**DEPARTMENT OF VETERANS AFFAIRS**
**Veterans Health Administration**
**National Health Physics Program**
**2200 Fort Roots Drive**
**North Little Rock, AR 72114**

JUN 23 2010

In Reply Refer To: 598/115HP/NLR

Cassandra F. Frazier
Division of Nuclear Material Safety
Nuclear Regulatory Commission (NRC), Region III
2443 Warrenville Road, Suite 210
Lisle, Illinois 60532-4352

Re: NRC Master Materials License 03-23853-01VA; VHA Permit Number 37-0123-03

Dear Ms. Frazier:

I request expedited review for the enclosed closeout survey documentation for Building 2 at VA Pittsburgh Healthcare System, Pittsburgh, Pennsylvania.

The documentation includes a Final Status Survey Report prepared by a contractor for Building 2 at the healthcare system. The documentation provides information consistent with 10 CFR 30.36. I conclude these results demonstrate the building is acceptable for unrestricted use under criteria in 10 CFR 20.1402.

Building surface screening values in the *Federal Register* on November 18, 1998 (63 FR 64132), as supplemented by the *Federal Register* on June 13, 2000 (65 FR 37186), were applied as the Derived Concentration Guideline Levels (DCGLs) for radionuclides of concern (tritium and carbon-14).

This building is planned for demolition with a goal to complete the demolition and begin construction for a new research building not later than the end of this fiscal year. Again, I request an expedited review to support this planned construction.

If you have any questions or comments, please contact Thomas E. Huston, Ph.D., National Health Physics Program, at 501-257-1578.

Sincerely,

Gary E. Williams
Director, National Health Physics Program

Enclosure

RECEIVED JUN 24 2010

*partnering in veteran-centered care*

VAPHS

**VA PITTSBURGH HEALTHCARE SYSTEM**
University Drive
Pittsburgh, PA 15240
412.688.6000
www.pittsburgh.va.gov



May 19, 2010

National Health Physics Program
Building 101, Room 208D
2200 Fort Roots Drive
North Little Rock, AR 72114

Subject: Amendment Request

To Whom it May Concern:

This is to request that building 2, University Drive, VA Pittsburgh Healthcare System (VAPHS), be released for unrestricted use and deleted from our Radioactive Materials Permit (Radioactive Materials Permit Number 37-01230-03).

In accordance with our April 8, 2010, email notification to your office, VA Pittsburgh Healthcare System has ceased all radioactive materials use and storage in building 2, University Drive. As part of the decommissioning of building 2, a Historical Site Assessment (HSA) and Final Status Survey (FSS) were conducted by Tidewater, Inc., during April 2010. The enclosed Final Status Survey Report (FSSR) from Tidewater Inc., concludes that building 2 can be released for unrestricted use based on the results of the survey measurements and current regulatory release criteria.

Building 2 sits on the construction footprint of the future Research Office Building (ROB). The ROB is at 100% design phase and will be ready for solicitation in the very near future. It is projected that the construction award will be made by the end of the summer with a notice to start construction issued by the end of the fiscal year. Therefore, it is critical that building 2 is ready for demolition by the end of the fiscal year.

It is my understanding that the FSSR can take up to 9 months before final approval is granted, and I request that the decision to release building 2 for unrestricted use is made in an expeditious manner.

