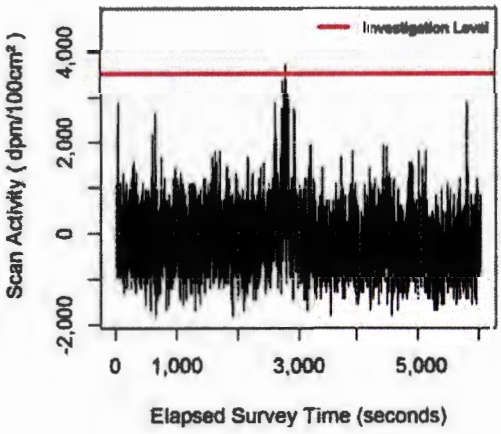


Survey Unit: BHB-3101 Probe: PR285699_Beta_Scans (43-68)

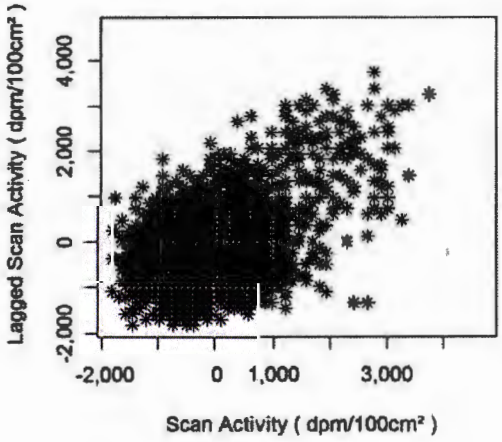


Survey Unit: BHB-3301 Probe: PR178300_Beta_Scans (43-37)

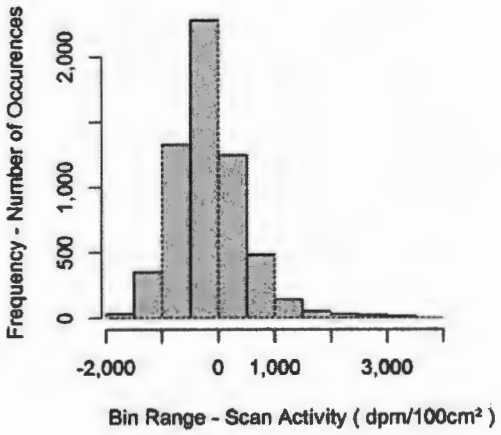
Scan Data



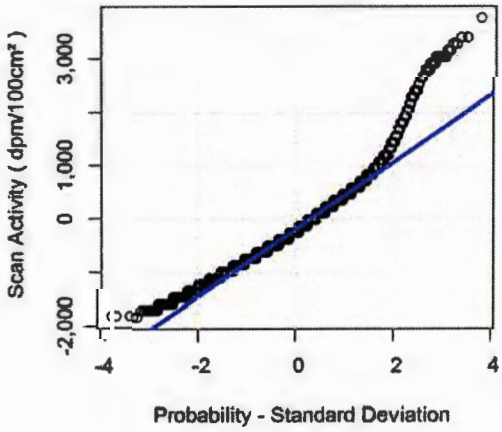
Lagged Scan Data



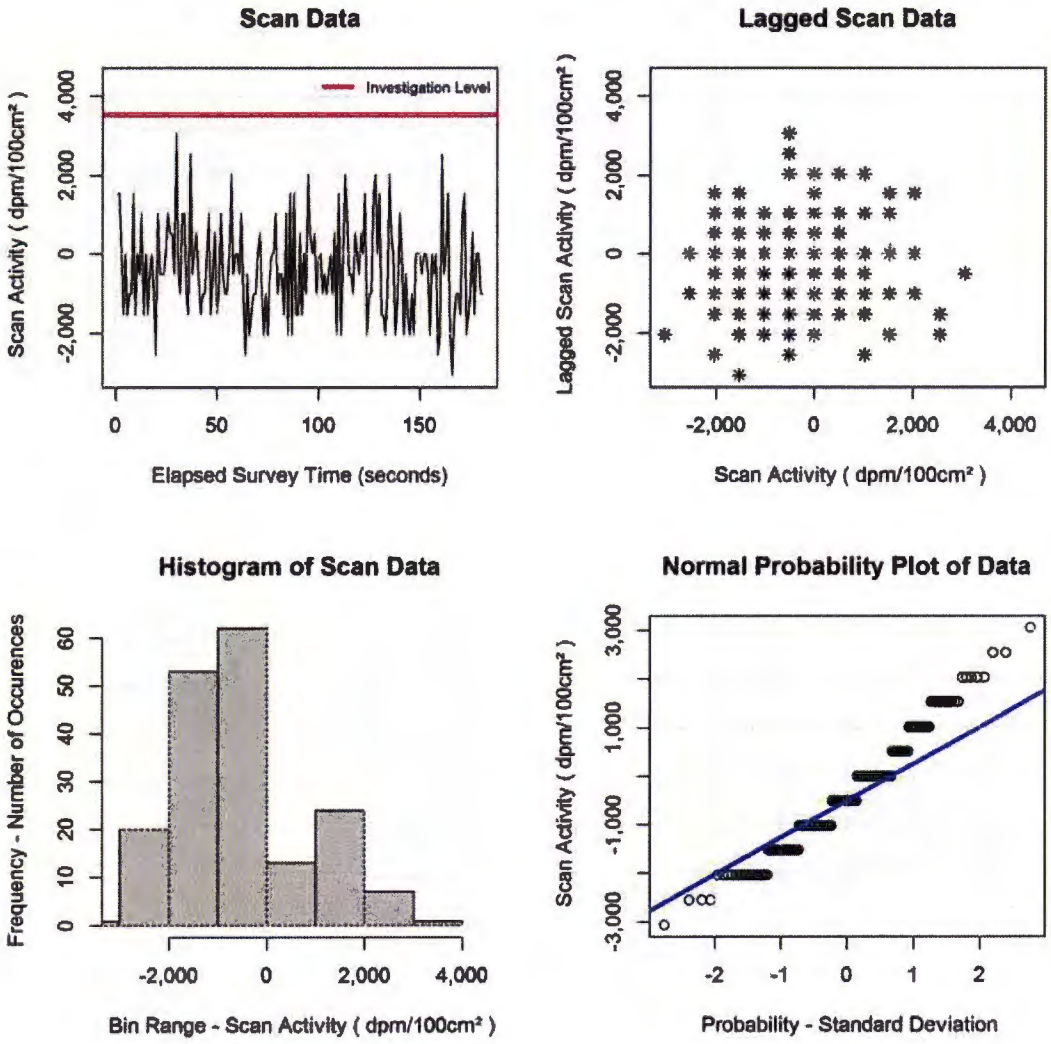
Histogram of Scan Data



Normal Probability Plot of Data

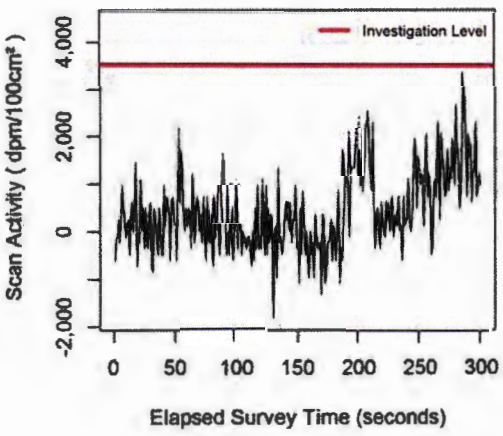


Survey Unit: BHB-3301 Probe: PR216394_Beta_Scans (43-68)

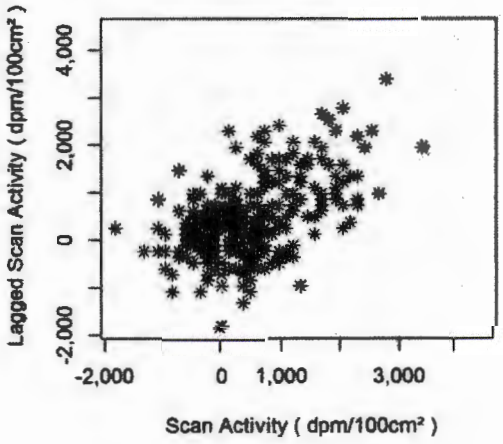


Survey Unit: BHB-4301 Probe: PR178300_Beta_Scans (43-37)

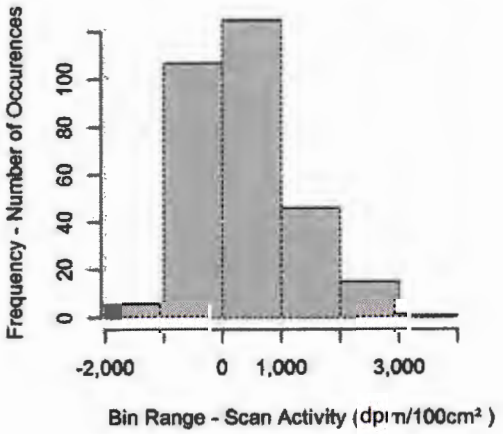
Scan Data



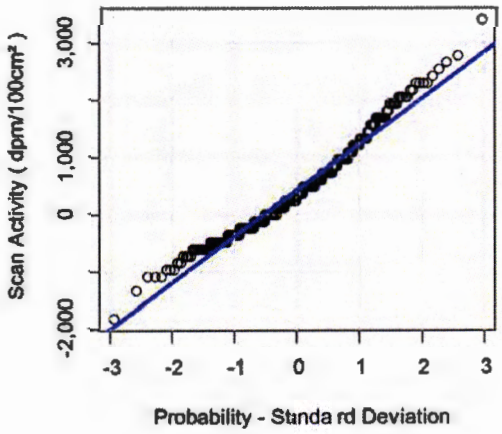
Lagged Scan Data



Histogram of Scan Data



Normal Probability Plot of Data



Appendix F
Structural Surfaces Final Status Survey Results

what is the investigation Level?

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-B101	Type of Survey: Final Status	Surveyor 1: Stefan Herold	Surveyor 2:	Date: 12/13/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 267113 43-37 / PR286836	SAT	6/30/2017	Alpha	Total	5	33.63%	0.25	8.41%	0.1	1	584	111	407	27%
2241-3 / 267113 43-37 / PR286836	SAT	6/30/2017	Beta	Total	970	37.88%	0.25	9.47%	0.1	0.1	584	883	7,050	13%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.1	36.49%	1	36.49%	1	10	100	18	40	45%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	60.4	23.92%	1	23.92%	1	10	100	125	705	18%

Comments:
Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-B101-W1-C-001	1	5	10	<MDC	0.03	109	120	217	<MDC	0.03	0.06	3	1.9	5	<MDC	0.13	67	6.6	28	<MDC	0.04	0.17	35	2	0
BHB-B101-W1-C-002	0	-5	-10	<MDC	0.00	130	330	597	<MDC	0.08	0.08	1	-0.1	0	<MDC	0.00	53	-7.4	-31	<MDC	0.00	0.00	**38**	4	1
BHB-B101-W1-B-003	3	25	51	<MDC	0.13	117	200	362	<MDC	0.05	0.18	0	-1.1	-3	<MDC	0.00	42	-18.4	-77	<MDC	0.00	0.00	28	6	0
BHB-B101-F1-V-004	1	5	10	<MDC	0.03	138	410	741	<MDC	0.11	0.13	2	0.9	2	<MDC	0.06	69	8.6	36	<MDC	0.05	0.11	33	0	1
BHB-B101-F1-V-005	1	5	10	<MDC	0.03	129	320	579	<MDC	0.08	0.11	1	-0.1	0	<MDC	0.00	61	0.6	3	<MDC	0.00	0.00	**126**	5	0
BHB-B101-W1-B-006	1	5	10	<MDC	0.03	125	280	506	<MDC	0.07	0.10	3	1.9	5	<MDC	0.13	58	-2.4	-10	<MDC	0.00	0.13	19	2	0
BHB-B101-W1-B-007	2	15	31	<MDC	0.08	135	380	687	<MDC	0.10	0.17	3	1.9	5	<MDC	0.13	54	-6.4	-27	<MDC	0.00	0.13	34	10	0
BHB-B101-F1-V-008	2	15	31	<MDC	0.08	147	500	**904**		0.13	0.20	1	-0.1	0	<MDC	0.00	55	-5.4	-23	<MDC	0.00	0.00	26	0	0
BHB-B101-W1-B-009	5	45	92	<MDC	0.23	113	160	289	<MDC	0.04	0.27	0	-1.1	-3	<MDC	0.00	54	-6.4	-27	<MDC	0.00	0.00	32	8	0
BHB-B101-W1-B-010	2	15	31	<MDC	0.08	119	220	398	<MDC	0.06	0.13	0	-1.1	-3	<MDC	0.00	55	-5.4	-23	<MDC	0.00	0.00	26	4	0
BHB-B101-B1-M-011	2	15	31	<MDC	0.08	127	300	542	<MDC	0.08	0.15	1	-0.1	0	<MDC	0.00	62	1.6	7	<MDC	0.01	0.01	30	5	1
BHB-B101-W1-B-012	3	25	51	<MDC	0.13	123	260	470	<MDC	0.07	0.19	0	-1.1	-3	<MDC	0.00	51	-9.4	-39	<MDC	0.00	0.00	**36**	8	0
Count	---	---	12	---	---	---	---	12	---	---	12	---	---	12	---	---	---	---	12	---	---	12	12	12	12
Min	---	---	-10	---	---	---	---	217	---	---	0.06	---	---	-3	---	---	---	---	-77	---	---	0.00	19	0	0
Max	---	---	92	---	---	---	---	904	---	---	0.27	---	---	5	---	---	---	---	36	---	---	0.17	126	10	1
Median	---	---	31	---	---	---	---	524	---	---	0.14	---	---	0	---	---	---	---	-23	---	---	0.00	33	5	0
Mean	---	---	29	---	---	---	---	524	---	---	0.15	---	---	0	---	---	---	---	-15	---	---	0.05	39	5	0
StDev	---	---	27	---	---	---	---	196	---	---	0.07	---	---	3	---	---	---	---	31	---	---	0.09	28	3	0

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-B102 | **Type of Survey:** Final Status | **Surveyor 1:** Rebecca Mumper | **Surveyor 2:** | **Date:** 12/17/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	2	32.04%	0.25	8.01%	0.1	1	584	97	407	24%
2241-3 / 253346 43-37 / PR259902	**SAT**	**1/11/2017**	**Beta**	**Total**	**870**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**901**	**7,050**	**13%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**59.6**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**124**	**705**	**18%**

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-B102-F1-V-001	0	-2	-4	<MDC	0.00	117	300	583	<MDC	0.08	0.08	0	-1.2	-3	<MDC	0.00	59	-0.6	-3	<MDC	0.00	0.00	**129**	5	0
BHB-B102-F1-V-002	0	-2	-4	<MDC	0.00	113	260	505	<MDC	0.07	0.07	0	-1.2	-3	<MDC	0.00	60	0.4	2	<MDC	0.00	0.00	**96**	4	0
BHB-B102-C1-M-003	1	8	17	<MDC	0.04	82	-50	-97	<MDC	0.00	0.04	0	-1.2	-3	<MDC	0.00	63	3.4	14	<MDC	0.02	0.02	**73**	0	0
BHB-B102-W1-B-004	1	8	17	<MDC	0.04	132	450	874	<MDC	0.12	0.17	2	0.8	2	<MDC	0.05	66	6.4	27	<MDC	0.04	0.09	**109**	8	2
BHB-B102-W1-B-005	3	28	60	<MDC	0.15	133	460	893	<MDC	0.13	0.27	1	-0.2	-1	<MDC	0.00	51	-8.6	-36	<MDC	0.00	0.00	**165**	0	0
BHB-B102-F1-V-006	0	-2	-4	<MDC	0.00	139	520	**1,010**		0.14	0.14	0	-1.2	-3	<MDC	0.00	46	-13.6	-57	<MDC	0.00	0.00	**98**	2	0
BHB-B102-F1-V-007	1	8	17	<MDC	0.04	97	100	194	<MDC	0.03	0.07	0	-1.2	-3	<MDC	0.00	56	-3.6	-15	<MDC	0.00	0.00	**109**	10	0
BHB-B102-W1-C-008	0	-2	-4	<MDC	0.00	101	140	272	<MDC	0.04	0.04	1	-0.2	-1	<MDC	0.00	46	-13.6	-57	<MDC	0.00	0.00	**119**	2	0
BHB-B102-W1-B-009	1	8	17	<MDC	0.04	106	190	369	<MDC	0.05	0.09	1	-0.2	-1	<MDC	0.00	59	-0.6	-3	<MDC	0.00	0.00	**85**	7	3
BHB-B102-W1-B-010	0	-2	-4	<MDC	0.00	113	260	505	<MDC	0.07	0.07	0	-1.2	-3	<MDC	0.00	65	5.4	23	<MDC	0.03	0.03	**78**	6	0
BHB-B102-F1-V-011	0	-2	-4	<MDC	0.00	107	200	388	<MDC	0.06	0.06	0	-1.2	-3	<MDC	0.00	59	-0.6	-3	<MDC	0.00	0.00	**121**	3	0
BHB-B102-F1-V-012	0	-2	-4	<MDC	0.00	94	70	136	<MDC	0.02	0.02	0	-1.2	-3	<MDC	0.00	62	2.4	10	<MDC	0.01	0.01	**70**	4	2
BHB-B102-W1-C-013	2	18	38	<MDC	0.09	118	310	602	<MDC	0.09	0.18	0	-1.2	-3	<MDC	0.00	58	-1.6	-7	<MDC	0.00	0.00	**112**	1	0
BHB-B102-W1-B-014	4	38	81	<MDC	0.20	149	620	**1,204**		0.17	0.37	3	1.8	5	<MDC	0.12	64	4.4	18	<MDC	0.03	0.15	**101**	0	0
BHB-B102-W1-M-015	3	28	60	<MDC	0.15	95	80	155	<MDC	0.02	0.17	0	-1.2	-3	<MDC	0.00	54	-5.6	-23	<MDC	0.00	0.00	**36**	14	1
Count	---	---	15	---	---	---	---	15	---	---	15	---	---	15	---	---	---	---	15	---	---	15	15	15	15
Min	---	---	-4	---	---	---	---	-97	---	---	0.02	---	---	-3	---	---	---	---	-57	---	---	0.00	36	0	0
Max	---	---	81	---	---	---	---	1,204	---	---	0.37	---	---	5	---	---	---	---	27	---	---	0.15	165	14	3
Median	---	---	17	---	---	---	---	505	---	---	0.08	---	---	-3	---	---	---	---	-3	---	---	0.00	101	4	0
Mean	---	---	19	---	---	---	---	506	---	---	0.12	---	---	-2	---	---	---	---	-7	---	---	0.02	100	4	1
StDev	---	---	29	---	---	---	---	363	---	---	0.09	---	---	3	---	---	---	---	26	---	---	0.07	30	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-B103	Type of Survey: Final Status	Surveyor 1: Stefan Herold	Surveyor 2:	Date: 12/13/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 267113 43-37 / PR286836	SAT	6/30/2017	Alpha	Total	13	33.63%	0.25	8.41%	0.1	1	584	141	407	35%
2241-3 / 267113 43-37 / PR286836	SAT	6/30/2017	Beta	Total	1310	37.88%	0.25	9.47%	0.1	0.1	584	1,017	7,050	14%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	57.1	23.92%	1	23.92%	1	10	100	122	705	17%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-B103-W1-B-001	3	17	35	<MDC	0.09	108	-230	-416	<MDC	0.00	0.09	1	0.2	1	<MDC	0.01	51	-6.1	-26	<MDC	0.00	0.01	24	21	0
BHB-B103-W1-B-002	1	-3	-6	<MDC	0.00	115	-160	-289	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	62	4.9	20	<MDC	0.03	0.03	19	2	0
BHB-B103-W1-B-003	3	17	35	<MDC	0.09	151	200	362	<MDC	0.05	0.14	0	-0.8	-2	<MDC	0.00	57	-0.1	0	<MDC	0.00	0.00	24	11	3
BHB-B103-W1-B-004	0	-13	-26	<MDC	0.00	131	0	0	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	50	-7.1	-30	<MDC	0.00	0.01	22	11	0
BHB-B103-F1-V-005	2	7	14	<MDC	0.04	130	-10	-18	<MDC	0.00	0.04	0	-0.8	-2	<MDC	0.00	55	-2.1	-9	<MDC	0.00	0.00	**136**	3	2
BHB-B103-F1-V-006	0	-13	-26	<MDC	0.00	149	180	325	<MDC	0.05	0.05	0	-0.8	-2	<MDC	0.00	63	5.9	25	<MDC	0.03	0.03	**102**	1	3
BHB-B103-F1-V-007	3	17	35	<MDC	0.09	122	-90	-163	<MDC	0.00	0.09	0	-0.8	-2	<MDC	0.00	68	10.9	46	<MDC	0.06	0.06	**41**	10	0
BHB-B103-W1-B-008	0	-13	-26	<MDC	0.00	133	20	36	<MDC	0.01	0.01	1	0.2	1	<MDC	0.01	54	-3.1	-13	<MDC	0.00	0.01	**80**	9	0
BHB-B103-F1-V-009	1	-3	-6	<MDC	0.00	130	-10	-18	<MDC	0.00	0.00	2	1.2	3	<MDC	0.08	51	-6.1	-26	<MDC	0.00	0.08	**91**	4	0
BHB-B103-W1-B-010	1	-3	-6	<MDC	0.00	98	-330	-597	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	52	-5.1	-21	<MDC	0.00	0.01	**88**	8	0
BHB-B103-F1-V-011	2	7	14	<MDC	0.04	124	-70	-127	<MDC	0.00	0.04	1	0.2	1	<MDC	0.01	72	14.9	62	<MDC	0.09	0.10	34	10	0
BHB-B103-F1-V-012	4	27	55	<MDC	0.14	117	-140	-253	<MDC	0.00	0.14	1	0.2	1	<MDC	0.01	67	9.9	41	<MDC	0.06	0.07	23	0	0
BHB-B103-W1-B-013	3	17	35	<MDC	0.09	132	10	18	<MDC	0.00	0.09	1	0.2	1	<MDC	0.01	52	-5.1	-21	<MDC	0.00	0.01	**62**	12	0
BHB-B103-W1-B-014	0	-13	-26	<MDC	0.00	140	90	163	<MDC	0.02	0.02	2	1.2	3	<MDC	0.08	56	-1.1	-5	<MDC	0.00	0.08	32	14	0
BHB-B103-W1-B-015	2	7	14	<MDC	0.04	103	-280	-506	<MDC	0.00	0.04	2	1.2	3	<MDC	0.08	48	-9.1	-38	<MDC	0.00	0.08	**59**	8	0
BHB-B103-W1-B-016	0	-13	-26	<MDC	0.00	121	-100	-181	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	53	-4.1	-17	<MDC	0.00	0.00	**64**	5	0
Count	---	---	16	---	---	---	---	16	---	---	16	---	---	16	---	---	---	---	16	---	---	16	16	16	16
Min	---	---	-26	---	---	---	---	-597	---	---	0.00	---	---	-2	---	---	---	---	-38	---	---	0.00	19	0	0
Max	---	---	55	---	---	---	---	362	---	---	0.14	---	---	3	---	---	---	---	62	---	---	0.10	136	21	3
Median	---	---	4	---	---	---	---	-72	---	---	0.04	---	---	1	---	---	---	---	-11	---	---	0.02	50	9	0
Mean	---	---	5	---	---	---	---	-104	---	---	0.04	---	---	0	---	---	---	---	-1	---	---	0.04	56	8	1
StDev	---	---	28	---	---	---	---	271	---	---	0.08	---	---	2	---	---	---	---	30	---	---	0.07	35	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-B104	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/17/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	5	32.04%	0.25	8.01%	0.1	1	584	116	407	29%
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Beta	Total	870	35.27%	0.25	8.82%	0.1	0.1	584	901	7,050	13%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	56.9	23.92%	1	23.92%	1	10	100	121	705	17%