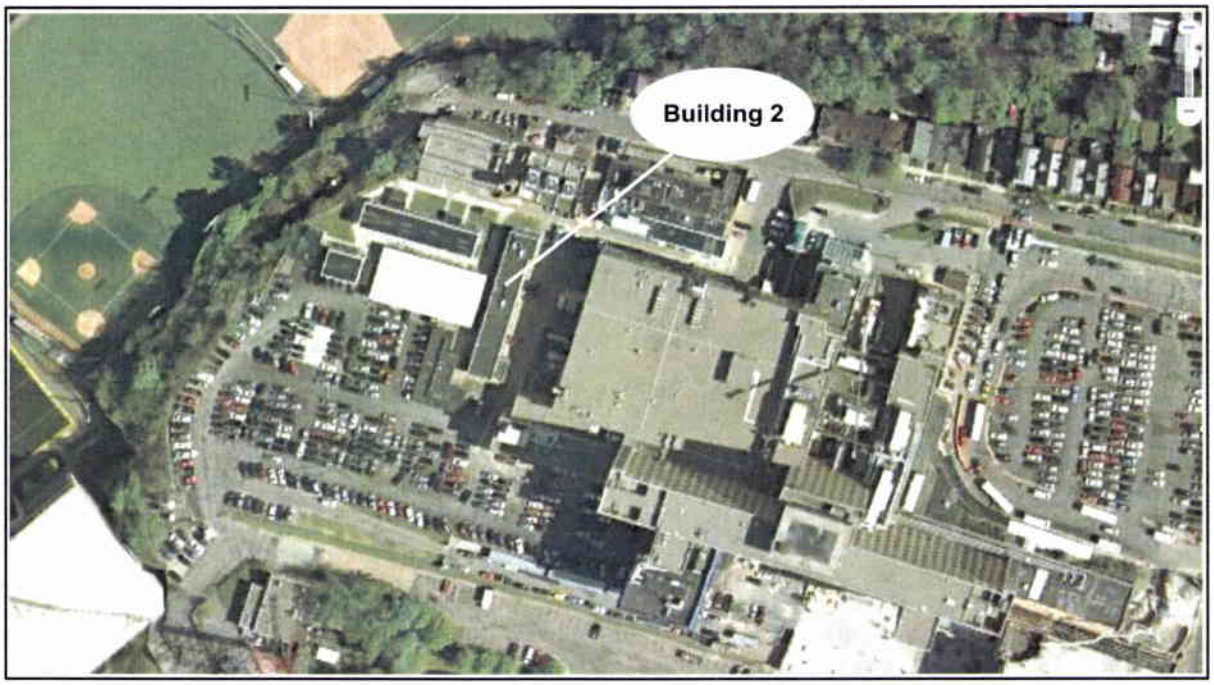
If you need additional information concerning this request, please contact Mitch Belanger, Radiation Safety Officer, at 412-360-3221.

TERRY GERIGK WOLF, FACHE
DIRECTOR

# FINAL STATUS SURVEY REPORT

## Veterans Administration-Pittsburgh, Building 2

## May 2010




TIDEWATER INC

Tidewater, Inc.

7161 Columbia Gateway Dr, Suite C

Columbia, MD 21046

## Glossary of Terms, Acronyms and Abbreviations

| | |
|---|---|
| ADAMS | Agencywide Documents Access and Management System |
| $^{14}C$ | Carbon-14 |
| CFR | Code of Federal Regulations |
| CHP | Certified by American Board of Health Physics |
| $cm^2$ | square centimeter |
| cpm | counts per minute |
| DCGL | Derived Concentration Guideline Level |
| dpm | disintegrations per minute |
| DQO | data quality objective |
| FSS | Final status survey |
| FSSR | Final status survey report |
| $ft^2$ | square feet |
| $^3H$ | Tritium |
| $H_a$ | Alternative Hypothesis |
| $H_o$ | Null Hypothesis |
| HSA | Historical Site Assessment |
| LBGR | Lower Bound of the Gray Region |
| MARS | Mapping and Radiation Survey Mapping System |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual |
| MARSAME | Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual |
| $m^2$ | square meter |
| MDC | minimum detectable count or concentration |
| MDCR | minimum detectable count rate |
| NORM | Naturally Occurring Radioactive Material |
| NRC | Nuclear Regulatory Commission |
| NUREG | NRC nuclear regulation document |
| PDA | Personal Data Assistant |
| QA/QC | Quality Assurance/Quality Control |
| RCOC | Radionuclide Contaminants of Concern |
| RSO | Radiation Safety Officer |
| STDEV | Standard Deviation |
| SU | survey unit |
| $^{99}Tc$ | Technecium-99 |
| VA-Pittsburgh | Veterans Administration Medical Center, Pittsburgh, PA |
| $^nX$ | The number of nucleons is denoted as a superscripted prefix to the chemical symbol (e.g. $^3H$,and $^{12}C$). |
| $\Delta/\sigma$ | Relative shift |
| VHA | Veterans Health Administration |
| VA | Veterans Administration |