Comments:
Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-B104-W1-C-001	0	-5	-11	<MDC	0.00	83	-40	-78	<MDC	0.00	0.00	1	-0.2	-1	<MDC	0.00	62	5.1	21	<MDC	0.03	0.03	**280**	0	0
BHB-B104-W1-M-002	3	25	53	<MDC	0.13	75	-120	-233	<MDC	0.00	0.13	1	-0.2	-1	<MDC	0.00	64	7.1	30	<MDC	0.04	0.04	**84**	2	0
BHB-B104-F1-V-003	2	15	32	<MDC	0.08	103	160	311	<MDC	0.04	0.12	0	-1.2	-3	<MDC	0.00	58	1.1	5	<MDC	0.01	0.01	**158**	2	0
BHB-B104-F1-V-004	0	-5	-11	<MDC	0.00	85	-20	-39	<MDC	0.00	0.00	1	-0.2	-1	<MDC	0.00	56	-0.9	-4	<MDC	0.00	0.00	**163**	2	0
BHB-B104-W1-C-005	0	-5	-11	<MDC	0.00	107	200	388	<MDC	0.06	0.06	1	-0.2	-1	<MDC	0.00	54	-2.9	-12	<MDC	0.00	0.00	**139**	2	0
BHB-B104-W1-C-006	3	25	53	<MDC	0.13	113	260	505	<MDC	0.07	0.20	0	-1.2	-3	<MDC	0.00	57	0.1	0	<MDC	0.00	0.00	**107**	4	0
BHB-B104-F1-V-007	2	15	32	<MDC	0.08	98	110	214	<MDC	0.03	0.11	1	-0.2	-1	<MDC	0.00	53	-3.9	-16	<MDC	0.00	0.00	**171**	0	2
BHB-B104-F1-V-008	4	35	75	<MDC	0.18	109	220	427	<MDC	0.06	0.24	4	2.8	8	<MDC	0.19	66	9.1	38	<MDC	0.05	0.25	**149**	6	0
BHB-B104-W1-B-009	4	35	75	<MDC	0.18	110	230	447	<MDC	0.06	0.25	0	-1.2	-3	<MDC	0.00	54	-2.9	-12	<MDC	0.00	0.00	**168**	5	0
BHB-B104-F1-V-010	1	5	11	<MDC	0.03	116	290	563	<MDC	0.08	0.11	1	-0.2	-1	<MDC	0.00	71	14.1	59	<MDC	0.08	0.08	**133**	5	0
BHB-B104-F1-V-011	2	15	32	<MDC	0.08	86	-10	-19	<MDC	0.00	0.08	1	-0.2	-1	<MDC	0.00	42	-14.9	-62	<MDC	0.00	0.00	**270**	5	0
BHB-B104-C1-M-012	1	5	11	<MDC	0.03	70	-170	-330	<MDC	0.00	0.03	0	-1.2	-3	<MDC	0.00	68	11.1	46	<MDC	0.07	0.07	**85**	1	2
Count	---	---	12	---	---	---	---	12	---	---	12	---	---	12	---	---	---	---	12	---	---	12	12	12	12
Min	---	---	-11	---	---	---	---	-330	---	---	0.00	---	---	-3	---	---	---	---	-62	---	---	0.00	84	0	0
Max	---	---	75	---	---	---	---	563	---	---	0.25	---	---	8	---	---	---	---	59	---	---	0.25	280	6	2
Median	---	---	32	---	---	---	---	262	---	---	0.11	---	---	-1	---	---	---	---	3	---	---	0.00	154	2	0
Mean	---	---	29	---	---	---	---	180	---	---	0.11	---	---	-1	---	---	---	---	8	---	---	0.04	159	3	0
StDev	---	---	31	---	---	---	---	306	---	---	0.09	---	---	3	---	---	---	---	33	---	---	0.09	62	2	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-B301	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/18/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)	Comments:
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	3	32.04%	0.25	8.01%	0.1	1	584	105	407	26%	Results above MDC are in bold. Results above the investigation level are in red.
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Beta	Total	960	35.27%	0.25	8.82%	0.1	0.1	584	944	7,050	13%	
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.7	36.49%	1	36.49%	1	10	100	16	40	40%	
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	58.7	23.92%	1	23.92%	1	10	100	123	705	17%	Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-B301-F1-C-001	5	47	100	<MDC	0.25	88	-80	-155	<MDC	0.00	0.25	1	0.3	1	<MDC	0.02	56	-2.7	-11	<MDC	0.00	0.02	**52**	6	0
BHB-B301-F1-C-002	1	7	15	<MDC	0.04	104	80	155	<MDC	0.02	0.06	3	2.3	6	<MDC	0.16	58	-0.7	-3	<MDC	0.00	0.16	**46**	2	3
BHB-B301-F1-C-003	3	27	58	<MDC	0.14	83	-130	-252	<MDC	0.00	0.14	1	0.3	1	<MDC	0.02	41	-17.7	-74	<MDC	0.00	0.02	25	12	6
BHB-B301-F1-M-004	1	7	15	<MDC	0.04	92	-40	-78	<MDC	0.00	0.04	3	2.3	6	<MDC	0.16	58	-0.7	-3	<MDC	0.00	0.16	**41**	2	0
BHB-B301-F1-V-005	0	-3	-6	<MDC	0.00	62	-340	-660	<MDC	0.00	0.00	1	0.3	1	<MDC	0.02	65	6.3	26	<MDC	0.04	0.06	**46**	8	0
BHB-B301-F1-T-006	4	37	79	<MDC	0.19	146	500	**971**		0.14	0.33	1	0.3	1	<MDC	0.02	54	-4.7	-20	<MDC	0.00	0.02	**45**	6	4
BHB-B301-F1-T-007	1	7	15	<MDC	0.04	44	-520	-1,010	<MDC	0.00	0.04	1	0.3	1	<MDC	0.02	52	-6.7	-28	<MDC	0.00	0.02	30	4	2
BHB-B301-F1-C-008	0	-3	-6	<MDC	0.00	98	20	39	<MDC	0.01	0.01	0	-0.7	-2	<MDC	0.00	54	-4.7	-20	<MDC	0.00	0.00	**49**	12	2
BHB-B301-F1-C-009	1	7	15	<MDC	0.04	101	50	97	<MDC	0.01	0.05	0	-0.7	-2	<MDC	0.00	56	-2.7	-11	<MDC	0.00	0.00	**37**	1	11
BHB-B301-F1-V-010	3	27	58	<MDC	0.14	89	-70	-136	<MDC	0.00	0.14	0	-0.7	-2	<MDC	0.00	55	-3.7	-15	<MDC	0.00	0.00	**42**	1	0
BHB-B301-F1-V-011	1	7	15	<MDC	0.04	92	-40	-78	<MDC	0.00	0.04	1	0.3	1	<MDC	0.02	48	-10.7	-45	<MDC	0.00	0.02	**90**	8	4
BHB-B301-F1-V-012	0	-3	-6	<MDC	0.00	81	-150	-291	<MDC	0.00	0.00	2	1.3	4	<MDC	0.09	44	-14.7	-61	<MDC	0.00	0.09	**75**	0	0
Count	---	---	12	---	---	---	---	12	---	---	12	---	---	12	---	---	---	---	12	---	---	12	12	12	12
Min	---	---	-6	---	---	---	---	-1,010	---	---	0.00	---	---	-2	---	---	---	---	-74	---	---	0.00	25	0	0
Max	---	---	100	---	---	---	---	971	---	---	0.33	---	---	6	---	---	---	---	26	---	---	0.16	90	12	11
Median	---	---	15	---	---	---	---	-107	---	---	0.04	---	---	1	---	---	---	---	-18	---	---	0.02	46	5	2
Mean	---	---	29	---	---	---	---	-117	---	---	0.09	---	---	1	---	---	---	---	-22	---	---	0.05	48	5	3
StDev	---	---	36	---	---	---	---	474	---	---	0.11	---	---	3	---	---	---	---	27	---	---	0.08	18	4	3

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-1101	Type of Survey: Final Status	Surveyor 1: Kirby Gemillion	Surveyor 2: Rebecca Mumper	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Alpha	Total	10	31.56%	0.25	7.89%	0.1	1	584	140	407	34%
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Beta	Total	1370	33.97%	0.25	8.49%	0.1	0.1	584	1,159	7,050	16%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	57.1	23.92%	1	23.92%	1	10	100	122	705	17%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1101-W1-C-001	2	10	22	<MDC	0.05	128	-90	-181	<MDC	0.00	0.05	0	-0.8	-2	<MDC	0.00	56	-1.1	-5	<MDC	0.00	0.00	0	4	0
BHB-1101-W1-B-002	1	0	0	<MDC	0.00	147	100	202	<MDC	0.03	0.03	1	0.2	1	<MDC	0.01	61	3.9	16	<MDC	0.02	0.04	**36**	0	0
BHB-1101-F1-M-003	1	0	0	<MDC	0.00	133	-40	-81	<MDC	0.00	0.00	3	2.2	6	<MDC	0.15	68	10.9	46	<MDC	0.06	0.22	**49**	3	0
BHB-1101-W1-B-004	1	0	0	<MDC	0.00	127	-100	-202	<MDC	0.00	0.00	2	1.2	3	<MDC	0.08	70	12.9	54	<MDC	0.08	0.16	18	8	0
BHB-1101-F1-T-005	4	30	65	<MDC	0.16	227	900	**1,815**		0.26	0.42	0	-0.8	-2	<MDC	0.00	55	-2.1	-9	<MDC	0.00	0.00	**37**	0	2
BHB-1101-F1-T-006	2	10	22	<MDC	0.05	264	1270	**2,561**		0.36	0.42	0	-0.8	-2	<MDC	0.00	59	1.9	8	<MDC	0.01	0.01	20	10	0
BHB-1101-W1-B-007	1	0	0	<MDC	0.00	127	-100	-202	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	62	4.9	20	<MDC	0.03	0.03	**42**	4	0
BHB-1101-W1-B-008	1	0	0	<MDC	0.00	110	-270	-544	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	60	2.9	12	<MDC	0.02	0.02	**48**	3	0
BHB-1101-W1-B-009	1	0	0	<MDC	0.00	121	-160	-323	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	57	-0.1	0	<MDC	0.00	0.01	**47**	3	0
BHB-1101-F1-T-010	0	-10	-22	<MDC	0.00	230	930	**1,875**		0.27	0.27	1	0.2	1	<MDC	0.01	63	5.9	25	<MDC	0.03	0.05	**72**	13	1
BHB-1101-W1-B-011	1	0	0	<MDC	0.00	142	50	101	<MDC	0.01	0.01	1	0.2	1	<MDC	0.01	54	-3.1	-13	<MDC	0.00	0.01	**70**	8	2
BHB-1101-F1-T-012	0	-10	-22	<MDC	0.00	241	1040	**2,097**		0.30	0.30	2	1.2	3	<MDC	0.08	62	4.9	20	<MDC	0.03	0.11	**62**	4	1
BHB-1101-F1-T-013	1	0	0	<MDC	0.00	124	-130	-262	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	61	3.9	16	<MDC	0.02	0.04	14	10	0
BHB-1101-C1-M-014	0	-10	-22	<MDC	0.00	101	-360	-726	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	48	-9.1	-38	<MDC	0.00	0.00	**48**	8	0
BHB-1101-W1-B-015	0	-10	-22	<MDC	0.00	131	-60	-121	<MDC	0.00	0.00	2	1.2	3	<MDC	0.08	52	-5.1	-21	<MDC	0.00	0.08	**62**	12	3
BHB-1101-W1-B-016	0	-10	-22	<MDC	0.00	158	210	423	<MDC	0.06	0.06	1	0.2	1	<MDC	0.01	59	1.9	8	<MDC	0.01	0.02	**59**	13	0
BHB-1101-W1-B-017	1	0	0	<MDC	0.00	140	30	60	<MDC	0.01	0.01	0	-0.8	-2	<MDC	0.00	65	7.9	33	<MDC	0.05	0.05	**57**	1	0
BHB-1101-W1-B-018	0	-10	-22	<MDC	0.00	156	190	383	<MDC	0.05	0.05	0	-0.8	-2	<MDC	0.00	44	-13.1	-55	<MDC	0.00	0.00	**36**	14	0
BHB-1101-F1-T-019	1	0	0	<MDC	0.00	144	70	141	<MDC	0.02	0.02	1	0.2	1	<MDC	0.01	65	7.9	33	<MDC	0.05	0.06	**67**	11	2
BHB-1101-F1-T-020	1	0	0	<MDC	0.00	235	980	**1,976**		0.28	0.28	1	0.2	1	<MDC	0.01	62	4.9	20	<MDC	0.03	0.04	**72**	3	0
BHB-1101-W1-B-021	0	-10	-22	<MDC	0.00	139	20	40	<MDC	0.01	0.01	0	-0.8	-2	<MDC	0.00	67	9.9	41	<MDC	0.06	0.06	**104**	8	0
BHB-1101-F1-T-022	4	30	65	<MDC	0.16	238	1010	**2,036**		0.29	0.45	0	-0.8	-2	<MDC	0.00	40	-17.1	-71	<MDC	0.00	0.00	**77**	1	1
Count	---	---	22	---	---	---	---	22	---	---	22	---	---	22	---	---	---	---	22	---	---	22	22	22	22
Min	---	---	-22	---	---	---	---	-726	---	---	0.00	---	---	-2	---	---	---	---	-71	---	---	0.00	0	0	0
Max	---	---	65	---	---	---	---	2,561	---	---	0.45	---	---	6	---	---	---	---	54	---	---	0.22	104	14	3
Median	---	---	0	---	---	---	---	81	---	---	0.02	---	---	1	---	---	---	---	14	---	---	0.03	49	6	0
Mean	---	---	1	---	---	---	---	503	---	---	0.11	---	---	0	---	---	---	---	6	---	---	0.05	50	6	1
StDev	---	---	25	---	---	---	---	1,018	---	---	0.16	---	---	2	---	---	---	---	32	---	---	0.07	24	5	1

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-1102 | **Type of Survey:** Final Status | **Surveyor 1:** Rebecca Mumper | **Surveyor 2:** Stefan Herold | **Date:** 12/8/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253356 43-37 / 281040	SAT	9/28/2017	Alpha	Total	10	32.17%	0.25	8.04%	0.1	1	584	137	407	34%
2241-3 / 253356 43-37 / 281040	**SAT**	**9/28/2017**	**Beta**	**Total**	**1270**	**38.17%**	**0.25**	**9.54%**	**0.1**	**0.1**	**584**	**995**	**7,050**	**14%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.7	36.49%	1	36.49%	1	10	100	16	40	40%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**56**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**120**	**705**	**17%**

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1102-C1-M-001	1	0	0	<MDC	0.00	108	-190	-341	<MDC	0.00	0.00	1	0.3	1	<MDC	0.02	49	-7.0	-29	<MDC	0.00	0.02	**38**	7	0
BHB-1102-W1-B-002	0	-10	-21	<MDC	0.00	161	340	610	<MDC	0.09	0.09	0	-0.7	-2	<MDC	0.00	59	3.0	13	<MDC	0.02	0.02	30	4	2
BHB-1102-W1-B-003	0	-10	-21	<MDC	0.00	155	280	502	<MDC	0.07	0.07	1	0.3	1	<MDC	0.02	53	-3.0	-13	<MDC	0.00	0.02	31	0	0
BHB-1102-F1-V-004	1	0	0	<MDC	0.00	112	-150	-269	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	64	8.0	33	<MDC	0.05	0.05	**51**	9	0
BHB-1102-F1-V-005	1	0	0	<MDC	0.00	133	60	108	<MDC	0.02	0.02	1	0.3	1	<MDC	0.02	64	8.0	33	<MDC	0.05	0.07	24	0	0
BHB-1102-B1-M-006	0	-10	-21	<MDC	0.00	141	140	251	<MDC	0.04	0.04	0	-0.7	-2	<MDC	0.00	59	3.0	13	<MDC	0.02	0.02	**53**	10	1
BHB-1102-W1-M-007	0	-10	-21	<MDC	0.00	145	180	323	<MDC	0.05	0.05	4	3.3	9	<MDC	0.23	62	6.0	25	<MDC	0.04	0.26	**64**	2	0
BHB-1102-W1-M-008	0	-10	-21	<MDC	0.00	143	160	287	<MDC	0.04	0.04	2	1.3	4	<MDC	0.09	63	7.0	29	<MDC	0.04	0.13	**85**	4	0
BHB-1102-B1-M-009	0	-10	-21	<MDC	0.00	146	190	341	<MDC	0.05	0.05	1	0.3	1	<MDC	0.02	63	7.0	29	<MDC	0.04	0.06	**120**	16	0
BHB-1102-F1-V-010	0	-10	-21	<MDC	0.00	144	170	305	<MDC	0.04	0.04	1	0.3	1	<MDC	0.02	49	-7.0	-29	<MDC	0.00	0.02	**70**	5	5
BHB-1102-F1-V-011	1	0	0	<MDC	0.00	138	110	197	<MDC	0.03	0.03	0	-0.7	-2	<MDC	0.00	51	-5.0	-21	<MDC	0.00	0.00	**86**	5	0
BHB-1102-W1-B-012	1	0	0	<MDC	0.00	155	280	502	<MDC	0.07	0.07	1	0.3	1	<MDC	0.02	48	-8.0	-33	<MDC	0.00	0.02	**63**	1	0
BHB-1102-W1-M-013	0	-10	-21	<MDC	0.00	79	-480	-861	<MDC	0.00	0.00	2	1.3	4	<MDC	0.09	61	5.0	21	<MDC	0.03	0.12	**45**	3	1
BHB-1102-W1-B-014	1	0	0	<MDC	0.00	144	170	305	<MDC	0.04	0.04	1	0.3	1	<MDC	0.02	59	3.0	13	<MDC	0.02	0.04	**73**	15	0
Count	---	---	14	---	---	---	---	14	---	---	14	---	---	14	---	---	---	---	14	---	---	14	14	14	14
Min	---	---	-21	---	---	---	---	-861	---	---	0.00	---	---	-2	---	---	---	---	-33	---	---	0.00	24	0	0
Max	---	---	0	---	---	---	---	610	---	---	0.09	---	---	9	---	---	---	---	33	---	---	0.26	120	16	5
Median	---	---	-21	---	---	---	---	296	---	---	0.04	---	---	1	---	---	---	---	13	---	---	0.03	58	5	0
Mean	---	---	-12	---	---	---	---	161	---	---	0.04	---	---	1	---	---	---	---	6	---	---	0.06	60	6	1
StDev	---	---	11	---	---	---	---	397	---	---	0.06	---	---	3	---	---	---	---	25	---	---	0.08	26	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-1103	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/18/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	6	32.04%	0.25	8.01%	0.1	1	584	121	407	30%
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Beta	Total	850	35.27%	0.25	8.82%	0.1	0.1	584	891	7,050	13%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.7	36.49%	1	36.49%	1	10	100	16	40	40%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	58.7	23.92%	1	23.92%	1	10	100	123	705	17%

Comments:
Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1103-W1-B-001	0	-6	-13	<MDC	0.00	128	430	835	<MDC	0.12	0.12	1	0.3	1	<MDC	0.02	57	-1.7	-7	<MDC	0.00	0.02	13	4	2
BHB-1103-W1-B-002	1	4	9	<MDC	0.02	114	290	563	<MDC	0.08	0.10	4	3.3	9	<MDC	0.23	48	-10.7	-45	<MDC	0.00	0.23	15	5	3
BHB-1103-W1-B-003	0	-6	-13	<MDC	0.00	129	440	854	<MDC	0.12	0.12	0	-0.7	-2	<MDC	0.00	74	15.3	64	<MDC	0.09	0.09	12	20	1
BHB-1103-F1-V-004	0	-6	-13	<MDC	0.00	98	130	252	<MDC	0.04	0.04	1	0.3	1	<MDC	0.02	47	-11.7	-49	<MDC	0.00	0.02	12	9	0
BHB-1103-F1-V-005	0	-6	-13	<MDC	0.00	110	250	485	<MDC	0.07	0.07	0	-0.7	-2	<MDC	0.00	42	-16.7	-70	<MDC	0.00	0.00	17	19	0
BHB-1103-W1-B-006	1	4	9	<MDC	0.02	110	250	485	<MDC	0.07	0.09	2	1.3	4	<MDC	0.09	56	-2.7	-11	<MDC	0.00	0.09	11	4	11
BHB-1103-W1-B-007	2	14	30	<MDC	0.07	96	110	214	<MDC	0.03	0.10	2	1.3	4	<MDC	0.09	53	-5.7	-24	<MDC	0.00	0.09	23	6	0
BHB-1103-F1-V-008	0	-6	-13	<MDC	0.00	88	30	58	<MDC	0.01	0.01	1	0.3	1	<MDC	0.02	48	-10.7	-45	<MDC	0.00	0.02	**37**	4	8
BHB-1103-F1-V-009	1	4	9	<MDC	0.02	84	-10	-19	<MDC	0.00	0.02	0	-0.7	-2	<MDC	0.00	52	-6.7	-28	<MDC	0.00	0.00	**42**	9	5
BHB-1103-W1-B-010	0	-6	-13	<MDC	0.00	98	130	252	<MDC	0.04	0.04	1	0.3	1	<MDC	0.02	53	-5.7	-24	<MDC	0.00	0.02	29	15	0
BHB-1103-W1-B-011	3	24	51	<MDC	0.13	89	40	78	<MDC	0.01	0.14	0	-0.7	-2	<MDC	0.00	62	3.3	14	<MDC	0.02	0.02	22	10	0
BHB-1103-F1-V-012	2	14	30	<MDC	0.07	91	60	117	<MDC	0.02	0.09	1	0.3	1	<MDC	0.02	67	8.3	35	<MDC	0.05	0.07	**45**	0	1
BHB-1103-F1-V-013	1	4	9	<MDC	0.02	91	60	117	<MDC	0.02	0.04	0	-0.7	-2	<MDC	0.00	39	-19.7	-82	<MDC	0.00	0.00	**42**	6	0
BHB-1103-W1-B-014	1	4	9	<MDC	0.02	117	320	621	<MDC	0.09	0.11	0	-0.7	-2	<MDC	0.00	60	1.3	5	<MDC	0.01	0.01	**42**	6	11
Count	---	---	14	---	---	---	---	14	---	---	14	---	---	14	---	---	---	---	14	---	---	14	14	14	14
Min	---	---	-13	---	---	---	---	-19	---	---	0.01	---	---	-2	---	---	---	---	-82	---	---	0.00	11	0	0
Max	---	---	51	---	---	---	---	854	---	---	0.14	---	---	9	---	---	---	---	64	---	---	0.23	45	20	11
Median	---	---	9	---	---	---	---	252	---	---	0.09	---	---	1	---	---	---	---	-24	---	---	0.02	23	6	1
Mean	---	---	5	---	---	---	---	351	---	---	0.08	---	---	1	---	---	---	---	-19	---	---	0.05	26	8	3
StDev	---	---	20	---	---	---	---	289	---	---	0.06	---	---	3	---	---	---	---	40	---	---	0.10	13	6	4

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-1201 | **Type of Survey:** Final Status | **Surveyor 1:** Rebecca Mumper | **Surveyor 2:** | **Date:** 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	7	32.04%	0.25	8.01%	0.1	1	584	126	407	31%
2241-3 / 253346 43-37 / PR259902	**SAT**	**1/11/2017**	**Beta**	**Total**	**1020**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**971**	**7,050**	**14%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**56.9**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**121**	**705**	**17%**

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1201-F1-M-001	1	3	6	<MDC	0.02	86	-160	-311	<MDC	0.00	0.02	1	0.2	1	<MDC	0.01	56	-0.9	-4	<MDC	0.00	0.01	22	5	1
BHB-1201-F1-M-002	0	-7	-15	<MDC	0.00	100	-20	-39	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	47	-9.9	-41	<MDC	0.00	0.00	21	5	0
BHB-1201-F1-M-003	5	43	92	<MDC	0.23	91	-110	-214	<MDC	0.00	0.23	1	0.2	1	<MDC	0.01	68	11.1	46	<MDC	0.07	0.08	**41**	0	5
BHB-1201-F1-M-004	0	-7	-15	<MDC	0.00	94	-80	-155	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	71	14.1	59	<MDC	0.08	0.10	11	0	0
BHB-1201-F1-M-005	0	-7	-15	<MDC	0.00	106	40	78	<MDC	0.01	0.01	2	1.2	3	<MDC	0.08	45	-11.9	-50	<MDC	0.00	0.08	**55**	9	1
BHB-1201-F1-M-006	2	13	28	<MDC	0.07	93	-90	-175	<MDC	0.00	0.07	0	-0.8	-2	<MDC	0.00	46	-10.9	-46	<MDC	0.00	0.00	21	0	0
BHB-1201-F1-M-007	0	-7	-15	<MDC	0.00	95	-70	-136	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	58	1.1	5	<MDC	0.01	0.01	23	7	0
BHB-1201-F1-M-008	2	13	28	<MDC	0.07	103	10	19	<MDC	0.00	0.07	0	-0.8	-2	<MDC	0.00	53	-3.9	-16	<MDC	0.00	0.00	29	10	0
BHB-1201-F1-M-009	0	-7	-15	<MDC	0.00	102	0	0	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	70	13.1	55	<MDC	0.08	0.09	23	0	4
BHB-1201-F1-M-010	3	23	49	<MDC	0.12	94	-80	-155	<MDC	0.00	0.12	0	-0.8	-2	<MDC	0.00	44	-12.9	-54	<MDC	0.00	0.00	21	12	0
BHB-1201-F1-M-011	1	3	6	<MDC	0.02	112	100	194	<MDC	0.03	0.04	1	0.2	1	<MDC	0.01	52	-4.9	-20	<MDC	0.00	0.01	15	4	0
BHB-1201-F1-M-012	1	3	6	<MDC	0.02	98	-40	-78	<MDC	0.00	0.02	1	0.2	1	<MDC	0.01	69	12.1	51	<MDC	0.07	0.09	27	0	4
BHB-1201-F1-M-013	0	-7	-15	<MDC	0.00	102	0	0	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	62	5.1	21	<MDC	0.03	0.03	0	11	0
BHB-1201-F1-M-014	0	-7	-15	<MDC	0.00	117	150	291	<MDC	0.04	0.04	0	-0.8	-2	<MDC	0.00	72	15.1	63	<MDC	0.09	0.09	21	2	0
BHB-1201-F1-M-015	0	-7	-15	<MDC	0.00	115	130	252	<MDC	0.04	0.04	0	-0.8	-2	<MDC	0.00	69	12.1	51	<MDC	0.07	0.07	0	0	0
Count	---	---	15	---	---	---	---	15	---	---	15	---	---	15	---	---	---	---	15	---	---	15	15	15	15
Min	---	---	-15	---	---	---	---	-311	---	---	0.00	---	---	-2	---	---	---	---	-54	---	---	0.00	0	0	0
Max	---	---	92	---	---	---	---	291	---	---	0.23	---	---	3	---	---	---	---	63	---	---	0.10	55	12	5
Median	---	---	-15	---	---	---	---	-39	---	---	0.02	---	---	-2	---	---	---	---	5	---	---	0.03	21	4	0
Mean	---	---	6	---	---	---	---	-28	---	---	0.04	---	---	-1	---	---	---	---	8	---	---	0.04	22	4	1
StDev	---	---	31	---	---	---	---	175	---	---	0.08	---	---	2	---	---	---	---	44	---	---	0.08	14	4	2

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-1202	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)	Comments:
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	5	32.04%	0.25	8.01%	0.1	1	584	116	407	29%	Results above MDC are in bold. Results above the investigation level are in red.
2241-3 / 253346 43-37 / PR259902	**SAT**	**1/11/2017**	**Beta**	**Total**	**1000**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**962**	**7,050**	**14%**	
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%	
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**56.9**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**121**	**705**	**17%**	**Reviewed:** Mike Culp — **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					SOF	Alpha					Beta					SOF	H-3	C-14	CH 3
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL				
BHB-1202-F1-V-001	0	-5	-11	<MDC	0.00	95	-50	-97	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	50	-6.9	-29	<MDC	0.00	0.00	**40**	0	1
BHB-1202-F1-V-002	0	-5	-11	<MDC	0.00	104	40	78	<MDC	0.01	0.01	0	-0.8	-2	<MDC	0.00	57	0.1	0	<MDC	0.00	0.00	**48**	3	1
BHB-1202-F1-V-003	1	5	11	<MDC	0.03	71	-290	-563	<MDC	0.00	0.03	0	-0.8	-2	<MDC	0.00	59	2.1	9	<MDC	0.01	0.01	**40**	1	0
BHB-1202-F1-V-004	0	-5	-11	<MDC	0.00	87	-130	-252	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	61	4.1	17	<MDC	0.02	0.04	35	8	3
BHB-1202-F1-V-005	0	-5	-11	<MDC	0.00	95	-50	-97	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	57	0.1	0	<MDC	0.00	0.01	25	4	0
BHB-1202-F1-V-006	1	5	11	<MDC	0.03	80	-200	-388	<MDC	0.00	0.03	0	-0.8	-2	<MDC	0.00	62	5.1	21	<MDC	0.03	0.03	30	0	2
BHB-1202-F1-V-007	1	5	11	<MDC	0.03	88	-120	-233	<MDC	0.00	0.03	1	0.2	1	<MDC	0.01	48	-8.9	-37	<MDC	0.00	0.01	**41**	0	0
BHB-1202-F1-V-008	0	-5	-11	<MDC	0.00	87	-130	-252	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	65	8.1	34	<MDC	0.05	0.06	**60**	4	5
BHB-1202-F1-V-009	1	5	11	<MDC	0.03	72	-280	-544	<MDC	0.00	0.03	0	-0.8	-2	<MDC	0.00	41	-15.9	-66	<MDC	0.00	0.00	**69**	1	2
BHB-1202-F1-V-010	2	15	32	<MDC	0.08	76	-240	-466	<MDC	0.00	0.08	0	-0.8	-2	<MDC	0.00	56	-0.9	-4	<MDC	0.00	0.00	32	0	0
BHB-1202-F1-V-011	2	15	32	<MDC	0.08	77	-230	-447	<MDC	0.00	0.08	0	-0.8	-2	<MDC	0.00	54	-2.9	-12	<MDC	0.00	0.00	15	10	2
BHB-1202-F1-V-012	0	-5	-11	<MDC	0.00	80	-200	-388	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	43	-13.9	-58	<MDC	0.00	0.00	**45**	0	3
BHB-1202-F1-V-013	0	-5	-11	<MDC	0.00	96	-40	-78	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	53	-3.9	-16	<MDC	0.00	0.00	20	9	0
BHB-1202-F1-V-014	1	5	11	<MDC	0.03	83	-170	-330	<MDC	0.00	0.03	1	0.2	1	<MDC	0.01	45	-11.9	-50	<MDC	0.00	0.01	0	6	2
BHB-1202-F1-V-015	0	-5	-11	<MDC	0.00	86	-140	-272	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	52	-4.9	-20	<MDC	0.00	0.00	**38**	0	0
BHB-1202-F1-V-016	1	5	11	<MDC	0.03	91	-90	-175	<MDC	0.00	0.03	0	-0.8	-2	<MDC	0.00	59	2.1	9	<MDC	0.01	0.01	2	8	0
Count	---	---	16	---	---	---	---	16	---	---	16	---	---	16	---	---	---	---	16	---	---	16	16	16	16
Min	---	---	-11	---	---	---	---	-563	---	---	0.00	---	---	-2	---	---	---	---	-66	---	---	0.00	0	0	0
Max	---	---	32	---	---	---	---	78	---	---	0.08	---	---	1	---	---	---	---	34	---	---	0.06	69	10	5
Median	---	---	0	---	---	---	---	-262	---	---	0.02	---	---	-2	---	---	---	---	-8	---	---	0.01	37	2	1
Mean	---	---	3	---	---	---	---	-282	---	---	0.02	---	---	-1	---	---	---	---	-13	---	---	0.01	34	3	1
StDev	---	---	15	---	---	---	---	181	---	---	0.05	---	---	1	---	---	---	---	29	---	---	0.05	19	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-1203	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	7	32.04%	0.25	8.01%	0.1	1	584	126	407	31%
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Beta	Total	800	35.27%	0.25	8.82%	0.1	0.1	584	866	7,050	12%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	56.9	23.92%	1	23.92%	1	10	100	121	705	17%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta				SOF	Alpha					Beta				SOF			
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		H-3	C-14	CH 3
BHB-1203-F1-V-001	0	-7	-15	<MDC	0.00	96	160	311	<MDC	0.04	0.04	1	0.2	1	<MDC	0.01	57	0.1	0	<MDC	0.00	0.01	9	11	0
BHB-1203-F1-V-002	1	3	6	<MDC	0.02	109	290	563	<MDC	0.08	0.10	0	-0.8	-2	<MDC	0.00	55	-1.9	-8	<MDC	0.00	0.00	24	6	0
BHB-1203-F1-V-003	1	3	6	<MDC	0.02	77	-30	-58	<MDC	0.00	0.02	3	2.2	6	<MDC	0.15	64	7.1	30	<MDC	0.04	0.19	0	6	2
BHB-1203-F1-V-004	1	3	6	<MDC	0.02	85	50	97	<MDC	0.01	0.03	3	2.2	6	<MDC	0.15	56	-0.9	-4	<MDC	0.00	0.15	28	13	2
BHB-1203-F1-V-005	0	-7	-15	<MDC	0.00	82	20	39	<MDC	0.01	0.01	1	0.2	1	<MDC	0.01	54	-2.9	-12	<MDC	0.00	0.01	17	8	5
BHB-1203-F1-V-006	3	23	49	<MDC	0.12	76	-40	-78	<MDC	0.00	0.12	0	-0.8	-2	<MDC	0.00	59	2.1	9	<MDC	0.01	0.01	17	10	2
BHB-1203-F1-V-007	2	13	28	<MDC	0.07	81	10	19	<MDC	0.00	0.07	0	-0.8	-2	<MDC	0.00	62	5.1	21	<MDC	0.03	0.03	15	10	5
BHB-1203-F1-V-008	1	3	6	<MDC	0.02	83	30	58	<MDC	0.01	0.02	0	-0.8	-2	<MDC	0.00	69	12.1	51	<MDC	0.07	0.07	**38**	2	4
BHB-1203-F1-V-009	1	3	6	<MDC	0.02	77	-30	-58	<MDC	0.00	0.02	3	2.2	6	<MDC	0.15	56	-0.9	-4	<MDC	0.00	0.15	**66**	1	1
BHB-1203-F1-V-010	0	-7	-15	<MDC	0.00	65	-150	-291	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	47	-9.9	-41	<MDC	0.00	0.01	23	1	0
BHB-1203-F1-V-011	1	3	6	<MDC	0.02	80	0	0	<MDC	0.00	0.02	0	-0.8	-2	<MDC	0.00	58	1.1	5	<MDC	0.01	0.01	**143**	1	0
BHB-1203-F1-V-012	2	13	28	<MDC	0.07	86	60	117	<MDC	0.02	0.08	1	0.2	1	<MDC	0.01	52	-4.9	-20	<MDC	0.00	0.01	**57**	9	0
BHB-1203-F1-V-013	0	-7	-15	<MDC	0.00	87	70	136	<MDC	0.02	0.02	0	-0.8	-2	<MDC	0.00	72	15.1	63	<MDC	0.09	0.09	**57**	2	0
BHB-1203-F1-V-014	1	3	6	<MDC	0.02	78	-20	-39	<MDC	0.00	0.02	1	0.2	1	<MDC	0.01	60	3.1	13	<MDC	0.02	0.03	**96**	4	0
BHB-1203-F1-V-015	1	3	6	<MDC	0.02	80	0	0	<MDC	0.00	0.02	1	0.2	1	<MDC	0.01	59	2.1	9	<MDC	0.01	0.03	27	17	0
BHB-1203-F1-V-016	1	3	6	<MDC	0.02	56	-240	-466	<MDC	0.00	0.02	2	1.2	3	<MDC	0.08	64	7.1	30	<MDC	0.04	0.12	18	4	0
Count	---	---	16	---	---	---	---	16	---	---	16	---	---	16	---	---	---	---	16	---	---	16	16	16	16
Min	---	---	-15	---	---	---	---	-466	---	---	0.00	---	---	-2	---	---	---	---	-41	---	---	0.00	0	1	0
Max	---	---	49	---	---	---	---	563	---	---	0.12	---	---	6	---	---	---	---	63	---	---	0.19	143	17	5
Median	---	---	6	---	---	---	---	10	---	---	0.02	---	---	1	---	---	---	---	7	---	---	0.03	26	6	0
Mean	---	---	6	---	---	---	---	22	---	---	0.04	---	---	1	---	---	---	---	9	---	---	0.06	40	7	1
StDev	---	---	17	---	---	---	---	226	---	---	0.05	---	---	3	---	---	---	---	26	---	---	0.09	37	5	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-1204 | **Type of Survey:** Final Status | **Surveyor 1:** Kirby Gemillion | **Surveyor 2:** | **Date:** 12/13/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / 259902	SAT	1/11/2017	Alpha	Total	7	32.04%	0.25	8.01%	0.1	1	584	126	407	31%
2241-3 / 253346 43-37 / 259902	**SAT**	**1/11/2017**	**Beta**	**Total**	**820**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**876**	**7,050**	**12%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**57.1**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**122**	**705**	**17%**

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1204-F1-V-001	0	-7	-15	<MDC	0.00	105	230	447	<MDC	0.06	0.06	2	1.2	3	<MDC	0.08	54	-3.1	-13	<MDC	0.00	0.08	24	0	1
BHB-1204-F1-V-002	2	13	28	<MDC	0.07	100	180	350	<MDC	0.05	0.12	2	1.2	3	<MDC	0.08	55	-2.1	-9	<MDC	0.00	0.08	26	1	2
BHB-1204-F1-V-003	0	-7	-15	<MDC	0.00	118	360	699	<MDC	0.10	0.10	0	-0.8	-2	<MDC	0.00	64	6.9	29	<MDC	0.04	0.04	26	0	0
BHB-1204-B1-M-004	0	-7	-15	<MDC	0.00	109	270	524	<MDC	0.07	0.07	1	0.2	1	<MDC	0.01	62	4.9	20	<MDC	0.03	0.04	**40**	13	1
BHB-1204-B1-M-005	0	-7	-15	<MDC	0.00	110	280	544	<MDC	0.08	0.08	2	1.2	3	<MDC	0.08	56	-1.1	-5	<MDC	0.00	0.08	**59**	0	0
BHB-1204-F1-V-006	2	13	28	<MDC	0.07	90	80	155	<MDC	0.02	0.09	1	0.2	1	<MDC	0.01	64	6.9	29	<MDC	0.04	0.05	**41**	0	4
BHB-1204-F1-V-007	4	33	71	<MDC	0.17	106	240	466	<MDC	0.07	0.24	2	1.2	3	<MDC	0.08	46	-11.1	-46	<MDC	0.00	0.08	**44**	0	0
BHB-1204-F1-V-008	3	23	49	<MDC	0.12	97	150	291	<MDC	0.04	0.16	1	0.2	1	<MDC	0.01	64	6.9	29	<MDC	0.04	0.05	20	4	2
BHB-1204-F1-V-009	1	3	6	<MDC	0.02	90	80	155	<MDC	0.02	0.04	2	1.2	3	<MDC	0.08	61	3.9	16	<MDC	0.02	0.11	23	5	0
BHB-1204-F1-V-010	0	-7	-15	<MDC	0.00	95	130	252	<MDC	0.04	0.04	0	-0.8	-2	<MDC	0.00	67	9.9	41	<MDC	0.06	0.06	21	5	1
BHB-1204-B1-M-011	1	3	6	<MDC	0.02	93	110	214	<MDC	0.03	0.05	1	0.2	1	<MDC	0.01	66	8.9	37	<MDC	0.05	0.07	**46**	2	0
BHB-1204-B1-M-012	2	13	28	<MDC	0.07	108	260	505	<MDC	0.07	0.14	2	1.2	3	<MDC	0.08	59	1.9	8	<MDC	0.01	0.09	21	5	0
BHB-1204-F1-V-013	0	-7	-15	<MDC	0.00	101	190	369	<MDC	0.05	0.05	0	-0.8	-2	<MDC	0.00	65	7.9	33	<MDC	0.05	0.05	30	12	2
BHB-1204-F1-V-014	3	23	49	<MDC	0.12	64	-180	-350	<MDC	0.00	0.12	1	0.2	1	<MDC	0.01	41	-16.1	-67	<MDC	0.00	0.01	32	12	0
BHB-1204-F1-V-015	2	13	28	<MDC	0.07	98	160	311	<MDC	0.04	0.11	1	0.2	1	<MDC	0.01	66	8.9	37	<MDC	0.05	0.07	28	6	1
BHB-1204-F1-V-016	0	-7	-15	<MDC	0.00	103	210	408	<MDC	0.06	0.06	1	0.2	1	<MDC	0.01	64	6.9	29	<MDC	0.04	0.05	23	10	0
BHB-1204-B1-M-017	0	-7	-15	<MDC	0.00	91	90	175	<MDC	0.02	0.02	1	0.2	1	<MDC	0.01	54	-3.1	-13	<MDC	0.00	0.01	31	4	0
Count	---	---	17	---	---	---	---	17	---	---	17	---	---	17	---	---	---	---	17	---	---	17	17	17	17
Min	---	---	-15	---	---	---	---	-350	---	---	0.02	---	---	-2	---	---	---	---	-67	---	---	0.01	20	0	0
Max	---	---	71	---	---	---	---	699	---	---	0.24	---	---	3	---	---	---	---	41	---	---	0.11	59	13	4
Median	---	---	6	---	---	---	---	350	---	---	0.08	---	---	1	---	---	---	---	20	---	---	0.06	28	4	0
Mean	---	---	10	---	---	---	---	324	---	---	0.09	---	---	1	---	---	---	---	9	---	---	0.06	31	5	1
StDev	---	---	29	---	---	---	---	232	---	---	0.08	---	---	2	---	---	---	---	31	---	---	0.07	11	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-1205	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	3	32.04%	0.25	8.01%	0.1	1	584	105	407	26%
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Beta	Total	1070	35.27%	0.25	8.82%	0.1	0.1	584	993	7,050	14%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	56.9	23.92%	1	23.92%	1	10	100	121	705	17%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha				Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1205-F1-V-001	0	-3	-6	<MDC	0.00	94	-130	-252	<MDC	0.00	0.00	2	1.2	3	<MDC	0.08	69	12.1	51	<MDC	0.07	0.15	21	9	4
BHB-1205-F1-V-002	0	-3	-6	<MDC	0.00	116	90	175	<MDC	0.02	0.02	1	0.2	1	<MDC	0.01	53	-3.9	-16	<MDC	0.00	0.01	**46**	5	0
BHB-1205-F1-V-003	2	17	36	<MDC	0.09	70	-370	-719	<MDC	0.00	0.09	0	-0.8	-2	<MDC	0.00	63	6.1	26	<MDC	0.04	0.04	**39**	5	1
BHB-1205-F1-V-004	3	27	58	<MDC	0.14	96	-110	-214	<MDC	0.00	0.14	0	-0.8	-2	<MDC	0.00	46	-10.9	-46	<MDC	0.00	0.00	**42**	5	3
BHB-1205-F1-V-005	2	17	36	<MDC	0.09	87	-200	-388	<MDC	0.00	0.09	0	-0.8	-2	<MDC	0.00	56	-0.9	-4	<MDC	0.00	0.00	24	0	0
BHB-1205-F1-V-006	0	-3	-6	<MDC	0.00	86	-210	-408	<MDC	0.00	0.00	1	0.2	1	<MDC	0.01	55	-1.9	-8	<MDC	0.00	0.01	**37**	5	0
BHB-1205-F1-V-007	1	7	15	<MDC	0.04	89	-180	-350	<MDC	0.00	0.04	0	-0.8	-2	<MDC	0.00	59	2.1	9	<MDC	0.01	0.01	**36**	4	3
BHB-1205-F1-V-008	0	-3	-6	<MDC	0.00	97	-100	-194	<MDC	0.00	0.00	0	-0.8	-2	<MDC	0.00	61	4.1	17	<MDC	0.02	0.02	**38**	2	0
BHB-1205-F1-V-009	1	7	15	<MDC	0.04	96	-110	-214	<MDC	0.00	0.04	1	0.2	1	<MDC	0.01	62	5.1	21	<MDC	0.03	0.04	18	5	0
BHB-1205-F1-V-010	1	7	15	<MDC	0.04	116	90	175	<MDC	0.02	0.06	2	1.2	3	<MDC	0.08	57	0.1	0	<MDC	0.00	0.08	**49**	2	1
BHB-1205-F1-V-011	1	7	15	<MDC	0.04	104	-30	-58	<MDC	0.00	0.04	1	0.2	1	<MDC	0.01	63	6.1	26	<MDC	0.04	0.05	**51**	3	2
BHB-1205-F1-V-012	1	7	15	<MDC	0.04	114	70	136	<MDC	0.02	0.06	1	0.2	1	<MDC	0.01	54	-2.9	-12	<MDC	0.00	0.01	**51**	6	0
BHB-1205-F1-V-013	1	7	15	<MDC	0.04	124	170	330	<MDC	0.05	0.08	2	1.2	3	<MDC	0.08	67	10.1	42	<MDC	0.06	0.14	20	10	2
BHB-1205-F1-V-014	1	7	15	<MDC	0.04	83	-240	-466	<MDC	0.00	0.04	1	0.2	1	<MDC	0.01	55	-1.9	-8	<MDC	0.00	0.01	20	6	2
Count	---	---	14	---	---	---	---	14	---	---	14	---	---	14	---	---	---	---	14	---	---	14	14	14	14
Min	---	---	-6	---	---	---	---	-719	---	---	0.00	---	---	-2	---	---	---	---	-46	---	---	0.00	18	0	0
Max	---	---	58	---	---	---	---	330	---	---	0.14	---	---	3	---	---	---	---	51	---	---	0.15	51	10	4
Median	---	---	15	---	---	---	---	-214	---	---	0.04	---	---	1	---	---	---	---	5	---	---	0.02	38	5	1
Mean	---	---	15	---	---	---	---	-175	---	---	0.05	---	---	0	---	---	---	---	7	---	---	0.04	35	5	1
StDev	---	---	19	---	---	---	---	295	---	---	0.06	---	---	2	---	---	---	---	25	---	---	0.06	12	3	1

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-1301 | **Type of Survey:** Final Status | **Surveyor 1:** Kirby Gemillion | **Surveyor 2:** | **Date:** 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Alpha	Total	1	31.56%	0.25	7.89%	0.1	1	584	89	407	22%
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Beta	Total	1050	33.97%	0.25	8.49%	0.1	0.1	584	1,022	7,050	14%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	57.1	23.92%	1	23.92%	1	10	100	122	705	17%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1301-F1-V-001	1	9	20	<MDC	0.05	133	280	565	<MDC	0.08	0.13	0	-0.8	-2	<MDC	0.00	77	19.9	83	<MDC	0.12	0.12	**47**	2	4
BHB-1301-F1-V-002	2	19	41	<MDC	0.10	114	90	181	<MDC	0.03	0.13	1	0.2	1	<MDC	0.01	67	9.9	41	<MDC	0.06	0.07	27	3	0
BHB-1301-F1-V-003	0	-1	-2	<MDC	0.00	119	140	282	<MDC	0.04	0.04	1	0.2	1	<MDC	0.01	60	2.9	12	<MDC	0.02	0.03	**80**	5	0
BHB-1301-F1-T-004	4	39	85	<MDC	0.21	226	1210	**2,440**		0.35	0.55	1	0.2	1	<MDC	0.01	59	1.9	8	<MDC	0.01	0.02	**36**	2	0
BHB-1301-F1-T-005	1	9	20	<MDC	0.05	153	480	968	<MDC	0.14	0.19	1	0.2	1	<MDC	0.01	43	-14.1	-59	<MDC	0.00	0.01	**73**	0	0
BHB-1301-F1-T-006	2	19	41	<MDC	0.10	216	1110	**2,238**		0.32	0.42	1	0.2	1	<MDC	0.01	58	0.9	4	<MDC	0.01	0.02	**61**	7	3
BHB-1301-F1-V-007	2	19	41	<MDC	0.10	126	210	423	<MDC	0.06	0.16	1	0.2	1	<MDC	0.01	65	7.9	33	<MDC	0.05	0.06	29	5	0
BHB-1301-F1-V-008	0	-1	-2	<MDC	0.00	128	230	464	<MDC	0.07	0.07	2	1.2	3	<MDC	0.08	49	-8.1	-34	<MDC	0.00	0.08	21	1	4
BHB-1301-F1-V-009	0	-1	-2	<MDC	0.00	121	160	323	<MDC	0.05	0.05	2	1.2	3	<MDC	0.08	48	-9.1	-38	<MDC	0.00	0.08	30	12	0
BHB-1301-F1-V-010	1	9	20	<MDC	0.05	123	180	363	<MDC	0.05	0.10	2	1.2	3	<MDC	0.08	64	6.9	29	<MDC	0.04	0.12	**42**	20	4
BHB-1301-F1-V-011	0	-1	-2	<MDC	0.00	128	230	464	<MDC	0.07	0.07	0	-0.8	-2	<MDC	0.00	51	-6.1	-26	<MDC	0.00	0.00	**41**	2	2
BHB-1301-F1-T-012	2	19	41	<MDC	0.10	196	910	**1,835**		0.26	0.36	0	-0.8	-2	<MDC	0.00	58	0.9	4	<MDC	0.01	0.01	17	0	1
BHB-1301-F1-M-013	2	19	41	<MDC	0.10	112	70	141	<MDC	0.02	0.12	0	-0.8	-2	<MDC	0.00	48	-9.1	-38	<MDC	0.00	0.00	24	12	3
BHB-1301-F1-M-014	2	19	41	<MDC	0.10	131	260	524	<MDC	0.07	0.18	0	-0.8	-2	<MDC	0.00	58	0.9	4	<MDC	0.01	0.01	8	8	3
BHB-1301-F1-V-015	0	-1	-2	<MDC	0.00	120	150	302	<MDC	0.04	0.04	1	0.2	1	<MDC	0.01	74	16.9	71	<MDC	0.10	0.11	25	4	5
Count	---	---	15	---	---	---	---	15	---	---	15	---	---	15	---	---	---	---	15	---	---	15	15	15	15
Min	---	---	-2	---	---	---	---	141	---	---	0.04	---	---	-2	---	---	---	---	-59	---	---	0.00	8	0	0
Max	---	---	85	---	---	---	---	2,440	---	---	0.55	---	---	3	---	---	---	---	83	---	---	0.12	80	20	5
Median	---	---	20	---	---	---	---	464	---	---	0.13	---	---	1	---	---	---	---	4	---	---	0.03	30	4	2
Mean	---	---	25	---	---	---	---	768	---	---	0.17	---	---	0	---	---	---	---	6	---	---	0.05	37	6	2
StDev	---	---	25	---	---	---	---	760	---	---	0.12	---	---	2	---	---	---	---	41	---	---	0.08	21	6	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-1302 | **Type of Survey:** Final Status | **Surveyor 1:** Kirby Gemillion | **Surveyor 2:** | **Date:** 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Alpha	Total	7	31.56%	0.25	7.89%	0.1	1	584	128	407	31%
2241-3 / 253351 43-37 / 178300	**SAT**	**8/24/2017**	**Beta**	**Total**	**1160**	**33.97%**	**0.25**	**8.49%**	**0.1**	**0.1**	**584**	**1,071**	**7,050**	**15%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.8	36.49%	1	36.49%	1	10	100	17	40	42%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**57.1**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**122**	**705**	**17%**

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta						
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1302-F1-V-001	0	-7	-15	<MDC	0.00	132	160	323	<MDC	0.05	0.05	1	0.2	1	<MDC	0.01	62	4.9	20	<MDC	0.03	0.04	**50**	4	2
BHB-1302-B1-M-002	1	3	7	<MDC	0.02	116	0	0	<MDC	0.00	0.02	0	-0.8	-2	<MDC	0.00	54	-3.1	-13	<MDC	0.00	0.00	31	0	0
BHB-1302-F1-V-003	0	-7	-15	<MDC	0.00	147	310	625	<MDC	0.09	0.09	1	0.2	1	<MDC	0.01	46	-11.1	-46	<MDC	0.00	0.01	**63**	2	1
BHB-1302-F1-V-004	5	43	93	<MDC	0.23	174	580	**1,169**		0.17	0.40	0	-0.8	-2	<MDC	0.00	65	7.9	33	<MDC	0.05	0.05	27	8	0
BHB-1302-F1-V-005	1	3	7	<MDC	0.02	89	-270	-544	<MDC	0.00	0.02	1	0.2	1	<MDC	0.01	62	4.9	20	<MDC	0.03	0.04	**37**	0	2
BHB-1302-F1-V-006	0	-7	-15	<MDC	0.00	161	450	907	<MDC	0.13	0.13	2	1.2	3	<MDC	0.08	64	6.9	29	<MDC	0.04	0.12	**55**	0	0
BHB-1302-F1-V-007	1	3	7	<MDC	0.02	121	50	101	<MDC	0.01	0.03	1	0.2	1	<MDC	0.01	57	-0.1	0	<MDC	0.00	0.01	35	13	0
BHB-1302-F1-V-008	0	-7	-15	<MDC	0.00	123	70	141	<MDC	0.02	0.02	1	0.2	1	<MDC	0.01	51	-6.1	-26	<MDC	0.00	0.01	**66**	0	1
BHB-1302-F1-V-009	0	-7	-15	<MDC	0.00	162	460	927	<MDC	0.13	0.13	2	1.2	3	<MDC	0.08	59	1.9	8	<MDC	0.01	0.09	**45**	3	0
BHB-1302-F1-V-010	2	13	28	<MDC	0.07	151	350	706	<MDC	0.10	0.17	0	-0.8	-2	<MDC	0.00	68	10.9	46	<MDC	0.06	0.06	**50**	6	6
BHB-1302-F1-V-011	0	-7	-15	<MDC	0.00	130	140	282	<MDC	0.04	0.04	1	0.2	1	<MDC	0.01	69	11.9	50	<MDC	0.07	0.08	**64**	1	0
BHB-1302-F1-V-012	0	-7	-15	<MDC	0.00	123	70	141	<MDC	0.02	0.02	2	1.2	3	<MDC	0.08	51	-6.1	-26	<MDC	0.00	0.08	**82**	4	2
BHB-1302-F1-T-013	2	13	28	<MDC	0.07	294	1780	**3,589**		0.51	**0.58**	2	1.2	3	<MDC	0.08	50	-7.1	-30	<MDC	0.00	0.08	34	6	4
BHB-1302-F1-V-014	1	3	7	<MDC	0.02	147	310	625	<MDC	0.09	0.10	2	1.2	3	<MDC	0.08	40	-17.1	-71	<MDC	0.00	0.08	14	8	0
BHB-1302-F1-T-015	0	-7	-15	<MDC	0.00	232	1160	**2,339**		0.33	0.33	1	0.2	1	<MDC	0.01	66	8.9	37	<MDC	0.05	0.07	32	10	0
BHB-1302-F1-V-016	6	53	115	<MDC	0.28	136	200	403	<MDC	0.06	0.34	1	0.2	1	<MDC	0.01	65	7.9	33	<MDC	0.05	0.06	**51**	8	0
Count	---	---	16	---	---	---	---	16	---	---	16	---	---	16	---	---	---	---	16	---	---	16	16	16	16
Min	---	---	-15	---	---	---	---	-544	---	---	0.02	---	---	-2	---	---	---	---	-71	---	---	0.00	14	0	0
Max	---	---	115	---	---	---	---	3,589	---	---	0.58	---	---	3	---	---	---	---	50	---	---	0.12	82	13	6
Median	---	---	-4	---	---	---	---	514	---	---	0.10	---	---	1	---	---	---	---	14	---	---	0.06	48	4	0
Mean	---	---	11	---	---	---	---	733	---	---	0.15	---	---	1	---	---	---	---	4	---	---	0.06	46	5	1
StDev	---	---	40	---	---	---	---	992	---	---	0.17	---	---	2	---	---	---	---	36	---	---	0.07	18	4	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-1303 | **Type of Survey:** Final Status | **Surveyor 1:** Stefan Herold | **Surveyor 2:** Kirby Gemillion | **Date:** 12/13/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / 281040	SAT	1/11/2017	Alpha	Total	5	32.04%	0.25	8.01%	0.1	1	584	116	407	29%
2241-3 / 253346 43-37 / 281040	SAT	1/11/2017	Beta	Total	1010	35.27%	0.25	8.82%	0.1	0.1	584	966	7,050	14%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.1	36.49%	1	36.49%	1	10	100	18	40	45%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	60.4	23.92%	1	23.92%	1	10	100	125	705	18%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-1303-F1-V-001	1	5	11	<MDC	0.03	94	-70	-136	<MDC	0.00	0.03	2	0.9	2	<MDC	0.06	58	-2.4	-10	<MDC	0.00	0.06	27	2	9
BHB-1303-F1-M-002	2	15	32	<MDC	0.08	96	-50	-97	<MDC	0.00	0.08	1	-0.1	0	<MDC	0.00	59	-1.4	-6	<MDC	0.00	0.00	**57**	5	4
BHB-1303-F1-M-003	1	5	11	<MDC	0.03	175	740	**1,437**		0.20	0.23	2	0.9	2	<MDC	0.06	61	0.6	3	<MDC	0.00	0.07	**46**	17	0
BHB-1303-F1-V-004	0	-5	-11	<MDC	0.00	93	-80	-155	<MDC	0.00	0.00	1	-0.1	0	<MDC	0.00	71	10.6	44	<MDC	0.06	0.06	29	9	0
BHB-1303-F1-V-005	0	-5	-11	<MDC	0.00	92	-90	-175	<MDC	0.00	0.00	1	-0.1	0	<MDC	0.00	59	-1.4	-6	<MDC	0.00	0.00	**54**	10	1
BHB-1303-F1-V-006	1	5	11	<MDC	0.03	92	-90	-175	<MDC	0.00	0.03	0	-1.1	-3	<MDC	0.00	60	-0.4	-2	<MDC	0.00	0.00	**46**	18	0
BHB-1303-F1-V-007	0	-5	-11	<MDC	0.00	88	-130	-252	<MDC	0.00	0.00	0	-1.1	-3	<MDC	0.00	66	5.6	23	<MDC	0.03	0.03	**61**	3	2
BHB-1303-B1-M-008	2	15	32	<MDC	0.08	82	-190	-369	<MDC	0.00	0.08	1	-0.1	0	<MDC	0.00	60	-0.4	-2	<MDC	0.00	0.00	**55**	10	5
BHB-1303-F1-V-009	0	-5	-11	<MDC	0.00	98	-30	-58	<MDC	0.00	0.00	3	1.9	5	<MDC	0.13	45	-15.4	-64	<MDC	0.00	0.13	**54**	0	0
BHB-1303-F1-V-010	0	-5	-11	<MDC	0.00	115	140	272	<MDC	0.04	0.04	2	0.9	2	<MDC	0.06	47	-13.4	-56	<MDC	0.00	0.06	**65**	7	2
BHB-1303-B1-M-011	0	-5	-11	<MDC	0.00	93	-80	-155	<MDC	0.00	0.00	1	-0.1	0	<MDC	0.00	40	-20.4	-85	<MDC	0.00	0.00	**101**	12	0
BHB-1303-F1-C-012	1	5	11	<MDC	0.03	98	-30	-58	<MDC	0.00	0.03	1	-0.1	0	<MDC	0.00	56	-4.4	-18	<MDC	0.00	0.00	**80**	3	0
BHB-1303-F1-M-013	1	5	11	<MDC	0.03	90	-110	-214	<MDC	0.00	0.03	2	0.9	2	<MDC	0.06	59	-1.4	-6	<MDC	0.00	0.06	23	1	0
BHB-1303-F1-M-014	2	15	32	<MDC	0.08	80	-210	-408	<MDC	0.00	0.08	0	-1.1	-3	<MDC	0.00	55	-5.4	-23	<MDC	0.00	0.00	**73**	1	4
BHB-1303-F1-V-015	1	5	11	<MDC	0.03	101	0	0	<MDC	0.00	0.03	1	-0.1	0	<MDC	0.00	52	-8.4	-35	<MDC	0.00	0.00	**48**	3	4
Count	---	---	15	---	---	---	---	15	---	---	15	---	---	15	---	---	---	---	15	---	---	15	15	15	15
Min	---	---	-11	---	---	---	---	-408	---	---	0.00	---	---	-3	---	---	---	---	-85	---	---	0.00	23	0	0
Max	---	---	32	---	---	---	---	1,437	---	---	0.23	---	---	5	---	---	---	---	44	---	---	0.13	101	18	9
Median	---	---	11	---	---	---	---	-155	---	---	0.03	---	---	0	---	---	---	---	-6	---	---	0.00	54	5	1
Mean	---	---	6	---	---	---	---	-36	---	---	0.04	---	---	0	---	---	---	---	-16	---	---	0.03	55	7	2
StDev	---	---	17	---	---	---	---	437	---	---	0.07	---	---	2	---	---	---	---	33	---	---	0.08	21	6	3