## FINAL STATUS SURVEY REPORT

## Veterans Administration Medical Center-Pittsburgh, Building 2

## EXECUTIVE SUMMARY

As a result of the decision to cease operations with radioactive materials in VA-Pittsburgh, Building 2, an investigation was performed at the facility to ensure that former use and storage locations of radioactive materials are suitable for unrestricted release as specified by the Nuclear Regulatory Commission (NRC) in 10 CFR Part 20. Tidewater, Inc. performed the final status surveys (FSS) for Building 2 during April 2010 in compliance with federal regulations. The purpose of the Final Status Survey Report (FSSR) is to demonstrate that radiological conditions at the facility satisfy release criteria and that the site can be released for unrestricted use.

Radiological operations in Building 2 are currently authorized under Veterans Health Administration (VHA) Permit Number 37-01230-03 issued to VA-Pittsburgh Health Care System, University Drive, Pittsburgh, PA 15240 with an expiration date of September 30, 2014.

A Historical Site Assessment (HSA) of Building 2 was conducted by Tidewater in April 2010. Both floors of the building were identified as actual or potential radioactive material use or storage areas through the years. Laboratories were associated with the long-lived radionuclides $^{3}H$ and $^{14}C$.

Radiologicalsurveys were performed during April 2010 in Building 2 with the intent of determining if residual radioactive material above the release criteria were present. The surveys were performed in accordance with the regulatory guidance found in MARSSIM (NUREG-1575 and NUREG -1757). The FSS included: a) a minimum of 30 measurement locations in each of 18 survey units; b) an investigative scan measurement in 10% of impacted areas; and c) bias and routine smears to evaluate the presence of removable contamination. The 30 measurements were performed first for $^{3}H$ with a detector designed specifically for that radionuclide and then with a different detector calibrated for $^{14}C$; for a total of 60 measurements per survey unit. Hoods and sinks were part of the bias investigations which required direct measurements and smears. The instruments were capable of detecting contamination at 0.1% of the release criteria.

The surveys confirmed that residual radioactive material, if any, was significantly less than the NRC screening levels. The structure is recommended for unrestricted release.

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## APPENDICES

## 1.0 HISTORICAL SITE ASSESSMENT

Tidewater, Inc. performed a Historical Site Assessment (HSA) in April 2010. The purpose of a HSA is to collect existing information concerning the site and its surroundings regarding the use of Nuclear Regulatory Commission (NRC) licensed radioactive materials. The primary objectives of the HSA include the following:

- identify potential sources of residual radioactivity,
- determine whether or not sites pose a threat to human health and the environment,
- differentiate impacted from non-impacted areas,
- provide input to scoping and characterization survey designs,
- provide an assessment of the likelihood of residual radioactivity migration, and
- identify additional potential radiation sites related to the site being investigated.

Impacted areas have a potential for radioactive contamination (based on historical data) or contain known radioactive contamination (based on past or preliminary radiological surveillance). This includes areas where (1) radioactive materials were used and stored; (2) records indicate spills, discharges, or other unusual occurrences that could result in the spread of contamination; and/or (3) radioactive materials were buried or disposed. Areas immediately surrounding or adjacent to these locations are included in this Classification because of the potential for inadvertent spread of contamination.

Non-impacted areas were identified through knowledge of site history or previous survey information. Non-impacted areas are those areas where there is no reasonable possibility for residual radioactive contamination.

### 1.1 Property Description

In June of 1946, VA acquired 14 acres of land from the University of Pittsburgh and local residents. In October of 1950, ground was broken for the main University Drive Hospital which was designed and constructed by the U.S. Army Corps of Engineers.

Building 2 was constructed in the mid-1950s as a nursing student dormitory and immediately adjacent to the main hospital of the VA Pittsburgh Health Care System. Building 2 now consists of a two-story, 9,440 sq. ft. medical research facility. By the mid 1970s (maybe earlier) it had been renovated into research laboratories.