Project: CMU Brooks Hall Building Decommissioning			Survey Unit: BHB-2101			Type of Survey: Final Status				Surveyor 1: Rebecca Mumper					Surveyor 2:	Date: 12/18/16
Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)	Comments: Results above MDC are in bold. Results above the investigation level are in red.	
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	8	32.04%	0.25	8.01%	0.1	1	584	130	407	32%		
2241-3 / 253346 43-37 / PR259902	**SAT**	**1/11/2017**	**Beta**	**Total**	**1000**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**962**	**7,050**	**14%**		
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.7	36.49%	1	36.49%	1	10	100	16	40	40%		
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**58.7**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**123**	**705**	**17%**	**Reviewed:** Mike Culp	**Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-2101-W1-B-001	0	-8	-17	<MDC	0.00	108	80	155	<MDC	0.02	0.02	0	-0.7	-2	<MDC	0.00	61	2.3	10	<MDC	0.01	0.01	19	5	0
BHB-2101-W1-B-002	0	-8	-17	<MDC	0.00	108	80	155	<MDC	0.02	0.02	0	-0.7	-2	<MDC	0.00	40	-18.7	-78	<MDC	0.00	0.00	23	6	4
BHB-2101-W1-B-003	0	-8	-17	<MDC	0.00	120	200	388	<MDC	0.06	0.06	0	-0.7	-2	<MDC	0.00	53	-5.7	-24	<MDC	0.00	0.00	32	0	7
BHB-2101-F1-M-004	0	-8	-17	<MDC	0.00	88	-120	-233	<MDC	0.00	0.00	1	0.3	1	<MDC	0.02	55	-3.7	-15	<MDC	0.00	0.02	**40**	1	0
BHB-2101-F1-M-005	1	2	4	<MDC	0.01	85	-150	-291	<MDC	0.00	0.01	0	-0.7	-2	<MDC	0.00	68	9.3	39	<MDC	0.06	0.06	6	8	0
BHB-2101-W1-B-006	1	2	4	<MDC	0.01	112	120	233	<MDC	0.03	0.04	0	-0.7	-2	<MDC	0.00	58	-0.7	-3	<MDC	0.00	0.00	20	9	2
BHB-2101-W1-B-007	1	2	4	<MDC	0.01	106	60	117	<MDC	0.02	0.03	1	0.3	1	<MDC	0.02	66	7.3	31	<MDC	0.04	0.06	**53**	12	0
BHB-2101-F1-M-008	1	2	4	<MDC	0.01	86	-140	-272	<MDC	0.00	0.01	1	0.3	1	<MDC	0.02	69	10.3	43	<MDC	0.06	0.08	**61**	6	0
BHB-2101-F1-M-009	1	2	4	<MDC	0.01	86	-140	-272	<MDC	0.00	0.01	2	1.3	4	<MDC	0.09	55	-3.7	-15	<MDC	0.00	0.09	**45**	0	1
BHB-2101-W1-B-010	1	2	4	<MDC	0.01	108	80	155	<MDC	0.02	0.03	2	1.3	4	<MDC	0.09	56	-2.7	-11	<MDC	0.00	0.09	**57**	0	3
BHB-2101-W1-B-011	0	-8	-17	<MDC	0.00	101	10	19	<MDC	0.00	0.00	4	3.3	9	<MDC	0.23	50	-8.7	-36	<MDC	0.00	0.23	**67**	3	0
BHB-2101-F1-M-012	0	-8	-17	<MDC	0.00	81	-190	-369	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	63	4.3	18	<MDC	0.03	0.03	**37**	2	0
BHB-2101-F1-M-013	3	22	47	<MDC	0.12	97	-30	-58	<MDC	0.00	0.12	0	-0.7	-2	<MDC	0.00	54	-4.7	-20	<MDC	0.00	0.00	**60**	0	3
BHB-2101-W1-B-014	0	-8	-17	<MDC	0.00	89	-110	-214	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	64	5.3	22	<MDC	0.03	0.03	**44**	2	2
BHB-2101-W1-M-015	1	2	4	<MDC	0.01	76	-240	-466	<MDC	0.00	0.01	3	2.3	6	<MDC	0.16	65	6.3	26	<MDC	0.04	0.19	16	6	0
BHB-2101-W1-B-016	0	-8	-17	<MDC	0.00	117	170	330	<MDC	0.05	0.05	1	0.3	1	<MDC	0.02	57	-1.7	-7	<MDC	0.00	0.02	34	5	0
Count	---	---	16	---	---	---	---	16	---	---	16	---	---	16	---	---	---	---	16	---	---	16	16	16	16
Min	---	---	-17	---	---	---	---	-466	---	---	0.00	---	---	-2	---	---	---	---	-78	---	---	0.00	6	0	0
Max	---	---	47	---	---	---	---	388	---	---	0.12	---	---	9	---	---	---	---	43	---	---	0.23	67	12	7
Median	---	---	-6	---	---	---	---	-19	---	---	0.02	---	---	-1	---	---	---	---	-5	---	---	0.03	39	4	0
Mean	---	---	-4	---	---	---	---	-39	---	---	0.03	---	---	1	---	---	---	---	-1	---	---	0.06	38	4	1
StDev	---	---	17	---	---	---	---	267	---	---	0.06	---	---	3	---	---	---	---	32	---	---	0.10	18	4	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-2201 | **Type of Survey:** Final Status | **Surveyor 1:** Kirby Gemillion | **Surveyor 2:** | **Date:** 12/13/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / 259902	SAT	1/11/2017	Alpha	Total	7	32.04%	0.25	8.01%	0.1	1	584	126	407	31%
2241-3 / 253346 43-37 / 259902	**SAT**	**1/11/2017**	**Beta**	**Total**	**820**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**876**	**7,050**	**12%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.1	36.49%	1	36.49%	1	10	100	18	40	45%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**60.4**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**125**	**705**	**18%**

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-2201-F1-V-001	1	3	6	<MDC	0.02	85	30	58	<MDC	0.01	0.02	1	-0.1	0	<MDC	0.00	50	-10.4	-43	<MDC	0.00	0.00	29	7	0
BHB-2201-F1-V-002	2	13	28	<MDC	0.07	81	-10	-19	<MDC	0.00	0.07	0	-1.1	-3	<MDC	0.00	62	1.6	7	<MDC	0.01	0.01	**50**	4	0
BHB-2201-F1-V-003	0	-7	-15	<MDC	0.00	104	220	427	<MDC	0.06	0.06	1	-0.1	0	<MDC	0.00	57	-3.4	-14	<MDC	0.00	0.00	26	7	0
BHB-2201-F1-V-004	1	3	6	<MDC	0.02	69	-130	-252	<MDC	0.00	0.02	1	-0.1	0	<MDC	0.00	56	-4.4	-18	<MDC	0.00	0.00	35	0	0
BHB-2201-F1-V-005	2	13	28	<MDC	0.07	86	40	78	<MDC	0.01	0.08	3	1.9	5	<MDC	0.13	62	1.6	7	<MDC	0.01	0.14	**73**	8	0
BHB-2201-F1-V-006	2	13	28	<MDC	0.07	47	-350	-680	<MDC	0.00	0.07	0	-1.1	-3	<MDC	0.00	57	-3.4	-14	<MDC	0.00	0.00	**69**	5	0
BHB-2201-F1-V-007	3	23	49	<MDC	0.12	85	30	58	<MDC	0.01	0.13	1	-0.1	0	<MDC	0.00	63	2.6	11	<MDC	0.02	0.02	**62**	0	5
BHB-2201-F1-V-008	0	-7	-15	<MDC	0.00	93	110	214	<MDC	0.03	0.03	0	-1.1	-3	<MDC	0.00	61	0.6	3	<MDC	0.00	0.00	35	9	0
BHB-2201-F1-V-009	0	-7	-15	<MDC	0.00	81	-10	-19	<MDC	0.00	0.00	5	3.9	11	<MDC	0.27	47	-13.4	-56	<MDC	0.00	0.27	**42**	3	0
BHB-2201-F1-V-010	0	-7	-15	<MDC	0.00	92	100	194	<MDC	0.03	0.03	2	0.9	2	<MDC	0.06	64	3.6	15	<MDC	0.02	0.08	**43**	9	0
BHB-2201-F1-V-011	0	-7	-15	<MDC	0.00	79	-30	-58	<MDC	0.00	0.00	2	0.9	2	<MDC	0.06	60	-0.4	-2	<MDC	0.00	0.06	**76**	8	0
BHB-2201-F1-V-012	1	3	6	<MDC	0.02	85	30	58	<MDC	0.01	0.02	1	-0.1	0	<MDC	0.00	56	-4.4	-18	<MDC	0.00	0.00	**43**	7	0
BHB-2201-F1-V-013	0	-7	-15	<MDC	0.00	98	160	311	<MDC	0.04	0.04	0	-1.1	-3	<MDC	0.00	61	0.6	3	<MDC	0.00	0.00	**52**	11	0
BHB-2201-F1-V-014	0	-7	-15	<MDC	0.00	84	20	39	<MDC	0.01	0.01	0	-1.1	-3	<MDC	0.00	57	-3.4	-14	<MDC	0.00	0.00	**72**	8	0
BHB-2201-F1-V-015	1	3	6	<MDC	0.02	89	70	136	<MDC	0.02	0.04	2	0.9	2	<MDC	0.06	54	-6.4	-27	<MDC	0.00	0.06	**85**	6	0
Count	---	---	15	---	---	---	---	15	---	---	15	---	---	15	---	---	---	---	15	---	---	15	15	15	15
Min	---	---	-15	---	---	---	---	-680	---	---	0.00	---	---	-3	---	---	---	---	-56	---	---	0.00	26	0	0
Max	---	---	49	---	---	---	---	427	---	---	0.13	---	---	11	---	---	---	---	15	---	---	0.27	85	11	5
Median	---	---	6	---	---	---	---	58	---	---	0.03	---	---	0	---	---	---	---	-14	---	---	0.00	50	7	0
Mean	---	---	4	---	---	---	---	36	---	---	0.04	---	---	0	---	---	---	---	-11	---	---	0.04	53	6	0
StDev	---	---	21	---	---	---	---	255	---	---	0.06	---	---	4	---	---	---	---	20	---	---	0.10	19	3	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-2301	Type of Survey: Final Status	Surveyor 1: Rebecca Mumper	Surveyor 2:	Date: 12/18/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Alpha	Total	2	32.04%	0.25	8.01%	0.1	1	584	97	407	24%
2241-3 / 253346 43-37 / PR259902	SAT	1/11/2017	Beta	Total	940	35.27%	0.25	8.82%	0.1	0.1	584	934	7,050	13%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.7	36.49%	1	36.49%	1	10	100	16	40	40%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	58.7	23.92%	1	23.92%	1	10	100	123	705	17%

Comments:
Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-2301-F1-V-001	0	-2	-4	<MDC	0.00	71	-230	-447	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	49	-9.7	-41	<MDC	0.00	0.00	**48**	15	0
BHB-2301-F1-V-002	0	-2	-4	<MDC	0.00	84	-100	-194	<MDC	0.00	0.00	3	2.3	6	<MDC	0.16	70	11.3	47	<MDC	0.07	0.22	**53**	4	1
BHB-2301-F1-V-003	0	-2	-4	<MDC	0.00	68	-260	-505	<MDC	0.00	0.00	1	0.3	1	<MDC	0.02	59	0.3	1	<MDC	0.00	0.02	**75**	18	0
BHB-2301-F1-V-004	2	18	38	<MDC	0.09	58	-360	-699	<MDC	0.00	0.09	0	-0.7	-2	<MDC	0.00	73	14.3	60	<MDC	0.08	0.08	**65**	11	2
BHB-2301-F1-M-005	1	8	17	<MDC	0.04	95	10	19	<MDC	0.00	0.04	1	0.3	1	<MDC	0.02	63	4.3	18	<MDC	0.03	0.05	**60**	10	4
BHB-2301-F1-V-006	0	-2	-4	<MDC	0.00	84	-100	-194	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	61	2.3	10	<MDC	0.01	0.01	**63**	0	0
BHB-2301-F1-T-007	0	-2	-4	<MDC	0.00	181	870	**1,690**		0.24	0.24	0	-0.7	-2	<MDC	0.00	55	-3.7	-15	<MDC	0.00	0.00	**78**	6	0
BHB-2301-F1-V-008	0	-2	-4	<MDC	0.00	104	100	194	<MDC	0.03	0.03	2	1.3	4	<MDC	0.09	60	1.3	5	<MDC	0.01	0.10	**78**	6	1
BHB-2301-F1-V-009	0	-2	-4	<MDC	0.00	92	-20	-39	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	61	2.3	10	<MDC	0.01	0.01	**36**	2	1
BHB-2301-F1-T-010	0	-2	-4	<MDC	0.00	262	1680	**3,263**		0.46	0.46	0	-0.7	-2	<MDC	0.00	51	-7.7	-32	<MDC	0.00	0.00	**58**	5	0
BHB-2301-F1-M-011	0	-2	-4	<MDC	0.00	90	-40	-78	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	55	-3.7	-15	<MDC	0.00	0.00	**69**	6	1
BHB-2301-F1-M-012	0	-2	-4	<MDC	0.00	79	-150	-291	<MDC	0.00	0.00	2	1.3	4	<MDC	0.09	58	-0.7	-3	<MDC	0.00	0.09	**53**	8	1
BHB-2301-F1-V-013	0	-2	-4	<MDC	0.00	86	-80	-155	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	54	-4.7	-20	<MDC	0.00	0.00	**47**	10	0
BHB-2301-F1-V-014	0	-2	-4	<MDC	0.00	84	-100	-194	<MDC	0.00	0.00	2	1.3	4	<MDC	0.09	65	6.3	26	<MDC	0.04	0.13	**82**	4	0
Count	---	---	14	---	---	---	---	14	---	---	14	---	---	14	---	---	---	---	14	---	---	14	14	14	14
Min	---	---	-4	---	---	---	---	-699	---	---	0.00	---	---	-2	---	---	---	---	-41	---	---	0.00	36	0	0
Max	---	---	38	---	---	---	---	3,263	---	---	0.46	---	---	6	---	---	---	---	60	---	---	0.22	82	18	4
Median	---	---	-4	---	---	---	---	-175	---	---	0.00	---	---	-2	---	---	---	---	3	---	---	0.02	62	6	1
Mean	---	---	0	---	---	---	---	169	---	---	0.06	---	---	0	---	---	---	---	4	---	---	0.05	62	8	1
StDev	---	---	12	---	---	---	---	1,049	---	---	0.15	---	---	3	---	---	---	---	28	---	---	0.08	14	5	1

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-3101 | **Type of Survey:** Final Status | **Surveyor 1:** Jay Gluck | **Surveyor 2:** | **Date:** 12/20/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 267138 43-37 / PR286832	SAT	5/4/2017	Alpha	Total	7	33.94%	0.25	8.49%	0.1	1	584	119	407	29%
2241-3 / 267138 43-37 / PR286832	SAT	5/4/2017	Beta	Total	1040	37.13%	0.25	9.28%	0.1	0.1	584	931	7,050	13%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1	36.49%	1	36.49%	1	10	100	18	40	44%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	59.7	23.92%	1	23.92%	1	10	100	124	705	18%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-3101-W1-M-001	1	3	6	<MDC	0.01	99	-50	-92	<MDC	0.00	0.01	1	0	0	<MDC	0.00	52	-7.7	-32	<MDC	0.00	0.00	**43**	9	0
BHB-3101-W1-M-002	1	3	6	<MDC	0.01	105	10	18	<MDC	0.00	0.02	2	1	3	<MDC	0.07	68	8.3	35	<MDC	0.05	0.12	12	7	0
BHB-3101-W1-B-003	1	3	6	<MDC	0.01	115	110	203	<MDC	0.03	0.04	0	-1	-3	<MDC	0.00	47	-12.7	-53	<MDC	0.00	0.00	3	0	0
BHB-3101-F1-V-004	0	-7	-14	<MDC	0.00	117	130	240	<MDC	0.03	0.03	1	0	0	<MDC	0.00	50	-9.7	-41	<MDC	0.00	0.00	9	2	0
BHB-3101-F1-V-005	0	-7	-14	<MDC	0.00	118	140	258	<MDC	0.04	0.04	3	2	5	<MDC	0.14	62	2.3	10	<MDC	0.01	0.15	0	6	2
BHB-3101-F1-V-006	1	3	6	<MDC	0.01	111	70	129	<MDC	0.02	0.03	3	2	5	<MDC	0.14	56	-3.7	-15	<MDC	0.00	0.14	22	0	1
BHB-3101-F1-V-007	1	3	6	<MDC	0.01	98	-60	-111	<MDC	0.00	0.01	1	0	0	<MDC	0.00	63	3.3	14	<MDC	0.02	0.02	7	4	1
BHB-3101-W1-B-008	0	-7	-14	<MDC	0.00	108	40	74	<MDC	0.01	0.01	0	-1	-3	<MDC	0.00	62	2.3	10	<MDC	0.01	0.01	9	0	0
BHB-3101-W1-B-009	1	3	6	<MDC	0.01	118	140	258	<MDC	0.04	0.05	0	-1	-3	<MDC	0.00	59	-0.7	-3	<MDC	0.00	0.00	22	7	0
BHB-3101-F1-V-010	0	-7	-14	<MDC	0.00	102	-20	-37	<MDC	0.00	0.00	0	-1	-3	<MDC	0.00	48	-11.7	-49	<MDC	0.00	0.00	**36**	3	0
BHB-3101-F1-V-011	0	-7	-14	<MDC	0.00	106	20	37	<MDC	0.01	0.01	0	-1	-3	<MDC	0.00	54	-5.7	-24	<MDC	0.00	0.00	30	3	0
BHB-3101-W1-B-012	0	-7	-14	<MDC	0.00	124	200	369	<MDC	0.05	0.05	1	0	0	<MDC	0.00	49	-10.7	-45	<MDC	0.00	0.00	22	5	6
BHB-3101-W1-B-013	1	3	6	<MDC	0.01	125	210	387	<MDC	0.05	0.07	0	-1	-3	<MDC	0.00	58	-1.7	-7	<MDC	0.00	0.00	10	0	0
Count	---	---	13	---	---	---	---	13	---	---	13	---	---	13	---	---	---	---	13	---	---	13	13	13	13
Min	---	---	-14	---	---	---	---	-111	---	---	0.00	---	---	-3	---	---	---	---	-53	---	---	0.00	0	0	0
Max	---	---	6	---	---	---	---	387	---	---	0.07	---	---	5	---	---	---	---	35	---	---	0.15	43	9	6
Median	---	---	6	---	---	---	---	129	---	---	0.03	---	---	0	---	---	---	---	-15	---	---	0.00	12	3	0
Mean	---	---	-3	---	---	---	---	133	---	---	0.03	---	---	0	---	---	---	---	-15	---	---	0.03	17	4	1
StDev	---	---	10	---	---	---	---	167	---	---	0.03	---	---	3	---	---	---	---	28	---	---	0.09	13	3	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-3301 | **Type of Survey:** Final Status | **Surveyor 1:** Kirby Gemillion | **Surveyor 2:** | **Date:** 12/19/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Alpha	Total	3	31.56%	0.25	7.89%	0.1	1	584	106	407	26%
2241-3 / 253351 43-37 / 178300	SAT	8/24/2017	Beta	Total	940	33.97%	0.25	8.49%	0.1	0.1	584	970	7,050	14%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	0.7	36.49%	1	36.49%	1	10	100	16	40	40%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	56.5	23.92%	1	23.92%	1	10	100	121	705	17%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-3301-F1-V-001	1	7	15	<MDC	0.04	109	150	302	<MDC	0.04	0.08	0	-0.7	-2	<MDC	0.00	49	-7.5	-31	<MDC	0.00	0.00	85	6	0
BHB-3301-F1-V-002	2	17	37	<MDC	0.09	113	190	383	<MDC	0.05	0.14	3	2.3	6	<MDC	0.16	41	-15.5	-65	<MDC	0.00	0.16	68	0	4
BHB-3301-F1-V-003	0	-3	-7	<MDC	0.00	101	70	141	<MDC	0.02	0.02	0	-0.7	-2	<MDC	0.00	48	-8.5	-36	<MDC	0.00	0.00	52	2	0
BHB-3301-F1-V-004	1	7	15	<MDC	0.04	112	180	363	<MDC	0.05	0.09	0	-0.7	-2	<MDC	0.00	59	2.5	10	<MDC	0.01	0.01	72	12	2
BHB-3301-F1-V-005	0	-3	-7	<MDC	0.00	92	-20	-40	<MDC	0.00	0.00	0	-0.7	-2	<MDC	0.00	65	8.5	36	<MDC	0.05	0.05	81	5	0
BHB-3301-F1-V-006	0	-3	-7	<MDC	0.00	107	130	262	<MDC	0.04	0.04	0	-0.7	-2	<MDC	0.00	60	3.5	15	<MDC	0.02	0.02	77	1	0
BHB-3301-F1-V-007	1	7	15	<MDC	0.04	112	180	363	<MDC	0.05	0.09	2	1.3	4	<MDC	0.09	38	-18.5	-77	<MDC	0.00	0.09	52	2	1
BHB-3301-F1-V-008	0	-3	-7	<MDC	0.00	108	140	282	<MDC	0.04	0.04	1	0.3	1	<MDC	0.02	58	1.5	6	<MDC	0.01	0.03	44	0	0
BHB-3301-F1-V-009	0	-3	-7	<MDC	0.00	116	220	444	<MDC	0.06	0.06	0	-0.7	-2	<MDC	0.00	54	-2.5	-10	<MDC	0.00	0.00	72	9	4
BHB-3301-F1-T-010	0	-3	-7	<MDC	0.00	253	1590	**3,206**		0.45	0.45	0	-0.7	-2	<MDC	0.00	54	-2.5	-10	<MDC	0.00	0.00	53	10	0
BHB-3301-F1-M-011	0	-3	-7	<MDC	0.00	111	170	343	<MDC	0.05	0.05	2	1.3	4	<MDC	0.09	56	-0.5	-2	<MDC	0.00	0.09	52	8	1
BHB-3301-F1-M-012	2	17	37	<MDC	0.09	124	300	605	<MDC	0.09	0.18	1	0.3	1	<MDC	0.02	50	-6.5	-27	<MDC	0.00	0.02	36	7	0
BHB-3301-F1-M-013	1	7	15	<MDC	0.04	128	340	686	<MDC	0.10	0.13	0	-0.7	-2	<MDC	0.00	62	5.5	23	<MDC	0.03	0.03	34	6	0
BHB-3301-F1-M-014	1	7	15	<MDC	0.04	101	70	141	<MDC	0.02	0.06	0	-0.7	-2	<MDC	0.00	53	-3.5	-15	<MDC	0.00	0.00	21	5	0
Count	---	---	14	---	---	---	---	14	---	---	14	---	---	14	---	---	---	---	14	---	---	14	14	14	14
Min	---	---	-7	---	---	---	---	-40	---	---	0.00	---	---	-2	---	---	---	---	-77	---	---	0.00	21	0	0
Max	---	---	37	---	---	---	---	3,206	---	---	0.45	---	---	6	---	---	---	---	36	---	---	0.16	85	12	4
Median	---	---	4	---	---	---	---	353	---	---	0.07	---	---	-2	---	---	---	---	-10	---	---	0.02	53	6	0
Mean	---	---	7	---	---	---	---	534	---	---	0.10	---	---	0	---	---	---	---	-13	---	---	0.04	57	5	1
StDev	---	---	16	---	---	---	---	790	---	---	0.12	---	---	3	---	---	---	---	32	---	---	0.08	19	4	1