### 1.2 Owner and Facility Location

The University Drive Division of VA Pittsburgh Healthcare System is located adjacent to the University of Pittsburgh's Petersen Events Center. The owner and operator of the facility is the VA Pittsburgh Health Care System, Veterans Affairs Medical Center, University Drive C, Pittsburgh, PA 15240. The contact is:

*William D. James Sr.*
Project Manager (COTR)
FMS Projects 138P-U
Phone: 412-360-3706
Mobile: 412-216-8890

Figure 1 illustrates the position (red star) of the VA Medical HealthCare facility in relation to its surroundings, such as the University of Pittsburgh.

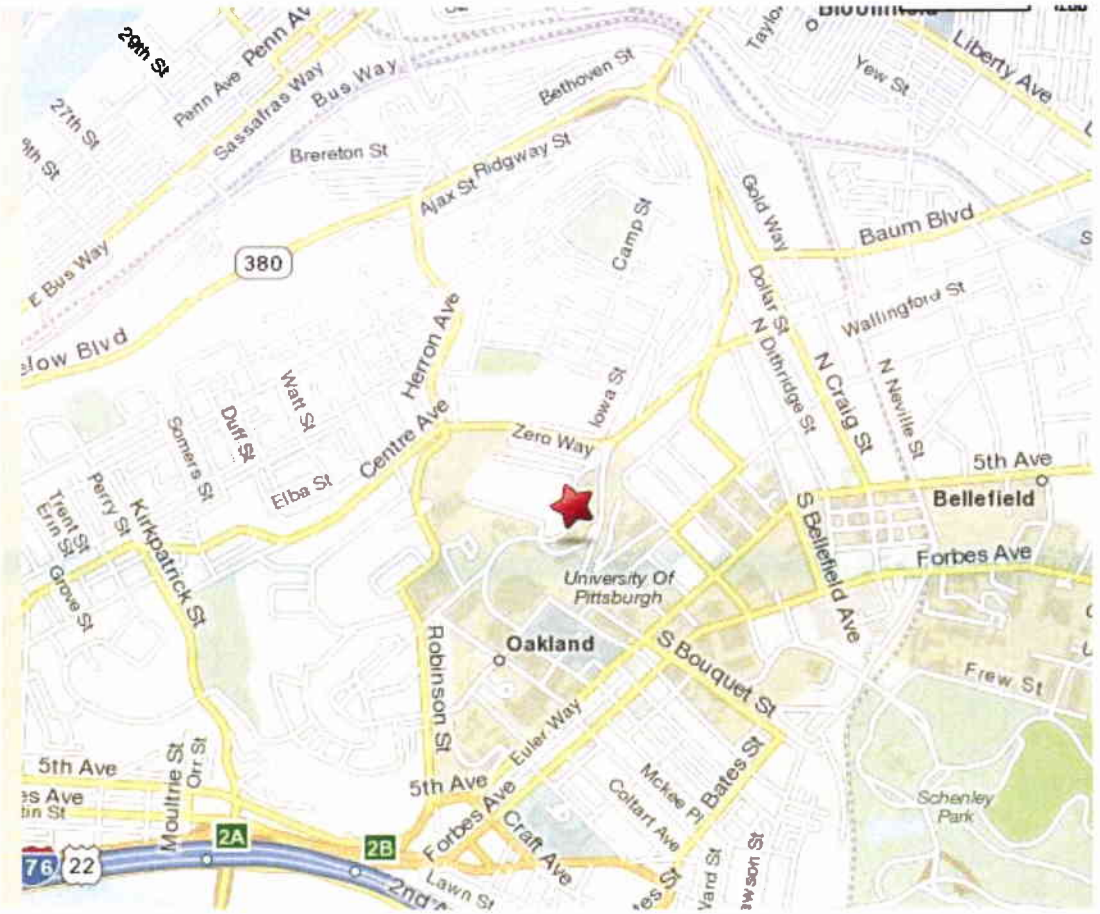



**Figure 1. Map of General Area Surrounding VA Medical HealthCare Facility**

Figure 2 (from GoogleEarth©) indicates the location of Building 2 within the VA Medical HealthCare facility.

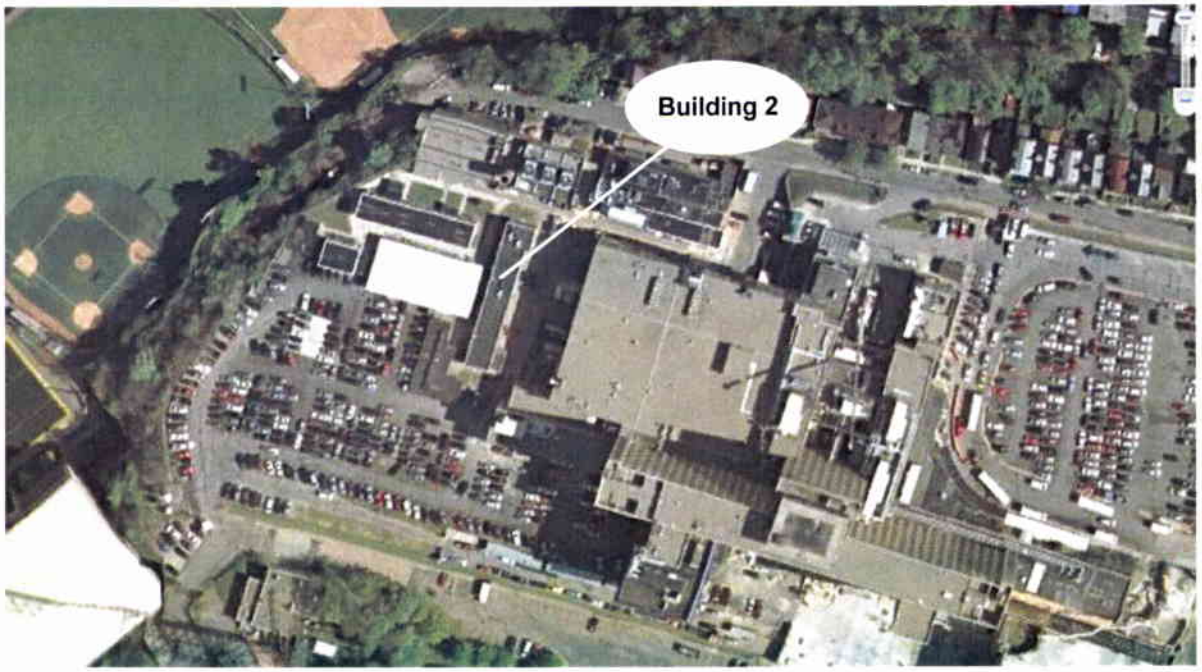



**Figure 2. Aerial Photograph of VA Medical HealthCare Facility Indicating Building 2**

## 1.3 Building Description

The research building is a two story brick enclosure with a flat roof. Fume hoods in the laboratory spaces appeared to operate under a negative pressure gradient. The fume hoods were exhausted through independent ventilation ducts/fan housings to the exterior sides of the building on the first floor while exhausting to the roof on the second floor. Sinks in the laboratories in this section of the building are drained to a sanitary sewer with piping typical of laboratory settings. No hold-up tank system was identified for the general neutralization of laboratory liquid wastes or the monitoring of hazardous liquid discharge; the liquid effluents of the building discharge to the sanitary sewerage system. The flooring is generally composed of concrete overlain by linoleum tiling in the halls and laboratory spaces, medium duty wall to wall carpeting in certain spaces, and ceramic tile in restrooms.

The photographs in Figures 3 and 4 show the general construction of the building exterior. A floor plan indicating the laboratory work areas is presented in Figure 5.