Project: CMU Brooks Hall Building Decommissioning			Survey Unit: BHB-4301			Type of Survey: Final Status				Surveyor 1: Kirby Gemillion					Surveyor 2:	Date: 12/13/16
Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)	Comments: Results above MDC are in bold. Results above the investigation level are in red.	
2241-3 / 253346 43-37 / 281040	SAT	1/11/2017	Alpha	Total	6	32.04%	0.25	8.01%	0.1	1	584	121	407	30%		
2241-3 / 253346 43-37 / 281040	**SAT**	**1/11/2017**	**Beta**	**Total**	**860**	**35.27%**	**0.25**	**8.82%**	**0.1**	**0.1**	**584**	**896**	**7,050**	**13%**		
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.1	36.49%	1	36.49%	1	10	100	18	40	45%		
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**60.4**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**125**	**705**	**18%**	**Reviewed:** Mike Culp	**Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-4301-F1-C-001	0	-6	-13	<MDC	0.00	110	240	466	<MDC	0.07	0.07	0	-1.1	-3	<MDC	0.00	60	-0.4	-2	<MDC	0.00	0.00	88	9	0
BHB-4301-F1-T-002	1	4	9	<MDC	0.02	161	750	**1,456**		0.21	0.23	1	-0.1	0	<MDC	0.00	43	-17.4	-73	<MDC	0.00	0.00	93	8	0
BHB-4301-F1-T-003	0	-6	-13	<MDC	0.00	154	680	**1,321**		0.19	0.19	0	-1.1	-3	<MDC	0.00	49	-11.4	-48	<MDC	0.00	0.00	109	1	2
BHB-4301-F1-T-004	1	4	9	<MDC	0.02	165	790	**1,534**		0.22	0.24	3	1.9	5	<MDC	0.13	58	-2.4	-10	<MDC	0.00	0.13	245	0	2
BHB-4301-F1-M-005	1	4	9	<MDC	0.02	103	170	330	<MDC	0.05	0.07	0	-1.1	-3	<MDC	0.00	58	-2.4	-10	<MDC	0.00	0.00	177	6	0
BHB-4301-F1-C-006	0	-6	-13	<MDC	0.00	131	450	874	<MDC	0.12	0.12	0	-1.1	-3	<MDC	0.00	65	4.6	19	<MDC	0.03	0.03	203	1	0
BHB-4301-F1-C-007	0	-6	-13	<MDC	0.00	92	60	117	<MDC	0.02	0.02	1	-0.1	0	<MDC	0.00	72	11.6	48	<MDC	0.07	0.07	222	0	0
BHB-4301-F1-C-008	0	-6	-13	<MDC	0.00	70	-160	-311	<MDC	0.00	0.00	1	-0.1	0	<MDC	0.00	57	-3.4	-14	<MDC	0.00	0.00	137	7	0
BHB-4301-F1-C-009	2	14	30	<MDC	0.07	95	90	175	<MDC	0.02	0.10	0	-1.1	-3	<MDC	0.00	67	6.6	28	<MDC	0.04	0.04	167	2	0
BHB-4301-F1-C-010	0	-6	-13	<MDC	0.00	97	110	214	<MDC	0.03	0.03	3	1.9	5	<MDC	0.13	50	-10.4	-43	<MDC	0.00	0.13	150	0	0
BHB-4301-F1-C-011	0	-6	-13	<MDC	0.00	88	20	39	<MDC	0.01	0.01	0	-1.1	-3	<MDC	0.00	69	8.6	36	<MDC	0.05	0.05	127	3	0
BHB-4301-F1-C-012	0	-6	-13	<MDC	0.00	106	200	388	<MDC	0.06	0.06	1	-0.1	0	<MDC	0.00	61	0.6	3	<MDC	0.00	0.00	215	3	0
BHB-4301-F1-C-013	0	-6	-13	<MDC	0.00	89	30	58	<MDC	0.01	0.01	0	-1.1	-3	<MDC	0.00	47	-13.4	-56	<MDC	0.00	0.00	219	0	0
BHB-4301-F1-C-014	0	-6	-13	<MDC	0.00	108	220	427	<MDC	0.06	0.06	3	1.9	5	<MDC	0.13	53	-7.4	-31	<MDC	0.00	0.13	92	0	0
BHB-4301-F1-C-015	0	-6	-13	<MDC	0.00	90	40	78	<MDC	0.01	0.01	1	-0.1	0	<MDC	0.00	74	13.6	57	<MDC	0.08	0.08	245	4	0
Count	---	---	15	---	---	---	---	15	---	---	15	---	---	15	---	---	---	---	15	---	---	15	15	15	15
Min	---	---	-13	---	---	---	---	-311	---	---	0.00	---	---	-3	---	---	---	---	-73	---	---	0.00	88	0	0
Max	---	---	30	---	---	---	---	1,534	---	---	0.24	---	---	5	---	---	---	---	57	---	---	0.13	245	9	2
Median	---	---	-13	---	---	---	---	330	---	---	0.06	---	---	0	---	---	---	---	-10	---	---	0.03	167	2	0
Mean	---	---	-6	---	---	---	---	478	---	---	0.08	---	---	0	---	---	---	---	-6	---	---	0.04	166	3	0
StDev	---	---	13	---	---	---	---	562	---	---	0.09	---	---	3	---	---	---	---	39	---	---	0.10	57	3	1

Appendix G
Systems Final Status Survey Results

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity											Removable Surface Activity												LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta									
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D3-M-001																							29	5	0
BHB-DR01-D3-M-002																							19	1	4
BHB-DR01-D1-M-003																							0	2	4
BHB-DR01-D2-M-004																							6	6	0
BHB-DR01-D3-M-005																							8	0	0
BHB-DR01-D1-M-006																							1	12	0
BHB-DR01-D3-M-007																							0	7	0
BHB-DR01-D3-M-008																							4	0	0
BHB-DR01-D3-M-009																							33	3	0
BHB-DR01-D1-M-010																							27	5	0
BHB-DR01-D3-M-011																							21	0	0
BHB-DR01-D1-M-012																							5	7	0
BHB-DR01-D1-M-013																							10	3	0
BHB-DR01-D3-M-014																							24	11	0
BHB-DR01-D3-M-015																							5	8	4
BHB-DR01-D1-M-016																							18	6	2
BHB-DR01-D1-M-017																							**140**	2	0
BHB-DR01-D3-M-018																							15	3	2
BHB-DR01-D3-M-019																							18	8	1
BHB-DR01-D3-M-020																							0	13	1
BHB-DR01-D3-M-021																							8	3	0
BHB-DR01-D3-M-022																							14	3	0
BHB-DR01-D3-M-023																							30	0	1
BHB-DR01-D3-M-024																							32	7	1
BHB-DR01-D3-M-025																							7	8	0
BHB-DR01-D3-M-026																							18	3	0
BHB-DR01-D3-M-027																							23	0	0
BHB-DR01-D3-M-028																							6	4	0
BHB-DR01-D3-M-029																							1	7	2
BHB-DR01-D4-M-030																							**38**	8	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		140	13	4
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		15	5	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		19	5	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		26	4	1

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-DR01 | **Type of Survey:** Final Status | **Surveyor 1:** Jay Gluck | **Surveyor 2:** | **Date:** 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D2-M-031																							28	0	0
BHB-DR01-D3-M-032																							0	5	0
BHB-DR01-D3-M-033																							11	1	0
BHB-DR01-D3-M-034																							12	0	2
BHB-DR01-D3-M-035																							16	11	0
BHB-DR01-D3-M-036																							11	1	0
BHB-DR01-D3-M-037																							15	4	0
BHB-DR01-D3-M-038																							3	0	0
BHB-DR01-D3-M-039																							20	5	0
BHB-DR01-D3-M-040																							15	0	0
BHB-DR01-D3-M-041																							20	4	1
BHB-DR01-D3-M-042																							24	0	0
BHB-DR01-D3-M-043																							7	11	2
BHB-DR01-D3-M-044																							0	15	0
BHB-DR01-D4-M-045																							35	0	0
BHB-DR01-D4-M-046																							16	2	0
BHB-DR01-D4-M-047																							6	6	0
BHB-DR01-D3-M-048																							0	0	0
BHB-DR01-D3-M-049																							17	11	4
BHB-DR01-D3-M-050																							12	15	0
BHB-DR01-D3-M-051																							32	0	3
BHB-DR01-D3-M-052																							**111**	2	0
BHB-DR01-D3-M-053																							25	0	1
BHB-DR01-D3-M-054																							13	1	2
BHB-DR01-D3-M-055																							12	8	1
BHB-DR01-D3-M-056																							27	4	0
BHB-DR01-D3-M-057																							27	11	0
BHB-DR01-D3-M-058																							25	2	0
BHB-DR01-D3-M-059																							1	7	2
BHB-DR01-D3-M-060																							28	0	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		111	15	4
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		16	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		19	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		20	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D3-M-061																							32	4	0
BHB-DR01-D3-M-062																							8	11	0
BHB-DR01-D3-M-063																							20	4	1
BHB-DR01-D1-M-064																							17	10	0
BHB-DR01-D1-M-065																							6	2	5
BHB-DR01-D1-M-066																							11	0	0
BHB-DR01-D1-M-067																							16	0	0
BHB-DR01-D3-M-068																							10	8	2
BHB-DR01-D3-M-069																							27	1	0
BHB-DR01-D1-M-070																							12	4	0
BHB-DR01-D3-M-071																							0	6	0
BHB-DR01-D3-M-072																							23	0	0
BHB-DR01-D3-M-073																							11	0	0
BHB-DR01-D3-M-074																							14	6	2
BHB-DR01-D3-M-075																							12	1	0
BHB-DR01-D3-M-076																							10	4	0
BHB-DR01-D3-M-077																							15	5	2
BHB-DR01-D3-M-078																							0	14	0
BHB-DR01-D3-M-079																							10	14	0
BHB-DR01-D3-M-080																							8	13	3
BHB-DR01-D3-M-081																							0	0	0
BHB-DR01-D1-M-082																							20	8	0
BHB-DR01-D3-M-083																							6	7	0
BHB-DR01-D3-M-084																							25	5	2
BHB-DR01-D3-M-085																							5	13	0
BHB-DR01-D1-M-086																							0	0	3
BHB-DR01-D3-M-087																							29	1	0
BHB-DR01-D1-M-088																							22	14	3
BHB-DR01-D4-M-089																							1	7	2
BHB-DR01-D3-M-090																							24	9	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		32	14	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		12	5	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		13	6	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		9	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta					SOF	Alpha					Beta					SOF			
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		H-3	C-14	CH 3
BHB-DR01-D3-M-091																							6	0	1
BHB-DR01-D3-M-092																							2	0	3
BHB-DR01-D3-M-093																							29	4	0
BHB-DR01-D3-M-094																							28	8	0
BHB-DR01-D3-M-095																							33	6	0
BHB-DR01-D3-M-096																							9	4	0
BHB-DR01-D3-M-097																							6	4	0
BHB-DR01-D2-M-098																							0	7	0
BHB-DR01-D3-M-099																							15	0	1
BHB-DR01-D3-M-100																							0	7	0
BHB-DR01-D3-M-101																							33	4	4
BHB-DR01-D3-M-102																							**47**	9	0
BHB-DR01-D3-M-103																							**68**	4	0
BHB-DR01-D3-M-104																							**64**	2	0
BHB-DR01-D3-M-105																							**49**	1	0
BHB-DR01-D3-M-106																							12	6	2
BHB-DR01-D3-M-107																							**56**	4	0
BHB-DR01-D1-M-108																							**43**	1	1
BHB-DR01-D1-M-109																							**39**	3	0
BHB-DR01-D3-M-110																							31	0	0
BHB-DR01-D3-M-111																							27	8	1
BHB-DR01-D3-M-112																							26	3	0
BHB-DR01-D3-M-113																							29	8	5
BHB-DR01-D3-M-114																							17	4	0
BHB-DR01-D3-M-115																							35	1	0
BHB-DR01-D1-M-116																							**38**	1	0
BHB-DR01-D3-M-117																							32	5	1
BHB-DR01-D4-M-118																							31	0	0
BHB-DR01-D4-M-119																							1	7	2
BHB-DR01-D4-M-120																							**53**	0	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		68	9	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	4	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		29	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		19	3	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta					SOF	Alpha					Beta					SOF			
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		H-3	C-14	CH 3
BHB-DR01-D4-M-121																							15	6	0
BHB-DR01-D4-M-122																							5	14	1
BHB-DR01-D4-M-123																							22	0	0
BHB-DR01-D4-M-124																							24	0	0
BHB-DR01-D4-M-125																							14	10	4
BHB-DR01-D4-M-126																							8	3	0
BHB-DR01-D3-M-127																							6	2	0
BHB-DR01-D1-M-128																							**45**	5	0
BHB-DR01-D3-M-129																							21	0	0
BHB-DR01-D3-M-130																							20	0	2
BHB-DR01-D1-M-131																							**52**	29	12
BHB-DR01-D3-M-132																							18	13	0
BHB-DR01-D3-M-133																							16	0	0
BHB-DR01-D1-M-134																							16	4	0
BHB-DR01-D3-M-135																							**37**	0	0
BHB-DR01-D2-M-136																							35	4	0
BHB-DR01-D2-M-137																							28	11	2
BHB-DR01-D4-M-138																							27	3	0
BHB-DR01-D2-M-139																							**54**	1	0
BHB-DR01-D3-M-140																							25	20	1
BHB-DR01-D4-M-141																							**52**	5	0
BHB-DR01-D3-M-142																							**166**	6	0
BHB-DR01-D2-M-143																							26	0	6
BHB-DR01-D2-M-144																							15	1	3
BHB-DR01-D2-M-145																							17	6	0
BHB-DR01-D2-M-146																							30	0	0
BHB-DR01-D2-M-147																							30	1	0
BHB-DR01-D2-M-148																							29	1	0
BHB-DR01-D4-M-149																							1	7	2
BHB-DR01-D4-M-150																							**50**	1	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		1	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		166	29	12
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		25	3	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	5	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		29	7	3

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D1-M-151																							**48**	0	0
BHB-DR01-D3-M-152																							18	0	0
BHB-DR01-D3-M-153																							16	6	0
BHB-DR01-D1-M-154																							**45**	7	0
BHB-DR01-D3-M-155																							32	5	0
BHB-DR01-D1-M-156																							30	3	0
BHB-DR01-D3-M-157																							**36**	7	0
BHB-DR01-D3-M-158																							0	7	2
BHB-DR01-D3-M-159																							24	7	0
BHB-DR01-D3-M-160																							28	0	0
BHB-DR01-D3-M-161																							**61**	11	0
BHB-DR01-D3-M-162																							**60**	0	0
BHB-DR01-D3-M-163																							31	19	3
BHB-DR01-D3-M-164																							21	4	0
BHB-DR01-D3-M-165																							**63**	3	0
BHB-DR01-D3-M-166																							**55**	0	0
BHB-DR01-D3-M-167																							**38**	0	0
BHB-DR01-D3-M-168																							**47**	0	0
BHB-DR01-D3-M-169																							**46**	0	0
BHB-DR01-D1-M-170																							**52**	0	0
BHB-DR01-D3-M-171																							**63**	4	0
BHB-DR01-D1-M-172																							**36**	7	0
BHB-DR01-D4-M-173																							26	11	0
BHB-DR01-D3-M-174																							**44**	0	0
BHB-DR01-D3-M-175																							**58**	7	0
BHB-DR01-D3-M-176																							30	4	0
BHB-DR01-D3-M-177																							**42**	0	0
BHB-DR01-D3-M-178																							**44**	3	2
BHB-DR01-D3-M-179																							1	7	2
BHB-DR01-D3-M-180																							3	2	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		63	19	3
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		37	4	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		37	4	0
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		18	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D3-M-181																							34	12	0
BHB-DR01-D3-M-182																							**88**	1	5
BHB-DR01-D1-M-183																							33	10	0
BHB-DR01-D1-M-184																							26	13	0
BHB-DR01-D3-M-185																							31	5	0
BHB-DR01-D4-M-186																							10	0	3
BHB-DR01-D3-M-187																							15	11	0
BHB-DR01-D1-M-188																							**38**	1	0
BHB-DR01-D3-M-189																							**94**	7	0
BHB-DR01-D1-M-190																							**44**	7	0
BHB-DR01-D3-M-191																							**77**	6	0
BHB-DR01-D3-M-192																							**50**	4	1
BHB-DR01-D1-M-193																							15	13	0
BHB-DR01-D3-M-194																							9	6	4
BHB-DR01-D3-M-195																							**48**	3	3
BHB-DR01-D3-M-196																							26	5	0
BHB-DR01-D1-M-197																							**52**	1	2
BHB-DR01-D1-M-198																							35	4	0
BHB-DR01-D2-M-199																							32	2	0
BHB-DR01-D3-M-200																							1	10	0
BHB-DR01-D3-M-201																							9	4	1
BHB-DR01-D2-M-202																							**42**	0	0
BHB-DR01-D2-M-203																							9	6	0
BHB-DR01-D2-M-204																							**51**	7	0
BHB-DR01-D2-M-205																							26	3	0
BHB-DR01-D3-M-206																							**45**	0	0
BHB-DR01-D3-M-207																							**53**	5	0
BHB-DR01-D3-M-208																							35	13	0
BHB-DR01-D4-M-209																							1	7	2
BHB-DR01-D2-M-210																							0	2	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		94	13	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		34	5	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		34	6	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		24	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D2-M-211																							**61**	5	2
BHB-DR01-D2-M-212																							26	1	2
BHB-DR01-D2-M-213																							**151**	0	1
BHB-DR01-D2-M-214																							**66**	0	2
BHB-DR01-D2-M-215																							**45**	9	0
BHB-DR01-D3-M-216																							24	11	0
BHB-DR01-D3-M-217																							32	3	4
BHB-DR01-D1-M-218																							17	7	2
BHB-DR01-D3-M-219																							**124**	9	4
BHB-DR01-D3-M-220																							**119**	2	0
BHB-DR01-D2-M-221																							**49**	6	0
BHB-DR01-D2-M-222																							**69**	0	3
BHB-DR01-D3-M-223																							14	7	0
BHB-DR01-D3-M-224																							19	1	0
BHB-DR01-D3-M-225																							33	3	0
BHB-DR01-D3-M-226																							14	4	0
BHB-DR01-D2-M-227																							**58**	4	0
BHB-DR01-D4-M-228																							**44**	6	3
BHB-DR01-D3-M-229																							22	3	3
BHB-DR01-D3-M-230																							**81**	0	1
BHB-DR01-D1-M-231																							7	4	2
BHB-DR01-D3-M-232																							**44**	0	3
BHB-DR01-D3-M-233																							**58**	0	0
BHB-DR01-D2-M-234																							**58**	15	0
BHB-DR01-D3-M-235																							23	4	4
BHB-DR01-D3-M-236																							24	7	0
BHB-DR01-D1-M-237																							5	8	3
BHB-DR01-D3-M-238																							26	8	0
BHB-DR01-D3-M-239																							1	7	2
BHB-DR01-D2-M-240																							**72**	4	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		1	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		151	15	4
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		39	4	1
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		46	5	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		36	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D2-M-241																							**72**	11	0
BHB-DR01-D2-M-242																							**42**	7	0
BHB-DR01-D2-M-243																							**66**	6	0
BHB-DR01-D2-M-244																							24	3	2
BHB-DR01-D3-M-245																							35	0	1
BHB-DR01-D3-M-246																							15	14	0
BHB-DR01-D1-M-247																							20	4	0
BHB-DR01-D3-M-248																							9	11	0
BHB-DR01-D3-M-249																							30	0	2
BHB-DR01-D3-M-250																							**42**	9	0
BHB-DR01-D3-M-251																							31	5	0
BHB-DR01-D1-M-252																							0	2	0
BHB-DR01-D3-M-253																							26	8	0
BHB-DR01-D3-M-254																							15	6	0
BHB-DR01-D2-M-255																							14	1	0
BHB-DR01-D3-M-256																							11	7	4
BHB-DR01-D3-M-257																							0	16	0
BHB-DR01-D3-M-258																							0	16	1
BHB-DR01-D1-M-259																							13	11	5
BHB-DR01-D1-M-260																							26	8	4
BHB-DR01-D3-M-261																							2	10	0
BHB-DR01-D2-M-262																							29	9	0
BHB-DR01-D2-M-263																							8	7	0
BHB-DR01-D2-M-264																							**38**	3	3
BHB-DR01-D2-M-265																							16	3	0
BHB-DR01-D3-M-266																							14	1	0
BHB-DR01-D1-M-267																							17	7	0
BHB-DR01-D3-M-268																							11	6	1
BHB-DR01-D3-M-269																							23	1	1
BHB-DR01-D4-M-270																							14	6	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		72	16	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		17	7	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		22	7	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		17	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D2-M-271																							30	0	0
BHB-DR01-D3-M-272																							26	4	0
BHB-DR01-D3-M-273																							1	10	0
BHB-DR01-D1-M-274																							27	3	0
BHB-DR01-D3-M-275																							5	8	3
BHB-DR01-D1-M-276																							24	4	0
BHB-DR01-D3-M-277																							0	0	0
BHB-DR01-D3-M-278																							**44**	0	3
BHB-DR01-D3-M-279																							19	11	0
BHB-DR01-D3-M-280																							30	2	0
BHB-DR01-D3-M-281																							**50**	4	0
BHB-DR01-D1-M-282																							**60**	12	0
BHB-DR01-D1-M-283																							28	0	0
BHB-DR01-D3-M-284																							**37**	3	0
BHB-DR01-D3-M-285																							**38**	6	0
BHB-DR01-D3-M-286																							25	7	0
BHB-DR01-D3-M-287																							22	12	6
BHB-DR01-D3-M-288																							14	2	0
BHB-DR01-D3-M-289																							10	8	0
BHB-DR01-D3-M-290																							21	10	0
BHB-DR01-D3-M-291																							26	3	3
BHB-DR01-D3-M-292																							6	0	0
BHB-DR01-D3-M-293																							**60**	2	0
BHB-DR01-D1-M-294																							**42**	3	0
BHB-DR01-D3-M-295																							18	4	0
BHB-DR01-D3-M-296																							5	5	0
BHB-DR01-D3-M-297																							6	13	0
BHB-DR01-D3-M-298																							15	6	0
BHB-DR01-D3-M-299																							**50**	20	0
BHB-DR01-D3-M-300																							21	4	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		60	20	6
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		25	4	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		25	6	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		17	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D3-M-301																							24	0	0
BHB-DR01-D4-M-302																							25	1	3
BHB-DR01-D4-M-303																							**60**	0	0
BHB-DR01-D2-M-304																							**71**	10	0
BHB-DR01-D3-M-305																							**144**	1	0
BHB-DR01-D3-M-306																							**125**	13	0
BHB-DR01-D3-M-307																							**83**	6	0
BHB-DR01-D2-M-308																							**73**	15	2
BHB-DR01-D3-M-309																							**64**	4	2
BHB-DR01-D3-M-310																							**58**	11	0
BHB-DR01-D2-M-311																							16	10	0
BHB-DR01-D3-M-312																							**66**	0	0
BHB-DR01-D3-M-313																							**48**	7	2
BHB-DR01-D3-M-314																							**42**	8	0
BHB-DR01-D3-M-315																							**228**	4	0
BHB-DR01-D3-M-316																							**67**	1	2
BHB-DR01-D3-M-317																							**50**	7	5
BHB-DR01-D3-M-318																							**115**	9	0
BHB-DR01-D3-M-319																							**136**	6	3
BHB-DR01-D3-M-320																							**84**	6	0
BHB-DR01-D3-M-321																							**45**	12	1
BHB-DR01-D3-M-322																							**38**	0	0
BHB-DR01-D3-M-323																							8	5	0
BHB-DR01-D2-M-324																							22	12	0
BHB-DR01-D3-M-325																							19	1	0
BHB-DR01-D3-M-326																							3	11	0
BHB-DR01-D3-M-327																							19	3	0
BHB-DR01-D2-M-328																							10	8	0
BHB-DR01-D3-M-329																							**203**	1	0
BHB-DR01-D3-M-330																							**36**	1	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		3	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		228	15	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		54	6	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		66	6	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		55	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-DR01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments:
Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D3-M-331																							14	0	1
BHB-DR01-D3-M-332																							24	0	0
BHB-DR01-D3-M-333																							16	15	0
BHB-DR01-D3-M-334																							23	3	1
BHB-DR01-D1-M-335																							17	12	0
BHB-DR01-D3-M-336																							20	17	0
BHB-DR01-D3-M-337																							15	10	0
BHB-DR01-D3-M-338																							14	1	0
BHB-DR01-D3-M-339																							22	10	0
BHB-DR01-D3-M-340																							21	6	0
BHB-DR01-D2-M-341																							25	0	1
BHB-DR01-D3-M-342																							16	10	0
BHB-DR01-D2-M-343																							16	0	0
BHB-DR01-D3-M-344																							33	3	3
BHB-DR01-D2-M-345																							31	0	1
BHB-DR01-D2-M-346																							**62**	11	0
BHB-DR01-D4-M-347																							28	3	0
BHB-DR01-D2-M-348																							9	4	0
BHB-DR01-D3-M-349																							15	0	0
BHB-DR01-D2-M-350																							16	0	0
BHB-DR01-D2-M-351																							12	0	0
BHB-DR01-D3-M-352																							19	6	0
BHB-DR01-D3-M-353																							22	0	0
BHB-DR01-D3-M-354																							13	12	0
BHB-DR01-D3-M-355																							18	6	3
BHB-DR01-D3-M-356																							16	1	1
BHB-DR01-D3-M-357																							27	0	2
BHB-DR01-D3-M-358																							30	10	1
BHB-DR01-D3-M-359																							22	3	0
BHB-DR01-D3-M-360																							31	1	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		9	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		62	17	3
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		20	3	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		22	5	0
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		10	5	1

Project: CMU Brooks Hall Building Decommissioning	**Survey Unit:** BHB-DR01	**Type of Survey:** Final Status	**Surveyor 1:** Jay Gluck	**Surveyor 2:**	**Date:** 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-DR01-D3-M-361																							22	9	0
BHB-DR01-D1-M-362																							27	5	1
BHB-DR01-D3-M-363																							**41**	7	0
BHB-DR01-D3-M-364																							15	4	0
BHB-DR01-D3-M-365																							24	11	4
BHB-DR01-D3-M-366																							26	8	0
BHB-DR01-D1-M-367																							26	16	0
BHB-DR01-D2-M-368																							17	1	0
BHB-DR01-D2-M-369																							**45**	9	0
BHB-DR01-D2-M-370																							20	7	0
BHB-DR01-D2-M-371																							33	0	0
BHB-DR01-D2-M-372																							30	6	0
BHB-DR01-D2-M-373																							**62**	2	0
BHB-DR01-D3-M-374																							**99**	0	0
BHB-DR01-D3-M-375																							**38**	0	0
BHB-DR01-D3-M-376																							23	4	0
BHB-DR01-D2-M-377																							**56**	0	0
BHB-DR01-D2-M-378																							**70**	4	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		18	18	18
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		15	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		99	16	4
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		29	5	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		37	5	0
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		22	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VA01-V1-M-001																							8	9	0
BHB-VA01-V1-M-002																							34	0	0
BHB-VA01-V1-M-003																							16	0	0
BHB-VA01-V1-M-004																							17	10	2
BHB-VA01-V1-M-005																							7	0	0
BHB-VA01-V1-M-006																							16	7	0
BHB-VA01-V1-M-007																							19	0	5
BHB-VA01-V1-M-008																							30	0	0
BHB-VA01-V1-M-009																							14	1	0
BHB-VA01-V1-M-010																							4	0	1
BHB-VA01-V1-M-011																							16	8	0
BHB-VA01-V1-M-012																							20	0	0
BHB-VA01-V1-M-013																							17	8	0
BHB-VA01-V1-M-014																							13	0	0
BHB-VA01-V1-M-015																							15	1	0
BHB-VA01-V1-M-016																							8	4	0
BHB-VA01-V1-M-017																							35	6	3
BHB-VA01-V1-M-018																							6	0	3
BHB-VA01-V1-M-019																							14	5	0
BHB-VA01-V1-M-020																							5	5	0
BHB-VA01-V1-M-021																							33	1	1
BHB-VA01-V1-M-022																							22	1	0
BHB-VA01-V1-M-023																							1	4	4
BHB-VA01-V1-M-024																							33	2	0
BHB-VA01-V1-M-025																							26	0	0
BHB-VA01-V1-M-026																							18	2	0
BHB-VA01-V1-M-027																							10	4	2
BHB-VA01-V1-M-028																							5	1	0
BHB-VA01-V1-M-029																							16	4	0
BHB-VA01-V1-M-030																							14	5	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		1	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		35	10	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		16	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		16	3	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		9	3	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VA01-V1-M-031																							19	0	1
BHB-VA01-V1-M-032																							30	0	0
BHB-VA01-V1-M-033																							21	2	0
BHB-VA01-V1-M-034																							30	0	1
BHB-VA01-V1-M-035																							7	13	0
BHB-VA01-V1-M-036																							18	2	0
BHB-VA01-V1-M-037																							27	0	0
BHB-VA01-V1-M-038																							12	2	0
BHB-VA01-V1-M-039																							6	1	0
BHB-VA01-V1-M-040																							24	0	4
BHB-VA01-V1-M-041																							**67**	1	0
BHB-VA01-V1-M-042																							20	0	0
BHB-VA01-V1-M-043																							26	7	0
BHB-VA01-V1-M-044																							7	6	0
BHB-VA01-V1-M-045																							21	1	0
BHB-VA01-V1-M-046																							28	1	0
BHB-VA01-V1-M-047																							24	0	0
BHB-VA01-V1-M-048																							18	0	0
BHB-VA01-V1-M-049																							5	2	0
BHB-VA01-V1-M-050																							29	3	0
BHB-VA01-V1-M-051																							**122**	11	3
BHB-VA01-V1-M-052																							**53**	9	0
BHB-VA01-V1-M-053																							**54**	9	0
BHB-VA01-V1-M-054																							**61**	10	3
BHB-VA01-V1-M-055																							**82**	3	0
BHB-VA01-V1-M-056																							**77**	14	0
BHB-VA01-V1-M-057																							**68**	4	3
BHB-VA01-V1-M-058																							**48**	0	5
BHB-VA01-V1-M-059																							**66**	4	0
BHB-VA01-V1-M-060																							**51**	1	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		5	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		122	14	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		28	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		37	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		28	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VA01-V1-M-061																							**45**	14	0
BHB-VA01-V1-M-062																							**97**	0	0
BHB-VA01-V1-M-063																							**60**	7	0
BHB-VA01-V1-M-064																							**38**	0	5
BHB-VA01-V1-M-065																							8	9	0
BHB-VA01-V1-M-066																							**48**	6	0
BHB-VA01-V1-M-067																							**61**	10	0
BHB-VA01-V1-M-068																							**42**	2	0
BHB-VA01-V1-M-069																							**58**	0	0
BHB-VA01-V1-M-070																							**117**	0	0
BHB-VA01-V1-M-071																							**110**	7	0
BHB-VA01-V1-M-072																							**76**	3	1
BHB-VA01-V1-M-073																							**62**	17	0
BHB-VA01-V1-M-074																							**77**	0	0
BHB-VA01-V1-M-075																							**85**	0	0
BHB-VA01-V1-M-076																							**64**	0	0
BHB-VA01-V1-M-077																							31	4	3
BHB-VA01-V1-M-078																							34	1	0
BHB-VA01-V1-M-079																							**52**	0	1
BHB-VA01-V1-M-080																							**38**	3	0
BHB-VA01-V1-M-081																							**122**	3	2
BHB-VA01-V1-M-082																							**115**	0	2
BHB-VA01-V1-M-083																							**79**	2	0
BHB-VA01-V1-M-084																							**77**	2	2
BHB-VA01-V1-M-085																							**72**	0	4
BHB-VA01-V1-M-086																							**55**	0	0
BHB-VA01-V1-M-087																							**36**	0	0
BHB-VA01-V1-M-088																							27	10	0
BHB-VA01-V1-M-089																							**90**	6	0
BHB-VA01-V1-M-090																							**66**	8	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		8	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		122	17	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		62	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		65	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		29	5	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha				Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VA01-V1-M-091																							**82**	7	0
BHB-VA01-V1-M-092																							**69**	9	4
BHB-VA01-V1-M-093																							**113**	5	2
BHB-VA01-V1-M-094																							**108**	1	0
BHB-VA01-V1-M-095																							**88**	1	4
BHB-VA01-V1-M-096																							**115**	0	0
BHB-VA01-V1-M-097																							**87**	0	0
BHB-VA01-V1-M-098																							**55**	18	0
BHB-VA01-V1-M-099																							**89**	3	5
BHB-VA01-V1-M-100																							**52**	5	0
BHB-VA01-V1-M-101																							**100**	10	1
BHB-VA01-V1-M-102																							**78**	0	0
BHB-VA01-V1-M-103																							**102**	3	0
BHB-VA01-V1-M-104																							**159**	0	0
BHB-VA01-V1-M-105																							**65**	3	3
BHB-VA01-V1-M-106																							**119**	1	0
BHB-VA01-V1-M-107																							**88**	12	3
BHB-VA01-V1-M-108																							**87**	1	0
BHB-VA01-V1-M-109																							**152**	0	0
BHB-VA01-V1-M-110																							**111**	1	1
BHB-VA01-V1-M-111																							**95**	8	0
BHB-VA01-V1-M-112																							**160**	1	1
BHB-VA01-V1-M-113																							**50**	10	3
BHB-VA01-V1-M-114																							**78**	2	0
BHB-VA01-V1-M-115																							**216**	2	1
BHB-VA01-V1-M-116																							**69**	0	9
BHB-VA01-V1-M-117																							**58**	0	6
BHB-VA01-V1-M-118																							**52**	10	0
BHB-VA01-V1-M-119																							**71**	2	0
BHB-VA01-V1-M-120																							**146**	10	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		50	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		216	18	9
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		88	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		97	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		39	5	2

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VA01-V1-M-121																							**69**	7	0
BHB-VA01-V1-M-122																							**71**	0	0
BHB-VA01-V1-M-123																							**91**	12	0
BHB-VA01-V1-M-124																							**80**	3	0
BHB-VA01-V1-M-125																							**71**	0	0
BHB-VA01-V1-M-126																							**37**	0	0
BHB-VA01-V1-M-127																							24	1	0
BHB-VA01-V1-M-128																							**64**	4	0
BHB-VA01-V1-M-129																							**91**	0	0
BHB-VA01-V1-M-130																							**73**	6	6
BHB-VA01-V1-M-131																							**88**	8	5
BHB-VA01-V1-M-132																							**125**	0	0
BHB-VA01-V1-M-133																							**53**	6	0
BHB-VA01-V1-M-134																							**99**	0	0
BHB-VA01-V1-M-135																							**108**	0	0
BHB-VA01-V1-M-136																							**76**	3	0
BHB-VA01-V1-M-137																							**42**	3	2
BHB-VA01-V1-M-138																							29	3	1
BHB-VA01-V1-M-139																							**71**	5	0
BHB-VA01-V1-M-140																							**68**	4	0
BHB-VA01-V1-M-141																							**83**	8	0
BHB-VA01-V1-M-142																							**112**	4	0
BHB-VA01-V1-M-143																							0	12	6
BHB-VA01-V1-M-144																							**40**	9	6
BHB-VA01-V1-M-145																							**56**	14	0
BHB-VA01-V1-M-146																							**67**	6	0
BHB-VA01-V1-M-147																							**69**	0	1
BHB-VA01-V1-M-148																							**70**	2	0
BHB-VA01-V1-M-149																							**165**	1	1
BHB-VA01-V1-M-150																							**82**	9	6
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		165	14	6
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		71	4	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		72	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		32	4	2

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta					SOF	Alpha					Beta					SOF			
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL		H-3	C-14	CH 3
BHB-VA01-V1-M-151																							**80**	6	10
BHB-VA01-V1-M-152																							20	0	0
BHB-VA01-V1-M-153																							**83**	0	1
BHB-VA01-V1-M-154																							**73**	2	0
BHB-VA01-V1-M-155																							**94**	0	0
BHB-VA01-V1-M-156																							**99**	0	0
BHB-VA01-V1-M-157																							**101**	0	0
BHB-VA01-V1-M-158																							**78**	6	0
BHB-VA01-V1-M-159																							**56**	1	2
BHB-VA01-V1-M-160																							**176**	0	0
BHB-VA01-V1-M-161																							**39**	5	0
BHB-VA01-V1-M-162																							33	5	0
BHB-VA01-V1-M-163																							**51**	0	0
BHB-VA01-V1-M-164																							19	6	0
BHB-VA01-V1-M-165																							**64**	0	0
BHB-VA01-V1-M-166																							35	7	0
BHB-VA01-V1-M-167																							**70**	4	5
BHB-VA01-V1-M-168																							**83**	0	0
BHB-VA01-V1-M-169																							**47**	0	0
BHB-VA01-V1-M-170																							22	1	7
BHB-VA01-V1-M-171																							33	9	0
BHB-VA01-V1-M-172																							23	0	1
BHB-VA01-V1-M-173																							9	6	0
BHB-VA01-V1-M-174																							5	0	3
BHB-VA01-V1-M-175																							18	0	0
BHB-VA01-V1-M-176																							**51**	2	1
BHB-VA01-V1-M-177																							**59**	9	0
BHB-VA01-V1-M-178																							**43**	17	0
BHB-VA01-V1-M-179																							**84**	13	1
BHB-VA01-V1-M-180																							**87**	4	6
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		5	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		176	17	10
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		54	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		58	3	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		36	4	3

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VA01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/14/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VA01-V1-M-181																							**76**	4	0
BHB-VA01-V1-M-182																							**73**	0	2
BHB-VA01-V1-M-183																							22	3	0
BHB-VA01-V1-M-184																							11	6	0
BHB-VA01-V1-M-185																							**56**	4	3
BHB-VA01-V1-M-186																							15	2	0
BHB-VA01-V1-M-187																							26	2	0
BHB-VA01-V1-M-188																							26	0	0
BHB-VA01-V1-M-189																							**111**	4	0
BHB-VA01-V1-M-190																							**86**	0	0
BHB-VA01-V1-M-191																							**85**	0	0
BHB-VA01-V1-M-192																							**80**	6	0
BHB-VA01-V1-M-193																							0	6	0
BHB-VA01-V1-M-194																							0	14	0
BHB-VA01-V1-M-195																							35	9	1
BHB-VA01-V1-M-196																							**65**	9	0
BHB-VA01-V1-M-197																							**67**	3	0
BHB-VA01-V1-M-198																							24	0	0
BHB-VA01-V1-M-199																							**78**	0	0
BHB-VA01-V1-M-200																							20	6	0
BHB-VA01-V1-M-201																							11	2	0
BHB-VA01-V1-M-202																							20	3	0
BHB-VA01-V1-M-203																							**38**	0	0
BHB-VA01-V1-M-204																							13	6	11
BHB-VA01-V1-M-205																							26	1	0
BHB-VA01-V1-M-206																							**62**	5	0
BHB-VA01-V1-M-207																							0	10	0
BHB-VA01-V1-M-208																							**42**	8	2
BHB-VA01-V2-M-209																							4	0	0
BHB-VA01-V2-M-210																							0	6	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		0	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		111	14	11
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		26	4	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		39	4	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		32	4	2

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VE01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253356 43-37 / PR281040	SAT	9/28/2017	Alpha	Total	5	32.17%	0.25	8.04%	0.1	1	584	116	407	28%
2241-3 / 253356 43-37 / PR281040	SAT	9/28/2017	Beta	Total	116	38.17%	0.25	9.54%	0.1	0.1	584	338	7,050	5%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	59.6	23.92%	1	23.92%	1	10	100	124	705	18%

Comments: Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E1-M-001	1	5	11	<MDC	0.03	116	1,044	**1,873**		0.27	0.29	1	-0.2	-1	<MDC	0.00	56	-3.6	-15	<MDC	0.00	0.00	1	4	0
BHB-VE01-E1-M-002	3	25	53	<MDC	0.13	106	944	**1,694**		0.24	0.37	0	-1.2	-3	<MDC	0.00	52	-7.6	-32	<MDC	0.00	0.00	0	9	3
BHB-VE01-E1-M-003	0	-5	-11	<MDC	0.00	97	854	**1,532**		0.22	0.22	2	0.8	2	<MDC	0.05	58	-1.6	-7	<MDC	0.00	0.05	14	7	0
BHB-VE01-E1-M-004	0	-5	-11	<MDC	0.00	141	1,294	**2,322**		0.33	0.33	1	-0.2	-1	<MDC	0.00	44	-15.6	-65	<MDC	0.00	0.00	17	13	0
BHB-VE01-E1-M-005	1	5	11	<MDC	0.03	112	1,004	**1,802**		0.26	0.28	0	-1.2	-3	<MDC	0.00	55	-4.6	-19	<MDC	0.00	0.00	**62**	4	0
BHB-VE01-E1-M-006	1	5	11	<MDC	0.03	117	1,054	**1,891**		0.27	0.29	1	-0.2	-1	<MDC	0.00	63	3.4	14	<MDC	0.02	0.02	**48**	5	0
BHB-VE01-E1-M-007	2	15	32	<MDC	0.08	96	844	**1,514**		0.21	0.29	0	-1.2	-3	<MDC	0.00	53	-6.6	-28	<MDC	0.00	0.00	**76**	0	0
BHB-VE01-E1-M-008	2	15	32	<MDC	0.08	105	934	**1,676**		0.24	0.32	0	-1.2	-3	<MDC	0.00	55	-4.6	-19	<MDC	0.00	0.00	**43**	0	0
BHB-VE01-E1-M-009	0	-5	-11	<MDC	0.00	99	874	**1,568**		0.22	0.22	4	2.8	8	<MDC	0.19	54	-5.6	-23	<MDC	0.00	0.19	**44**	6	0
BHB-VE01-E1-M-010	1	5	11	<MDC	0.03	108	964	**1,730**		0.25	0.27	1	-0.2	-1	<MDC	0.00	34	-25.6	-107	<MDC	0.00	0.00	**51**	0	2
BHB-VE01-E1-M-011	0	-5	-11	<MDC	0.00	110	984	**1,766**		0.25	0.25	2	0.8	2	<MDC	0.05	56	-3.6	-15	<MDC	0.00	0.05	**56**	0	0
BHB-VE01-E1-M-012	1	5	11	<MDC	0.03	102	904	**1,622**		0.23	0.26	2	0.8	2	<MDC	0.05	77	17.4	73	<MDC	0.10	0.16	**37**	2	1
BHB-VE01-E1-M-013	2	15	32	<MDC	0.08	103	914	**1,640**		0.23	0.31	0	-1.2	-3	<MDC	0.00	58	-1.6	-7	<MDC	0.00	0.00	**92**	3	4
BHB-VE01-E1-M-014	0	-5	-11	<MDC	0.00	115	1,034	**1,855**		0.26	0.26	3	1.8	5	<MDC	0.12	61	1.4	6	<MDC	0.01	0.13	24	12	0
BHB-VE01-E1-M-015	2	15	32	<MDC	0.08	124	1,124	**2,017**		0.29	0.36	4	2.8	8	<MDC	0.19	70	10.4	43	<MDC	0.06	0.25	**65**	6	0
BHB-VE01-E1-M-016	0	-5	-11	<MDC	0.00	102	904	**1,622**		0.23	0.23	0	-1.2	-3	<MDC	0.00	65	5.4	23	<MDC	0.03	0.03	32	0	0
BHB-VE01-E1-M-017	1	5	11	<MDC	0.03	127	1,154	**2,071**		0.29	0.32	1	-0.2	-1	<MDC	0.00	67	7.4	31	<MDC	0.04	0.04	**90**	5	0
BHB-VE01-E1-M-018	0	-5	-11	<MDC	0.00	121	1,094	**1,963**		0.28	0.28	2	0.8	2	<MDC	0.05	58	-1.6	-7	<MDC	0.00	0.05	33	12	0
BHB-VE01-E1-M-019	0	-5	-11	<MDC	0.00	105	934	**1,676**		0.24	0.24	2	0.8	2	<MDC	0.05	62	2.4	10	<MDC	0.01	0.07	27	2	0
BHB-VE01-E1-M-020	2	15	32	<MDC	0.08	116	1,044	**1,873**		0.27	0.34	1	-0.2	-1	<MDC	0.00	53	-6.6	-28	<MDC	0.00	0.00	**50**	1	0
BHB-VE01-E1-M-021	0	-5	-11	<MDC	0.00	84	724	**1,299**		0.18	0.18	2	0.8	2	<MDC	0.05	55	-4.6	-19	<MDC	0.00	0.05	**119**	10	5
BHB-VE01-E1-M-022	1	5	11	<MDC	0.03	100	884	**1,586**		0.23	0.25	0	-1.2	-3	<MDC	0.00	46	-13.6	-57	<MDC	0.00	0.00	**40**	11	10
Count	---	---	22	---	---	---	---	22	---	---	22	---	---	22	---	---	---	---	22	---	---	22	22	22	22
Min	---	---	-11	---	---	---	---	1,299	---	---	0.18	---	---	-3	---	---	---	---	-107	---	---	0.00	0	0	0
Max	---	---	53	---	---	---	---	2,322	---	---	0.37	---	---	8	---	---	---	---	73	---	---	0.25	119	13	10
Median	---	---	11	---	---	---	---	1,712	---	---	0.28	---	---	-1	---	---	---	---	-15	---	---	0.03	44	5	0
Mean	---	---	9	---	---	---	---	1,754	---	---	0.28	---	---	0	---	---	---	---	-11	---	---	0.05	46	5	1
StDev	---	---	20	---	---	---	---	222	---	---	0.06	---	---	3	---	---	---	---	38	---	---	0.10	30	4	2

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VE01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-37 / PR216394	SAT	8/24/2017	Alpha	Total	1	31.56%	0.25	7.89%	0.1	1	584	89	407	22%
2241-3 / 253351 43-37 / PR216394	SAT	8/24/2017	Beta	Total	28	33.97%	0.25	8.49%	0.1	0.1	584	217	7,050	3%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	59.6	23.92%	1	23.92%	1	10	100	124	705	18%

Comments: Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E1-M-023	1	9	20	<MDC	0.05	22	192	**387**		0.05	0.10	0	-1.2	-3	<MDC	0.00	53	-6.6	-28	<MDC	0.00	0.00	**94**	3	0
Count	---	---	1	---	---	---	---	1	---	---	1	---	---	1	---	---	---	---	1	---	---	1	1	1	1
Min	---	---	20	---	---	---	---	387	---	---	0.10	---	---	-3	---	---	---	---	-28	---	---	0.00	94	3	0
Max	---	---	20	---	---	---	---	387	---	---	0.10	---	---	-3	---	---	---	---	-28	---	---	0.00	94	3	0
Median	---	---	20	---	---	---	---	387	---	---	0.10	---	---	-3	---	---	---	---	-28	---	---	0.00	94	3	0
Mean	---	---	20	---	---	---	---	387	---	---	0.10	---	---	-3	---	---	---	---	-28	---	---	0.00	94	3	0
StDev	---	---	N/A	---	---	---	---	N/A	---	---	N/A	---	---	N/A	---	---	---	---	N/A	---	---	N/A	N/A	N/A	N/A

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VE01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253356 43-37 / PR281040	SAT	9/28/2017	Alpha	Total	1	32.17%	0.25	8.04%	0.1	1	584	87	407	21%
2241-3 / 253356 43-37 / PR281040	SAT	9/28/2017	Beta	Total	125	38.17%	0.25	9.54%	0.1	0.1	584	349	7,050	5%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	59.6	23.92%	1	23.92%	1	10	100	124	705	18%

Comments: Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta				SOF	Alpha					Beta				SOF	H-3	C-14	CH 3
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL				
BHB-VE01-E1-M-024	1	9	19	<MDC	0.05	115	1,025	**1,839**		0.26	0.31	2	0.8	2	<MDC	0.05	70	10.4	43	<MDC	0.06	0.12	15	3	0
BHB-VE01-E1-M-025	1	9	19	<MDC	0.05	106	935	**1,678**		0.24	0.29	1	-0.2	-1	<MDC	0.00	52	-7.6	-32	<MDC	0.00	0.00	**37**	8	0
BHB-VE01-E1-M-026	1	9	19	<MDC	0.05	123	1,105	**1,983**		0.28	0.33	2	0.8	2	<MDC	0.05	64	4.4	18	<MDC	0.03	0.08	29	5	0
BHB-VE01-E1-M-027	0	-1	-2	<MDC	0.00	122	1,095	**1,965**		0.28	0.28	0	-1.2	-3	<MDC	0.00	56	-3.6	-15	<MDC	0.00	0.00	**44**	2	3
BHB-VE01-E1-M-028	0	-1	-2	<MDC	0.00	102	895	**1,606**		0.23	0.23	1	-0.2	-1	<MDC	0.00	49	-10.6	-44	<MDC	0.00	0.00	**87**	10	0
BHB-VE01-E1-M-029	1	9	19	<MDC	0.05	100	875	**1,570**		0.22	0.27	1	-0.2	-1	<MDC	0.00	64	4.4	18	<MDC	0.03	0.03	**50**	5	0
BHB-VE01-E1-M-030	1	9	19	<MDC	0.05	111	985	**1,768**		0.25	0.30	1	-0.2	-1	<MDC	0.00	48	-11.6	-48	<MDC	0.00	0.00	27	0	6
BHB-VE01-E1-M-031	0	-1	-2	<MDC	0.00	102	895	**1,606**		0.23	0.23	0	-1.2	-3	<MDC	0.00	57	-2.6	-11	<MDC	0.00	0.00	**66**	8	0
BHB-VE01-E1-M-032	0	-1	-2	<MDC	0.00	105	925	**1,660**		0.24	0.24	1	-0.2	-1	<MDC	0.00	54	-5.6	-23	<MDC	0.00	0.00	**64**	8	1
BHB-VE01-E1-M-033	0	-1	-2	<MDC	0.00	104	915	**1,642**		0.23	0.23	1	-0.2	-1	<MDC	0.00	61	1.4	6	<MDC	0.01	0.01	**59**	2	8
BHB-VE01-E1-M-034	0	-1	-2	<MDC	0.00	104	915	**1,642**		0.23	0.23	3	1.8	5	<MDC	0.12	71	11.4	48	<MDC	0.07	0.19	**53**	3	5
BHB-VE01-E1-M-035	1	9	19	<MDC	0.05	106	935	**1,678**		0.24	0.29	0	-1.2	-3	<MDC	0.00	62	2.4	10	<MDC	0.01	0.01	**60**	7	5
BHB-VE01-E1-M-036	1	9	19	<MDC	0.05	107	945	**1,696**		0.24	0.29	2	0.8	2	<MDC	0.05	68	8.4	35	<MDC	0.05	0.10	**57**	1	0
BHB-VE01-E1-M-037	1	9	19	<MDC	0.05	109	965	**1,732**		0.25	0.29	1	-0.2	-1	<MDC	0.00	50	-9.6	-40	<MDC	0.00	0.00	28	5	0
BHB-VE01-E1-M-038	0	-1	-2	<MDC	0.00	103	905	**1,624**		0.23	0.23	1	-0.2	-1	<MDC	0.00	57	-2.6	-11	<MDC	0.00	0.00	**53**	0	1
BHB-VE01-E1-M-039	0	-1	-2	<MDC	0.00	104	915	**1,642**		0.23	0.23	2	0.8	2	<MDC	0.05	78	18.4	77	<MDC	0.11	0.16	**81**	10	2
BHB-VE01-E1-M-040	1	9	19	<MDC	0.05	115	1,025	**1,839**		0.26	0.31	0	-1.2	-3	<MDC	0.00	79	19.4	81	<MDC	0.12	0.12	**70**	0	1
BHB-VE01-E1-M-041	0	-1	-2	<MDC	0.00	109	965	**1,732**		0.25	0.25	1	-0.2	-1	<MDC	0.00	42	-17.6	-74	<MDC	0.00	0.00	34	0	3
BHB-VE01-E1-M-042	1	9	19	<MDC	0.05	106	935	**1,678**		0.24	0.29	0	-1.2	-3	<MDC	0.00	47	-12.6	-53	<MDC	0.00	0.00	**46**	0	0
BHB-VE01-E1-M-043	1	9	19	<MDC	0.05	112	995	**1,785**		0.25	0.30	1	-0.2	-1	<MDC	0.00	77	17.4	73	<MDC	0.10	0.10	**90**	6	0
Count	---	---	20	---	---	---	---	20	---	---	20	---	---	20	---	---	---	---	20	---	---	20	20	20	20
Min	---	---	-2	---	---	---	---	1,570	---	---	0.23	---	---	-3	---	---	---	---	-74	---	---	0.00	15	0	0
Max	---	---	19	---	---	---	---	1,983	---	---	0.33	---	---	5	---	---	---	---	81	---	---	0.19	90	10	8
Median	---	---	19	---	---	---	---	1,678	---	---	0.28	---	---	-1	---	---	---	---	-3	---	---	0.00	53	4	1
Mean	---	---	10	---	---	---	---	1,718	---	---	0.27	---	---	0	---	---	---	---	3	---	---	0.05	53	4	2
StDev	---	---	11	---	---	---	---	115	---	---	0.03	---	---	2	---	---	---	---	46	---	---	0.09	21	4	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-VE01 | **Type of Survey:** Final Status | **Surveyor 1:** Jay Gluck | **Surveyor 2:** Mike Culp | **Date:** 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-68 / PR216394	SAT	8/24/2017	Alpha	Total	1	37.35%	0.25	9.34%	0.1	1	584	75	407	18%
2241-3 / 253351 43-68 / PR216394	SAT	8/24/2017	Beta	Total	28	32.59%	0.25	8.15%	0.1	0.1	584	227	7,050	3%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	59.6	23.92%	1	23.92%	1	10	100	124	705	18%

Comments: Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E1-M-044	1	9	17	<MDC	0.04	19	162	**340**		0.05	0.09	5	3.8	10	<MDC	0.26	60	0.4	2	<MDC	0.00	0.26	**83**	0	1
BHB-VE01-E1-M-045	1	9	17	<MDC	0.04	27	242	**509**		0.07	0.11	2	0.8	2	<MDC	0.05	55	-4.6	-19	<MDC	0.00	0.05	**109**	8	1
BHB-VE01-E1-M-046	0	-1	-2	<MDC	0.00	19	162	**340**		0.05	0.05	0	-1.2	-3	<MDC	0.00	62	2.4	10	<MDC	0.01	0.01	**44**	4	5
BHB-VE01-E1-M-047	1	9	17	<MDC	0.04	25	222	**467**		0.07	0.11	0	-1.2	-3	<MDC	0.00	68	8.4	35	<MDC	0.05	0.05	18	17	0
BHB-VE01-E1-M-048	0	-1	-2	<MDC	0.00	18	152	**319**		0.05	0.05	0	-1.2	-3	<MDC	0.00	71	11.4	48	<MDC	0.07	0.07	**51**	4	1
BHB-VE01-E1-M-049	0	-1	-2	<MDC	0.00	19	162	**340**		0.05	0.05	0	-1.2	-3	<MDC	0.00	74	14.4	60	<MDC	0.09	0.09	18	12	0
BHB-VE01-E1-M-050	0	-1	-2	<MDC	0.00	20	172	**361**		0.05	0.05	1	-0.2	-1	<MDC	0.00	65	5.4	23	<MDC	0.03	0.03	35	9	2
BHB-VE01-E1-M-051	0	-1	-2	<MDC	0.00	23	202	**425**		0.06	0.06	0	-1.2	-3	<MDC	0.00	61	1.4	6	<MDC	0.01	0.01	28	5	1
BHB-VE01-E1-M-052	0	-1	-2	<MDC	0.00	25	222	**467**		0.07	0.07	2	0.8	2	<MDC	0.05	58	-1.6	-7	<MDC	0.00	0.05	7	2	1
Count	---	---	9	---	---	---	---	9	---	---	9	---	---	9	---	---	---	---	9	---	---	9	9	9	9
Min	---	---	-2	---	---	---	---	319	---	---	0.05	---	---	-3	---	---	---	---	-19	---	---	0.01	7	0	0
Max	---	---	17	---	---	---	---	509	---	---	0.11	---	---	10	---	---	---	---	60	---	---	0.26	109	17	5
Median	---	---	-2	---	---	---	---	361	---	---	0.06	---	---	-3	---	---	---	---	10	---	---	0.05	35	5	1
Mean	---	---	4	---	---	---	---	397	---	---	0.07	---	---	0	---	---	---	---	17	---	---	0.07	44	7	1
StDev	---	---	9	---	---	---	---	70	---	---	0.02	---	---	5	---	---	---	---	26	---	---	0.12	33	5	2

Project: CMU Brooks Hall Building Decommissioning | **Survey Unit:** BHB-VE01 | **Type of Survey:** Final Status | **Surveyor 1:** Jay Gluck | **Surveyor 2:** Mike Culp | **Date:** 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 253351 43-37 / PR178300	SAT	8/24/2017	Alpha	Total	3	31.56%	0.25	7.89%	0.1	1	584	106	407	26%
2241-3 / 253351 43-37 / PR178300	**SAT**	**8/24/2017**	**Beta**	**Total**	**113**	**33.97%**	**0.25**	**8.49%**	**0.1**	**0.1**	**584**	**376**	**7,050**	**5%**
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1.2	36.49%	1	36.49%	1	10	100	19	40	46%
2929 / 160013 43-10-1 / PR167231	**SAT**	**11/23/2017**	**Beta**	**Removable**	**59.6**	**23.92%**	**1**	**23.92%**	**1**	**10**	**100**	**124**	**705**	**18%**

Comments: Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp | **Date:** 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E1-M-053	1	7	15	<MDC	0.04	95	837	**1,688**		0.24	0.28	4	2.8	8	<MDC	0.19	63	3.4	14	<MDC	0.02	0.21	25	7	0
Count	---	---	1	---	---	---	---	1	---	---	1	---	---	1	---	---	---	---	1	---	---	1	1	1	1
Min	---	---	15	---	---	---	---	1,688	---	---	0.28	---	---	8	---	---	---	---	14	---	---	0.21	25	7	0
Max	---	---	15	---	---	---	---	1,688	---	---	0.28	---	---	8	---	---	---	---	14	---	---	0.21	25	7	0
Median	---	---	15	---	---	---	---	1,688	---	---	0.28	---	---	8	---	---	---	---	14	---	---	0.21	25	7	0
Mean	---	---	15	---	---	---	---	1,688	---	---	0.28	---	---	8	---	---	---	---	14	---	---	0.21	25	7	0
StDev	---	---	N/A	---	---	---	---	N/A	---	---	N/A	---	---	N/A	---	---	---	---	N/A	---	---	N/A	N/A	N/A	N/A

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VE01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E3-M-054																							**107**	13	2
BHB-VE01-E3-M-055																							**56**	6	2
BHB-VE01-E3-M-056																							**62**	4	0
BHB-VE01-E3-M-057																							**80**	2	2
BHB-VE01-E3-M-058																							**82**	0	0
BHB-VE01-E3-M-059																							**45**	2	0
BHB-VE01-E3-M-060																							**39**	2	0
BHB-VE01-E3-M-061																							**53**	0	0
BHB-VE01-E3-M-062																							**55**	0	2
BHB-VE01-E3-M-063																							**93**	2	0
BHB-VE01-E3-M-064																							**88**	4	0
BHB-VE01-E3-M-065																							**89**	0	0
BHB-VE01-E3-M-066																							**98**	1	0
BHB-VE01-E3-M-067																							**103**	1	0
BHB-VE01-E3-M-068																							**60**	0	2
BHB-VE01-E3-M-069																							**68**	5	2
BHB-VE01-E3-M-070																							**58**	0	0
BHB-VE01-E3-M-071																							**75**	0	0
BHB-VE01-E3-M-072																							**78**	5	1
BHB-VE01-E3-M-073																							**63**	0	2
BHB-VE01-E3-M-074																							**44**	0	4
BHB-VE01-E3-M-075																							**45**	7	0
BHB-VE01-E3-M-076																							**100**	2	0
BHB-VE01-E3-M-077																							**104**	0	0
BHB-VE01-E3-M-078																							**54**	4	1
BHB-VE01-E3-M-079																							**91**	2	0
BHB-VE01-E3-M-080																							**49**	6	1
BHB-VE01-E3-M-081																							**85**	13	1
BHB-VE01-E3-M-082																							**83**	0	0
BHB-VE01-E3-M-083																							**78**	0	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		39	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		107	13	4
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		77	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		73	3	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		20	4	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VE01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/16/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Comments:
Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.

Reviewed: Mike Culp **Date:** 1-6-17

Location	Total Surface Activity											Removable Surface Activity											LSC ($dpm/100cm^2$)		
	Alpha					Beta						Alpha					Beta								
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E3-M-084																							**105**	8	1
BHB-VE01-E3-M-085																							**69**	0	0
BHB-VE01-E3-M-086																							**66**	2	0
BHB-VE01-E3-M-087																							**72**	2	0
BHB-VE01-E3-M-088																							**100**	2	0
BHB-VE01-E3-M-089																							**62**	9	0
BHB-VE01-E3-M-090																							**111**	0	1
BHB-VE01-E3-M-091																							**134**	3	0
BHB-VE01-E3-M-092																							**77**	13	0
BHB-VE01-E3-M-093																							**110**	0	0
BHB-VE01-E3-M-094																							**89**	3	0
BHB-VE01-E3-M-095																							**94**	1	4
BHB-VE01-E3-M-096																							**60**	5	0
BHB-VE01-E3-M-097																							**44**	0	3
BHB-VE01-E3-M-098																							**46**	1	0
BHB-VE01-E3-M-099																							**58**	10	0
BHB-VE01-E3-M-100																							**84**	0	0
BHB-VE01-E3-M-101																							**104**	2	1
BHB-VE01-E3-M-102																							**141**	4	2
BHB-VE01-E3-M-103																							**115**	0	0
BHB-VE01-E3-M-104																							**37**	6	1
BHB-VE01-E3-M-105																							**42**	1	0
BHB-VE01-E3-M-106																							**68**	0	1
BHB-VE01-E3-M-107																							30	2	3
BHB-VE01-E3-M-108																							**51**	1	5
BHB-VE01-E3-M-109																							**97**	0	1
BHB-VE01-E3-M-110																							**41**	2	0
BHB-VE01-E3-M-111																							**60**	1	0
BHB-VE01-E3-M-112																							**44**	5	0
BHB-VE01-E3-M-113																							**79**	0	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	30	30
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		141	13	5
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		71	2	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		76	3	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		30	3	1

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-VE01	Type of Survey: Final Status	Surveyor 1: Jay Gluck	Surveyor 2: Mike Culp	Date: 12/16/16
				Comments: Total surface activity measurements and cloth disc smears not performed due to geometry. Results above MDC are bold. Results above the investigation level are red.	
				Reviewed: Mike Culp	Date: 1-6-17

Instrument / Serial # / Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-VE01-E3-M-114																							**68**	3	0
BHB-VE01-E3-M-115																							**75**	3	2
BHB-VE01-E3-M-116																							**53**	1	0
BHB-VE01-E3-M-117																							**95**	0	0
BHB-VE01-E3-M-118																							**36**	6	1
BHB-VE01-E3-M-119																							**63**	5	0
Count	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		6	6	6
Min	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		36	0	0
Max	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		95	6	2
Median	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		66	3	0
Mean	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		65	3	1
StDev	---	---		---	---	---	---		---	---		---	---		---	---	---	---		---	---		20	2	1

Appendix H
Quality Assurance Survey Results

Project: CMU Brooks Hall Building Decommissioning	Survey Unit: BHB-QA01	Type of Survey: Quality Assurance	Surveyor 1: Jay Gluck	Surveyor 2:	Date: 12/18/16

Instrument / Serial # Detector / Serial #	Source Check	Cal. Due	Type	Total/ Removable	Bkgd (cpm)	Efficiency	Surface Efficiency	Total Efficiency	Count Time (min) Sample	Count Time (min) Bkg.	Area (cm^2)	MDC ($dpm/100cm^2$)	DCGL ($dpm/100cm^2$)	MDC (% of DCGL)
2241-3 / 267113 43-37 / PR286836	SAT	6/30/2017	Alpha	Total	3	33.63%	0.25	8.41%	0.1	1	584	100	407	24%
2241-3 / 267113 43-37 / PR286836	SAT	6/30/2017	Beta	Total	1020	37.88%	0.25	9.47%	0.1	0.1	584	904	7,050	13%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Alpha	Removable	1	36.49%	1	36.49%	1	10	100	18	40	44%
2929 / 160013 43-10-1 / PR167231	SAT	11/23/2017	Beta	Removable	59.9	23.92%	1	23.92%	1	10	100	124	705	18%

Comments: Results above MDC are in bold. Results above the investigation level are in red.

Reviewed: Mike Culp — Date: 1-6-17

Location	Total Surface Activity										Removable Surface Activity										LSC ($dpm/100cm^2$)		
	Alpha					Beta					Alpha					Beta							
	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	Gross Counts	Net cpm	Activity ($dpm/100cm^2$)	Notes	Fraction of DCGL	SOF	H-3	C-14	CH 3
BHB-QA01-F1-C-001	2	17	35	<MDC	0.09	113	110	199	<MDC	0.03	0.11	2	1	3	<MDC	0.07	58	-1.9	-8	<MDC	0.00	0.07	**109**	2	0
BHB-QA01-F1-V-002	1	7	14	<MDC	0.04	114	120	217	<MDC	0.03	0.07	0	-1	-3	<MDC	0.00	60	0.1	0	<MDC	0.00	0.00	**61**	3	6
BHB-QA01-F1-V-003	1	7	14	<MDC	0.04	83	-190	-344	<MDC	0.00	0.04	0	-1	-3	<MDC	0.00	49	-10.9	-46	<MDC	0.00	0.00	**58**	2	3
BHB-QA01-F1-V-004	2	17	35	<MDC	0.09	115	130	235	<MDC	0.03	0.12	0	-1	-3	<MDC	0.00	48	-11.9	-50	<MDC	0.00	0.00	**83**	10	0
BHB-QA01-F1-V-005	0	-3	-6	<MDC	0.00	101	-10	-18	<MDC	0.00	0.00	1	0	0	<MDC	0.00	66	6.1	26	<MDC	0.04	0.04	**82**	2	3
BHB-QA01-F1-M-006	2	17	35	<MDC	0.09	109	70	127	<MDC	0.02	0.10	1	0	0	<MDC	0.00	50	-9.9	-41	<MDC	0.00	0.00	**82**	16	3
BHB-QA01-F1-V-007	0	-3	-6	<MDC	0.00	95	-70	-127	<MDC	0.00	0.00	1	0	0	<MDC	0.00	51	-8.9	-37	<MDC	0.00	0.00	**40**	9	0
BHB-QA01-F1-V-008	1	7	14	<MDC	0.04	93	-90	-163	<MDC	0.00	0.04	0	-1	-3	<MDC	0.00	66	6.1	26	<MDC	0.04	0.04	**94**	5	0
BHB-QA01-F1-V-009	1	7	14	<MDC	0.04	124	220	398	<MDC	0.06	0.09	2	1	3	<MDC	0.07	51	-8.9	-37	<MDC	0.00	0.07	**43**	3	1
BHB-QA01-F1-V-010	3	27	55	<MDC	0.14	107	50	90	<MDC	0.01	0.15	1	0	0	<MDC	0.00	49	-10.9	-46	<MDC	0.00	0.00	**68**	7	0
BHB-QA01-W1-B-011	0	-3	-6	<MDC	0.00	108	60	108	<MDC	0.02	0.02	1	0	0	<MDC	0.00	49	-10.9	-46	<MDC	0.00	0.00	**144**	1	0
BHB-QA01-W1-C-012	2	17	35	<MDC	0.09	122	200	362	<MDC	0.05	0.14	1	0	0	<MDC	0.00	66	6.1	26	<MDC	0.04	0.04	**88**	5	0
BHB-QA01-W1-C-013	1	7	14	<MDC	0.04	101	-10	-18	<MDC	0.00	0.04	2	1	3	<MDC	0.07	57	-2.9	-12	<MDC	0.00	0.07	**66**	9	2
BHB-QA01-W1-B-014	1	7	14	<MDC	0.04	116	140	253	<MDC	0.04	0.07	0	-1	-3	<MDC	0.00	53	-6.9	-29	<MDC	0.00	0.00	**52**	4	0
BHB-QA01-W1-C-015	1	7	14	<MDC	0.04	120	180	325	<MDC	0.05	0.08	0	-1	-3	<MDC	0.00	69	9.1	38	<MDC	0.05	0.05	**57**	9	0
BHB-QA01-F1-V-016	1	7	14	<MDC	0.04	102	0	0	<MDC	0.00	0.04	0	-1	-3	<MDC	0.00	57	-2.9	-12	<MDC	0.00	0.00	**49**	9	0
BHB-QA01-F1-V-017	3	27	55	<MDC	0.14	116	140	253	<MDC	0.04	0.17	1	0	0	<MDC	0.00	62	2.1	9	<MDC	0.01	0.01	**81**	0	0
BHB-QA01-W1-B-018	0	-3	-6	<MDC	0.00	118	160	289	<MDC	0.04	0.04	0	-1	-3	<MDC	0.00	45	-14.9	-62	<MDC	0.00	0.00	**76**	1	0
BHB-QA01-F1-V-019	1	7	14	<MDC	0.04	95	-70	-127	<MDC	0.00	0.04	3	2	5	<MDC	0.14	65	5.1	21	<MDC	0.03	0.17	**122**	0	0
BHB-QA01-F1-V-020	0	-3	-6	<MDC	0.00	95	-70	-127	<MDC	0.00	0.00	1	0	0	<MDC	0.00	58	-1.9	-8	<MDC	0.00	0.00	**45**	1	0
BHB-QA01-F1-V-021	1	7	14	<MDC	0.04	105	30	54	<MDC	0.01	0.04	2	1	3	<MDC	0.07	58	-1.9	-8	<MDC	0.00	0.07	**110**	0	0
BHB-QA01-F1-V-022	1	7	14	<MDC	0.04	101	-10	-18	<MDC	0.00	0.04	0	-1	-3	<MDC	0.00	46	-13.9	-58	<MDC	0.00	0.00	2	12	0
Count	---	---	22	---	---	---	---	22	---	---	22	---	---	22	---	---	---	---	22	---	---	22	22	22	22
Min	---	---	-6	---	---	---	---	-344	---	---	0.00	---	---	-3	---	---	---	---	-62	---	---	0.00	2	0	0
Max	---	---	55	---	---	---	---	398	---	---	0.17	---	---	5	---	---	---	---	38	---	---	0.17	144	16	6
Median	---	---	14	---	---	---	---	99	---	---	0.04	---	---	0	---	---	---	---	-12	---	---	0.00	72	4	0
Mean	---	---	17	---	---	---	---	90	---	---	0.06	---	---	0	---	---	---	---	-16	---	---	0.03	73	5	1
StDev	---	---	18	---	---	---	---	196	---	---	0.05	---	---	2	---	---	---	---	31	---	---	0.07	31	4	2

Appendix I
Dose Modeling Output Reports

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 9/12/2016 8:41:09 AM
Site Name: Any
Description: DSV Determination with NUREG 1720 REsuspension Factor
FileName: C:\Users\mgdtke\Desktop\Dave DandD\Pb-210+C DSV, NUREG 1720 RF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are NOT distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
210Pb	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DSV Determination		Value 1.00E+00

Chain Data:

Number of chains: 1

Chain No. 1: 210Pb
Nuclides in chain: 3

Nuclide	Chain Position	Half Life	First Par ent	Fractional Yield	Second Par ent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surface **Dose Rate** Factor ((Sv/d)/(Bq/m^2))	**15 cm Dose Rate** Factor ((Sv/d)/(Bq/m^3))
210Pb	1	8.15E+03					1.45E-06	3.67E-06	2.14E-13	1.13E-15
210Bi	2	5.01E+00	1	1	0	0	1.73E-09	5.29E-08	9.06E-14	1.61E-15
210Po	3	1.38E+02	2	1	0	0	5.14E-07	2.54E-06	7.16E-16	2.11E-17

Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	**Surface Concentration (dpm/100 cm**2)**
210Pb	1.00E+00
210Bi	0.00E+00

210Po	0.00E+00

Model Parameters:

General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy Period	The duration of the occupancy exposure period	CONSTANT(days)
Default value used		Value 3.65E+02
Vo:Breathing Rate	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
RFo*:Resuspension Factor	Effective resuspension factor during the occupancy period = RFo * Fl	CONSTANT(1/m)
Justification for modification: NUREG 1720 Recommendation		Value 1.00E-06
		Default DERIVED(1/m)
GO*:Ingestion Rate	Effective secondary ingestion transfer rate of removable surface activity from building surfaces to the mouth during building occupancy = GO * Fl	DERIVED(m**2/hr)
Default value used		
Tstart:Start Time	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
Tend:End Time	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
dt:Time Step Size	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
Pstep:Print Step Size	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
AOExt:External Exposure Area	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOInh:Inhalation Exposure Area	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOIng:Secondary Ingestion Exposure Area	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AO:Exposure Area	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
Fl:Loose Fraction	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)

Default value used		Value 1.00E-01
~~Rfo:Loose Resuspension~~ Factor	~~Resuspension factor for loose~~ contamination	CONTINUOUS LOGARITHMIC(1/m)
Default value used		Value / Probability 9.12E-06 / 0.00E+00 1.10E-04 / 7.67E-01 1.46E-04 / 9.09E-01 1.62E-04 / 9.50E-01 1.85E-04 / 9.90E-01 1.90E-04 / 1.00E+00
GO:Loose Ingestion Rate	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)
Default value used		Value 1.10E-04

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 1.00E-02 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.00E-02 to 1.00E-02 mrem/year

Detailed Results:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Concentration at Time of Peak Dose:

Nuclide	Surface Concentration (dpm/100 cm**2)
210Pb	9.85E-01
210Bi	9.65E-01
210Po	5.19E-01

Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External	Inhalation	Secondary Ingestion
1.00E-02	4.85E-06	2.72E-03	7.28E-03

Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
210Pb	8.10E-03
210Bi	3.65E-05
210Po	1.87E-03
All Nuclides	1.00E-02

Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External	Inhalation	Secondary

			Ingestion
210Pb	3.42E-06	1.97E-03	6.13E-03
210Bi	1.42E-06	2.79E-05	7.17E-06
210Po	6.04E-09	7.20E-04	1.15E-03

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 9/12/2016 12:34:21 AM
Site Name: Any
Description: DSV Determination with NUREG 1720 REsuspension Factor
FileName: C:\Users\mgdtke\Desktop\Dave DandD\Pu-238 DSV, NUREG 1720 RF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
238Pu	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DSV Determination		Value 1.00E+00

Chain Data:

Number of chains: 1

Chain No. 1: 238Pu
Nuclides in chain: 13

Nuclide	Chain Position	Half Life	First Par ent	Fractional Yield	Second Par ent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surface **Dose Rate** Factor (((Sv/d)/(Bq/m^2))	**15 cm Dose Rate** Factor (((Sv/d)/(Bq/m^3))
238Pu	1	3.20E+04					8.65E-07	1.06E-04	7.23E-14	6.97E-17
234U	2	8.93E+07	1	1	0	0	7.66E-08	3.58E-05	6.46E-14	1.85E-16
230Th	3	2.81E+07	2	1	0	0	1.48E-07	8.80E-05	6.48E-14	5.52E-16
226Ra	4	5.84E+05	3	1	0	0	3.58E-07	2.32E-06	5.56E-13	1.42E-14
222Rn	5	3.82E+00	4	1	0	0	0.00E+00	0.00E+00	3.41E-14	9.81E-16
218Po	Implicit		5	1			0.00E+00	0.00E+00	7.67E-16	2.27E-17
214Pb	Implicit		5	0.9998			1.69E-10	2.11E-09	2.10E-11	5.78E-13
218At	Implicit		5	0.0002			0.00E+00	0.00E+00	0.00E+00	0.00E+00
214Bi	Implicit		5	1			7.64E-11	1.78E-09	1.22E-10	3.77E-12
214Po	Implicit		5	0.9998			0.00E+00	0.00E+00	7.02E-15	2.07E-16

210Pb	6	8.15E+03	5	1	0	0	1.45E-06	3.67E-06	2.14E-13	1.13E-15
210Bi	7	5.01E+00	6	1	0	0	1.73E-09	5.29E-08	9.06E-14	1.61E-15
210Po	8	1.38E+02	7	1	0	0	5.14E-07	2.54E-06	7.16E-16	2.11E-17

Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
238Pu	1.00E+00
234U	0.00E+00
230Th	0.00E+00
226Ra	0.00E+00
222Rn	0.00E+00
218Po	0.00E+00
214Pb	0.00E+00
218At	0.00E+00
214Bi	0.00E+00
214Po	0.00E+00
210Pb	0.00E+00
210Bi	0.00E+00
210Po	0.00E+00

Model Parameters:

General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy Period	The duration of the occupancy exposure period	CONSTANT(days)
Default value used		Value 3.65E+02
Vo:Breathing Rate	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
RFo*:Resuspension Factor	Effective resuspension factor during the occupancy period = RFo * Fl	CONSTANT(1/m)
Justification for modification: NUREG 1720 Recommendation		Value 1.00E-06
		Default DERIVED(1/m)
GO*:Ingestion Rate	Effective secondary ingestion transfer rate of removable surface activity from building surfaces to the mouth during building occupancy = GO * Fl	DERIVED(m**2/hr)
Default value used		
Tstart:Start Time	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
Tend:End Time	The ending time of the scenario in days	CONSTANT(days)

Default value used		Value 3.65E+02
dt:Time Step Size	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
Pstep:Print Step Size	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
AOExt:External Exposure Area	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOInh:Inhalation Exposure Area	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOIng:Secondary Ingestion Exposure Area	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AO:Exposure Area	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
Fl:Loose Fraction	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)
Default value used		Value 1.00E-01
Rfo:Loose Resuspension Factor	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)
Default value used		Value / Probability 9.12E-06 / 0.00E+00 1.10E-04 / 7.67E-01 1.46E-04 / 9.09E-01 1.62E-04 / 9.50E-01 1.85E-04 / 9.90E-01 1.90E-04 / 1.00E+00
GO:Loose Ingestion Rate	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)
Default value used		Value 1.10E-04

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 6.14E-02 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 6.14E-02 to 6.14E-02 mrem/year

Detailed Results:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Concentration at Time of Peak Dose:

Nuclide	Surface Concentration (dpm/100 cm**2)

238Pu	9.96E-01
234U	1.41E-06
230Th	4.25E-12
226Ra	4.61E-16
222Rn	4.34E-16
218Po	4.34E-16
214Pb	4.34E-16
218At	8.68E-20
214Bi	4.34E-16
214Po	4.34E-16
210Pb	2.60E-18
210Bi	2.26E-18
210Po	5.17E-19

Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External	Inhalation	Secondary Ingestion
6.14E-02	1.17E-06	5.77E-02	3.70E-03

Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
238Pu	6.14E-02
234U	2.81E-08
230Th	2.07E-13
226Ra	1.30E-18
222Rn	2.40E-22
218Po	5.41E-24
214Pb	1.49E-19
218At	0.00E+00
214Bi	8.61E-19
214Po	4.95E-23
210Pb	2.14E-20
210Bi	8.54E-23
210Po	1.86E-21
All Nuclides	6.14E-02

Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External	Inhalation	Secondary Ingestion
238Pu	1.17E-06	5.77E-02	3.70E-03
234U	1.48E-12	2.76E-08	4.65E-10
230Th	4.47E-18	2.04E-13	2.70E-15
226Ra	4.16E-21	5.84E-19	7.08E-19
222Rn	2.40E-22	0.00E+00	0.00E+00
218Po	5.41E-24	0.00E+00	0.00E+00

214Pb	1.48E-19	5.00E-22	3.15E-22
218At	0.00E+00	0.00E+00	0.00E+00
214Bi	8.60E-19	4.22E-22	1.42E-22
214Po	4.95E-23	0.00E+00	0.00E+00
210Pb	9.03E-24	5.20E-21	1.62E-20
210Bi	3.33E-24	6.53E-23	1.68E-23
210Po	6.02E-27	7.18E-22	1.14E-21

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 9/12/2016 8:37:16 AM
Site Name: Any
Description: DSV Determination with NUREG 1720 REsuspension Factor
FileName: C:\Users\mgdtke\Desktop\Dave DandD\Ra-226+C DSV, NUREG 1720 RF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are NOT distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
226Ra+C	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DSV Determination		Value 1.00E+00

Chain Data:

Number of chains: 1

Chain No. 1: 226Ra+C
Nuclides in chain: 10

Nuclide	Chain Position	Half Life	First Par ent	Fractional Yield	Second Par ent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surface **Dose Rate** Factor ((Sv/d)/(Bq/m^2))	**15 cm Dose Rate** Factor ((Sv/d)/(Bq/m^3))
226Ra+C	1	5.84E+05								
222Rn	2	3.82E+00	1	1	0	0	0.00E+00	0.00E+00	3.41E-14	9.81E-16
218Po	Implicit		2	1			0.00E+00	0.00E+00	7.67E-16	2.27E-17
214Pb	Implicit		2	0.9998			1.69E-10	2.11E-09	2.10E-11	5.78E-13
218At	Implicit		2	0.0002			0.00E+00	0.00E+00	0.00E+00	0.00E+00
214Bi	Implicit		2	1			7.64E-11	1.78E-09	1.22E-10	3.77E-12
214Po	Implicit		2	0.9998			0.00E+00	0.00E+00	7.02E-15	2.07E-16
210Pb	3	8.15E+03	2	1	0	0	1.45E-06	3.67E-06	2.14E-13	1.13E-15
210Bi	4	5.01E+00	3	1	0	0	1.73E-09	5.29E-08	9.06E-14	1.61E-15
210Po	5	1.38E+02	4	1	0	0	5.14E-07	2.54E-06	7.16E-16	2.11E-17

Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
226Ra	1.00E+00
222Rn	1.00E+00
218Po	1.00E+00
214Pb	1.00E+00
218At	2.00E-04
214Bi	1.00E+00
214Po	1.00E+00
210Pb	1.01E+00
210Bi	1.01E+00
210Po	1.01E+00

Model Parameters:

General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy Period	The duration of the occupancy exposure period	CONSTANT(days)
Default value used		Value 3.65E+02
Vo:Breathing Rate	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
RFo*:Resuspension Factor	Effective resuspension factor during the occupancy period = RFo * Fl	CONSTANT(1/m)
Justification for modification: NUREG 1720 Recommendation		Value 1.00E-06
		Default DERIVED(1/m)
GO*:Ingestion Rate	Effective secondary ingestion transfer rate of removable surface activity from building surfaces to the mouth during building occupancy = GO * Fl	DERIVED(m**2/hr)
Default value used		
Tstart:Start Time	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
Tend:End Time	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
dt:Time Step Size	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
Pstep:Print Step Size	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
AOExt:External	Minimum surface area to which occupant is	

Exposure Area	exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOInh:Inhalation Exposure Area	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOIng:Secondary Ingestion Exposure Area	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AO:Exposure Area	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
Fl:Loose Fraction	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)
Default value used		Value 1.00E-01
Rfo:Loose Resuspension Factor	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)
Default value used		Value / Probability 9.12E-06 / 0.00E+00 1.10E-04 / 7.67E-01 1.46E-04 / 9.09E-01 1.62E-04 / 9.50E-01 1.85E-04 / 9.90E-01 1.90E-04 / 1.00E+00
GO:Loose Ingestion Rate	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)
Default value used		Value 1.10E-04

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 1.72E-02 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.72E-02 to 1.72E-02 mrem/year

Detailed Results:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Concentration at Time of Peak Dose:

Nuclide	Surface Concentration (dpm/100 cm**2)
226Ra	1.00E+00
222Rn	1.00E+00
218Po	1.00E+00
214Pb	1.00E+00
218At	2.00E-04
214Bi	1.00E+00
214Po	1.00E+00
210Pb	1.01E+00

210Bi	1.01E+00
210Po	1.01E+00

Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External	Inhalation	Secondary Ingestion
1.72E-02	2.34E-03	4.74E-03	1.01E-02

Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
226Ra	2.81E-03
222Rn	5.54E-07
218Po	1.25E-08
214Pb	3.43E-04
218At	0.00E+00
214Bi	1.98E-03
214Po	1.14E-07
210Pb	8.34E-03
210Bi	3.83E-05
210Po	3.64E-03
All Nuclides	1.72E-02

Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External	Inhalation	Secondary Ingestion
226Ra	9.03E-06	1.27E-03	1.54E-03
222Rn	5.54E-07	0.00E+00	0.00E+00
218Po	1.25E-08	0.00E+00	0.00E+00
214Pb	3.41E-04	1.15E-06	7.25E-07
218At	0.00E+00	0.00E+00	0.00E+00
214Bi	1.98E-03	9.72E-07	3.28E-07
214Po	1.14E-07	0.00E+00	0.00E+00
210Pb	3.53E-06	2.03E-03	6.31E-03
210Bi	1.49E-06	2.93E-05	7.53E-06
210Po	1.18E-08	1.41E-03	2.24E-03

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 9/12/2016 8:35:01 AM
Site Name: Any
Description: DSV Determination with NUREG 1720 REsuspension Factor
FileName: C:\Users\mgdtke\Desktop\Dave DandD\Th-232+C DSV, NUREG 1720 RF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are NOT distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
232Th+C	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DSV Determination		Value 1.00E+00

Chain Data:

Number of chains: 1

Chain No. 1: 232Th+C
Nuclides in chain: 11

Nuclide	Chain Position	Half Life	First Par ent	Fractional Yield	Second Par ent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surface **Dose Rate** Factor ((Sv/d)/(Bq/m^2))	**15 cm Dose Rate** Factor ((Sv/d)/(Bq/m^3))
232Th+C	1	5.13E+12								
228Ra	2	2.10E+03	1	1	0	0	3.88E-07	1.29E-06	0.00E+00	0.00E+00
228Ac	Implicit		2	1			5.85E-10	8.33E-08	8.01E-11	2.38E-12
228Th	3	6.99E+02	2	1	0	0	1.07E-07	9.23E-05	2.03E-13	3.60E-15
224Ra	4	3.66E+00	3	1	0	0	9.89E-08	8.53E-07	8.26E-13	2.26E-14
220Rn	Implicit		4	1			0.00E+00	0.00E+00	3.29E-14	9.52E-16
216Po	Implicit		4	1			0.00E+00	0.00E+00	1.43E-15	4.21E-17
212Pb	5	4.43E-01	4	1	0	0	1.23E-08	4.56E-08	1.23E-11	3.13E-13
212Bi	Implicit		5	1			2.87E-10	5.83E-09	1.54E-11	4.63E-13
212Po	Implicit		5	0.6407			0.00E+00	0.00E+00	0.00E+00	0.00E+00
208Tl	Implicit		5	0.3593			0.00E+00	0.00E+00	2.58E-10	8.36E-12

Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
232Th	1.00E+00
228Ra	1.00E+00
228Ac	1.00E+00
228Th	1.00E+00
224Ra	1.00E+00
220Rn	1.00E+00
216Po	1.00E+00
212Pb	1.00E+00
212Bi	1.00E+00
212Po	6.41E-01
208Tl	3.59E-01

Model Parameters:

General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy Period	The duration of the occupancy exposure period	CONSTANT(days)
Default value used		Value 3.65E+02
Vo:Breathing Rate	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
RFo*:Resuspension Factor	Effective resuspension factor during the occupancy period = RFo * Fl	CONSTANT(1/m)
Justification for modification: NUREG 1720 Recommendation		Value 1.00E-06
		Default DERIVED(1/m)
GO*:Ingestion Rate	Effective secondary ingestion transfer rate of removable surface activity from building surfaces to the mouth during building occupancy = GO * Fl	DERIVED(m**2/hr)
Default value used		
Tstart:Start Time	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
Tend:End Time	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
dt:Time Step Size	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
Pstep:Print Step Size	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00

AOExt:External Exposure Area	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOInh:Inhalation Exposure Area	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOIng:Secondary Ingestion Exposure Area	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AO:Exposure Area	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
Fl:Loose Fraction	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)
Default value used		Value 1.00E-01
Rfo:Loose Resuspension Factor	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)
Default value used		Value / Probability 9.12E-06 / 0.00E+00 1.10E-04 / 7.67E-01 1.46E-04 / 9.09E-01 1.62E-04 / 9.50E-01 1.85E-04 / 9.90E-01 1.90E-04 / 1.00E+00
GO:Loose Ingestion Rate	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)
Default value used		Value 1.10E-04

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 3.03E-01 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 3.03E-01 to 3.03E-01 mrem/year

Detailed Results:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Concentration at Time of Peak Dose:

Nuclide	Surface Concentration (dpm/100 cm**2)
232Th	1.00E+00
228Ra	1.00E+00
228Ac	1.00E+00
228Th	1.00E+00
224Ra	1.00E+00
220Rn	1.00E+00
216Po	1.00E+00

212Pb	1.00E+00
212Bi	1.00E+00
212Po	6.41E-01
208Tl	3.59E-01

Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External	Inhalation	Secondary Ingestion
3.03E-01	3.28E-03	2.94E-01	5.77E-03

Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
232Th	2.45E-01
228Ra	2.37E-03
228Ac	1.35E-03
228Th	5.09E-02
224Ra	9.04E-04
220Rn	5.35E-07
216Po	2.32E-08
212Pb	2.78E-04
212Bi	2.55E-04
212Po	0.00E+00
208Tl	1.51E-03
All Nuclides	3.03E-01

Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External	Inhalation	Secondary Ingestion
232Th	7.73E-07	2.42E-01	3.17E-03
228Ra	0.00E+00	7.04E-04	1.66E-03
228Ac	1.30E-03	4.55E-05	2.51E-06
228Th	3.30E-06	5.04E-02	4.59E-04
224Ra	1.34E-05	4.66E-04	4.24E-04
220Rn	5.35E-07	0.00E+00	0.00E+00
216Po	2.32E-08	0.00E+00	0.00E+00
212Pb	2.00E-04	2.49E-05	5.28E-05
212Bi	2.50E-04	3.18E-06	1.23E-06
212Po	0.00E+00	0.00E+00	0.00E+00
208Tl	1.51E-03	0.00E+00	0.00E+00

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 9/12/2016 8:25:34 AM
Site Name: Any
Description: DSV Determination with NUREG 1720 REsuspension Factor
FileName: C:\Users\mgdtke\Desktop\Dave DandD\U-238 DSV, NUREG 1720 RF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
238U	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DSV Determination		Value 1.00E+00

Chain Data:

Number of chains: 1

Chain No. 1: 238U
Nuclides in chain: 16

Nuclide	Chain Position	Half Life	First Par ent	Fractional Yield	Second Par ent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surface **Dose Rate** Factor ((Sv/d)/(Bq/m^2))	**15 cm Dose Rate** Factor ((Sv/d)/(Bq/m^3))
238U	1	1.63E+12					6.88E-08	3.20E-05	4.76E-14	4.76E-17
234Th	2	2.41E+01	1	1	0	0	3.69E-09	9.47E-09	7.18E-13	1.12E-14
234mPa	Implicit		2	0.998			0.00E+00	0.00E+00	1.32E-12	3.62E-14
234Pa	Implicit		2	0.002	0	0.0013	5.84E-10	2.20E-10	1.59E-10	4.65E-12
234U	3	8.93E+07	2	1	0	0	7.66E-08	3.58E-05	6.46E-14	1.85E-16
230Th	4	2.81E+07	3	1	0	0	1.48E-07	8.80E-05	6.48E-14	5.52E-16
226Ra	5	5.84E+05	4	1	0	0	3.58E-07	2.32E-06	5.56E-13	1.42E-14
222Rn	6	3.82E+00	5	1	0	0	0.00E+00	0.00E+00	3.41E-14	9.81E-16
218Po	Implicit		6	1			0.00E+00	0.00E+00	7.67E-16	2.27E-17
214Pb	Implicit		6	0.9998			1.69E-10	2.11E-09	2.10E-11	5.78E-13
218At	Implicit		6	0.0002			0.00E+00	0.00E+00	0.00E+00	0.00E+00

214Bi	Implicit		6	1			7.64E-11	1.78E-09	1.22E-10	3.77E-12
214Po	Implicit		6	0.9998			0.00E+00	0.00E+00	7.02E-15	2.07E-16
210Pb	7	8.15E+03	6	1	0	0	1.45E-06	3.67E-06	2.14E-13	1.13E-15
210Bi	8	5.01E+00	7	1	0	0	1.73E-09	5.29E-08	9.06E-14	1.61E-15
210Po	9	1.38E+02	8	1	0	0	5.14E-07	2.54E-06	7.16E-16	2.11E-17

Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
238U	1.00E+00
234Th	0.00E+00
234mPa	0.00E+00
234Pa	0.00E+00
234U	0.00E+00
230Th	0.00E+00
226Ra	0.00E+00
222Rn	0.00E+00
218Po	0.00E+00
214Pb	0.00E+00
218At	0.00E+00
214Bi	0.00E+00
214Po	0.00E+00
210Pb	0.00E+00
210Bi	0.00E+00
210Po	0.00E+00

Model Parameters:

General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy Period	The duration of the occupancy exposure period	CONSTANT(days)
Default value used		Value 3.65E+02
Vo:Breathing Rate	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
RFo*:Resuspension Factor	Effective resuspension factor during the occupancy period = RFo * Fl	CONSTANT(1/m)
Justification for modification: NUREG 1720 Recommendation		Value 1.00E-06
		Default DERIVED(1/m)
	Effective secondary ingestion transfer rate of removable surface activity from building	

GO*:Ingestion Rate	surfaces to the mouth during building occupancy = GO * FI	DERIVED(m**2/hr)
Default value used		
Tstart:Start Time	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
Tend:End Time	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
dt:Time Step Size	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
Pstep:Print Step Size	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
AOExt:External Exposure Area	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOInh:Inhalation Exposure Area	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOIng:Secondary Ingestion Exposure Area	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AO:Exposure Area	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
Fl:Loose Fraction	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)
Default value used		Value 1.00E-01
Rfo:Loose Resuspension Factor	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)
Default value used		Value / Probability 9.12E-06 / 0.00E+00 1.10E-04 / 7.67E-01 1.46E-04 / 9.09E-01 1.62E-04 / 9.50E-01 1.85E-04 / 9.90E-01 1.90E-04 / 1.00E+00
GO:Loose Ingestion Rate	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)
Default value used		Value 1.10E-04

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 1.78E-02 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.78E-02 to 1.78E-02 mrem/year

Detailed Results:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Concentration at Time of Peak Dose:

Nuclide	Surface Concentration (dpm/100 cm**2)
238U	1.00E+00
234Th	9.05E-01
234mPa	9.03E-01
234Pa	1.81E-03
234U	1.17E-06
230Th	3.25E-12
226Ra	3.47E-16
222Rn	2.25E-16
218Po	2.25E-16
214Pb	2.25E-16
218At	4.51E-20
214Bi	2.25E-16
214Po	2.25E-16
210Pb	0.00E+00
210Bi	9.67E-18
210Po	1.82E-16

Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External	Inhalation	Secondary Ingestion
1.78E-02	3.54E-05	1.75E-02	3.10E-04

Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
238U	1.78E-02
234Th	2.96E-05
234mPa	1.94E-05
234Pa	4.68E-06
234U	2.33E-08
230Th	1.58E-13
226Ra	9.75E-19
222Rn	1.25E-22
218Po	2.81E-24
214Pb	7.73E-20
218At	0.00E+00
214Bi	4.47E-19
214Po	2.57E-23
210Pb	0.00E+00

210Bi	3.65E-22
210Po	6.54E-19
All Nuclides	1.78E-02

Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External	Inhalation	Secondary Ingestion
238U	7.73E-07	1.75E-02	2.95E-04
234Th	1.06E-05	4.68E-06	1.43E-05
234mPa	1.94E-05	0.00E+00	0.00E+00
234Pa	4.68E-06	2.17E-10	4.53E-09
234U	1.23E-12	2.29E-08	3.86E-10
230Th	3.42E-18	1.56E-13	2.06E-15
226Ra	3.13E-21	4.39E-19	5.33E-19
222Rn	1.25E-22	0.00E+00	0.00E+00
218Po	2.81E-24	0.00E+00	0.00E+00
214Pb	7.69E-20	2.60E-22	1.63E-22
218At	0.00E+00	0.00E+00	0.00E+00
214Bi	4.47E-19	2.19E-22	7.39E-23
214Po	2.57E-23	0.00E+00	0.00E+00
210Pb	0.00E+00	0.00E+00	0.00E+00
210Bi	1.42E-23	2.79E-22	7.18E-23
210Po	2.12E-24	2.53E-19	4.02E-19

DandD Building Occupancy Scenario

DandD Version: 2.1.0
Run Date/Time: 9/12/2016 8:32:26 AM
Site Name: Any
Description: DSV Determination with NUREG 1720 REsuspension Factor
FileName: C:\Users\mgdtke\Desktop\Dave DandD\U-238+C DSV, NUREG 1720 RF.mcd

Options:

Implicit progeny doses NOT included with explicit parent doses
Nuclide concentrations are NOT distributed among all progeny
Number of simulations: 100
Seed for Random Generation: 8718721
Averages used for behavioral type parameters

External Pathway is ON
Inhalation Pathway is ON
Secondary Ingestion Pathway is ON

Initial Activities:

Nuclide	Area of Contamination (m^2)	Distribution
238U+C	UNLIMITED	CONSTANT(dpm/100 cm**2)
Justification for concentration: DSV Determination		Value 1.00E+00

Chain Data:

Number of chains: 1

Chain No. 1: 238U+C
Nuclides in chain: 16

Nuclide	Chain Position	Half Life	First Par ent	Fractional Yield	Second Par ent	Fractional Yield	Ingestion CEDE Factor (Sv/Bq)	Inhalation CEDE Factor (Sv/Bq)	Surface **Dose Rate** Factor (((Sv/d)/(Bq/m^2))	**15 cm Dose Rate** Factor (((Sv/d)/(Bq/m^3))
238U+C	1	1.63E+12								
234Th	2	2.41E+01	1	1	0	0	3.69E-09	9.47E-09	7.18E-13	1.12E-14
234mPa	Implicit		2	0.998			0.00E+00	0.00E+00	1.32E-12	3.62E-14
234Pa	Implicit		2	0.002	0	0.0013	5.84E-10	2.20E-10	1.59E-10	4.65E-12
234U	3	8.93E+07	2	1	0	0	7.66E-08	3.58E-05	6.46E-14	1.85E-16
230Th	4	2.81E+07	3	1	0	0	1.48E-07	8.80E-05	6.48E-14	5.52E-16
226Ra	5	5.84E+05	4	1	0	0	3.58E-07	2.32E-06	5.56E-13	1.42E-14
222Rn	6	3.82E+00	5	1	0	0	0.00E+00	0.00E+00	3.41E-14	9.81E-16
218Po	Implicit		6	1			0.00E+00	0.00E+00	7.67E-16	2.27E-17
214Pb	Implicit		6	0.9998			1.69E-10	2.11E-09	2.10E-11	5.78E-13
218At	Implicit		6	0.0002			0.00E+00	0.00E+00	0.00E+00	0.00E+00

214Bi	Implicit		6	1			7.64E-11	1.78E-09	1.22E-10	3.77E-12
214Po	Implicit		6	0.9998			0.00E+00	0.00E+00	7.02E-15	2.07E-16
210Pb	7	8.15E+03	6	1	0	0	1.45E-06	3.67E-06	2.14E-13	1.13E-15
210Bi	8	5.01E+00	7	1	0	0	1.73E-09	5.29E-08	9.06E-14	1.61E-15
210Po	9	1.38E+02	8	1	0	0	5.14E-07	2.54E-06	7.16E-16	2.11E-17

Initial Concentrations:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Nuclide	Surface Concentration (dpm/100 cm**2)
238U	1.00E+00
234Th	1.00E+00
234mPa	9.98E-01
234Pa	2.00E-03
234U	1.00E+00
230Th	1.00E+00
226Ra	1.00E+00
222Rn	1.00E+00
218Po	1.00E+00
214Pb	1.00E+00
218At	2.00E-04
214Bi	1.00E+00
214Po	1.00E+00
210Pb	1.00E+00
210Bi	1.00E+00
210Po	1.00E+00

Model Parameters:

General Parameters:

Parameter Name	Description	Distribution
To:Time In Building	The time in the building during the occupancy period	CONSTANT(hr/week)
Default value used		Value 4.50E+01
Tto:Occupancy Period	The duration of the occupancy exposure period	CONSTANT(days)
Default value used		Value 3.65E+02
Vo:Breathing Rate	The average volumetric breathing rate during building occupancy for an 8-hour work day	CONSTANT(m**3/hr)
Default value used		Value 1.40E+00
RFo*:Resuspension Factor	Effective resuspension factor during the occupancy period = RFo * Fl	CONSTANT(1/m)
Justification for modification: NUREG 1720 Recommendation		Value 1.00E-06
		Default DERIVED(1/m)
GO*:Ingestion Rate	Effective secondary ingestion transfer rate of removable surface activity from building	DERIVED(m**2/hr)

	surfaces to the mouth during building occupancy = GO * FI	
Default value used		
Tstart:Start Time	The start time of the scenario in days	CONSTANT(days)
Default value used		Value 0.00E+00
Tend:End Time	The ending time of the scenario in days	CONSTANT(days)
Default value used		Value 3.65E+02
dt:Time Step Size	The time step size	CONSTANT(days)
Default value used		Value 3.65E+02
Pstep:Print Step Size	The time steps for the history file. Doses will be written to the history file every n time steps	CONSTANT(none)
Default value used		Value 1.00E+00
AOExt:External Exposure Area	Minimum surface area to which occupant is exposed via external radiation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOInh:Inhalation Exposure Area	Minimum surface area to which occupant is exposed via inhalation during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AOIng:Secondary Ingestion Exposure Area	Minimum surface area to which occupant is exposed via secondary ingestion during occupancy period	CONSTANT(m**2)
Default value used		Value 1.00E+01
AO:Exposure Area	Minimum surface area to which occupant is exposed during the occupancy period	DERIVED(m**2)
Default value used		
Fl:Loose Fraction	Fraction of surface contamination available for resuspension and ingestion	CONSTANT(none)
Default value used		Value 1.00E-01
Rfo:Loose Resuspension Factor	Resuspension factor for loose contamination	CONTINUOUS LOGARITHMIC(1/m)
Default value used		Value / Probability 9.12E-06 / 0.00E+00 1.10E-04 / 7.67E-01 1.46E-04 / 9.09E-01 1.62E-04 / 9.50E-01 1.85E-04 / 9.90E-01 1.90E-04 / 1.00E+00
GO:Loose Ingestion Rate	The secondary ingestion transfer rate of loose removable surface activity from building surfaces to the mouth during building occupancy	CONSTANT(m**2/hr)
Default value used		Value 1.10E-04

Correlation Coefficients:

None

Summary Results:

90.00% of the 100 calculated TEDE values are < 1.03E-01 mrem/year .
The 95 % Confidence Interval for the 0.9 quantile value of TEDE is 1.03E-01 to 1.03E-01 mrem/year

Detailed Results:

Note: All reported values are the upper bound of the symmetric 95% confidence interval for the 0.9 quantile value

Concentration at Time of Peak Dose:

Nuclide	Surface Concentration (dpm/100 cm**2)
238U	1.00E+00
234Th	1.00E+00
234mPa	9.98E-01
234Pa	2.00E-03
234U	1.00E+00
230Th	1.00E+00
226Ra	1.00E+00
222Rn	1.00E+00
218Po	1.00E+00
214Pb	1.00E+00
218At	2.00E-04
214Bi	1.00E+00
214Po	1.00E+00
210Pb	1.00E+00
210Bi	1.00E+00
210Po	1.00E+00

Pathway Dose from All Nuclides (mrem)

All Pathways Dose	External	Inhalation	Secondary Ingestion
1.03E-01	2.38E-03	8.98E-02	1.12E-02

Radionuclide Dose through All Active Pathways (mrem)

Nuclide	All Pathways Dose
238U	1.78E-02
234Th	3.27E-05
234mPa	2.14E-05
234Pa	5.17E-06
234U	1.99E-02
230Th	4.87E-02
226Ra	2.81E-03
222Rn	5.54E-07
218Po	1.25E-08
214Pb	3.43E-04
218At	0.00E+00
214Bi	1.98E-03
214Po	1.14E-07
210Pb	8.23E-03
210Bi	3.78E-05
210Po	3.59E-03
All Nuclides	1.03E-01

Dose from Each Nuclide through Each Active Pathway (mrem)

Nuclide	External	Inhalation	Secondary Ingestion
238U	7.73E-07	1.75E-02	2.95E-04
234Th	1.17E-05	5.17E-06	1.58E-05
234mPa	2.14E-05	0.00E+00	0.00E+00
234Pa	5.17E-06	2.40E-10	5.01E-09
234U	1.05E-06	1.96E-02	3.29E-04
230Th	1.05E-06	4.81E-02	6.35E-04
226Ra	9.04E-06	1.27E-03	1.54E-03
222Rn	5.54E-07	0.00E+00	0.00E+00
218Po	1.25E-08	0.00E+00	0.00E+00
214Pb	3.41E-04	1.15E-06	7.25E-07
218At	0.00E+00	0.00E+00	0.00E+00
214Bi	1.98E-03	9.72E-07	3.28E-07
214Po	1.14E-07	0.00E+00	0.00E+00
210Pb	3.48E-06	2.00E-03	6.22E-03
210Bi	1.47E-06	2.89E-05	7.42E-06
210Po	1.16E-08	1.39E-03	2.21E-03

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