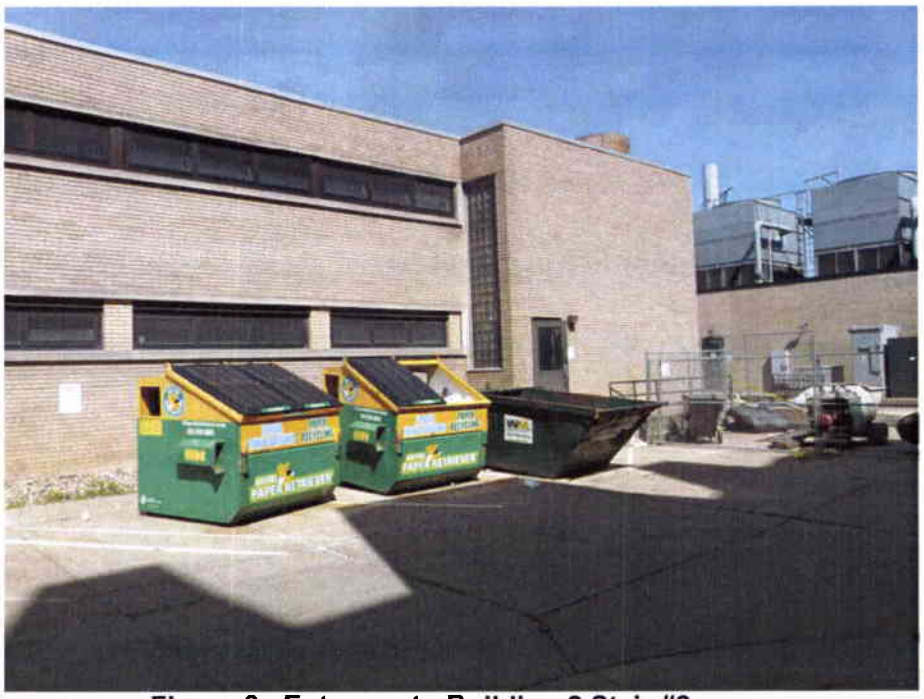


Figure 3. Entrance to Building 2 Stair #2

Figure 4. Building 2 Exterior With Room 1A112, Equipment Room, On Far Left

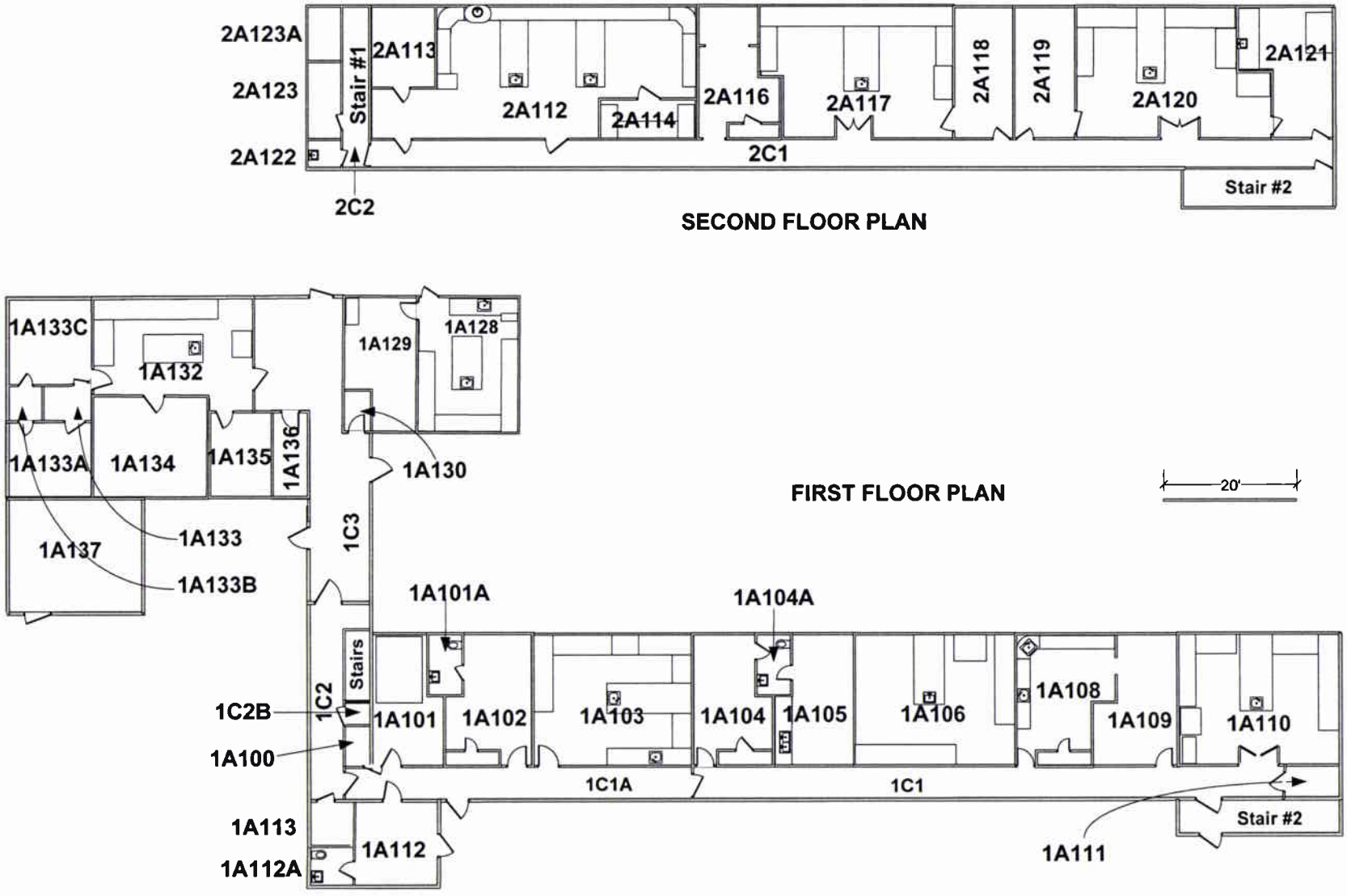



**Figure 5. Building 2 Floor Plan**

### 1.4 Documents Reviewed

Records maintained by the radiation safety staff for Building 2 were reviewed. The following comments are provided on those records related to Area Classification as impacted or non-impacted.

Permits and Licenses:

Amendment 81 to VHA Permit 37-01230-03 signed 11/19/2008 with an expiration date of 9/30/2014. The VHA National Health Physics Program had conducted radiation safety inspections in March 2010, September 2007, September 2004, and October 2001. The inspection reports did not identify any issues with contamination at Building 2.

Application for Renewal of VHA Permit 37-01230-03 signed 8/30/2004. The application indicated use and storage in Building 2 Rooms 1A135, 1A136, 1A100, 1A101, 1A103, 1A108, 1A109. Planned radionuclide use and storage indicated $^{51}Cr$, $^{32}P$, $^{14}C$, and $^{3}H$.

Incoming Radioactive Isotopes Notebooks: These logs were maintained to October 1993 – February 2005. Entries indicated receipts of radioactive material at Building 2 for Rooms 1A103, 1A110, 1A128, 1A129, 1A135, 2A117, 2A118, and 2A120. Receipts included $^{125}I$, $^{35}S$, $^{32}P$, $^{14}C$, and $^{3}H$ in the microcurie to millicurie range.

Incident Folder: There was no indication of any major spills or incidents involving long lived radionuclides in the Incident Folder.

NRC ADAMS Website:

The **A**gencywide **D**ocuments **A**ccess and **M**anagement **S**ystem (ADAMS) is an information system that provides access to all image and text documents that the NRC has made public.

Only one document was available for review at the NRC ADAMS Public website which was License Amendment Number 66 dated 10/19/2000 under docket 03002978 with an expiration date of 9/30/2004.

The same search under the ADAMS Public Legacy Library indicated that 40 documents dating back to 1983 were available for review at the Public Document Room. These were mostly regarding licensing amendments and inspections. Table 1 indicates the dates of inspections and the topic of violation identified if any. None of the identified issues indicated a need to physically inspect the documents.

**Table 1. NRC Inspection Date and Result Summary**

| Inspection Date | Result Summary |
|---|---|
| 10/4/1983 | Failure to perform dose calibrator linearity checks |
| 12/9/1986 | Failure to survey incoming package |
| 3/15/1990 | No Violations Identified |
| 5/11/1993 | No Violations Identified |
| 10/11/1994 | Failure to dispose solid rad waste in labeled container |
| 11/18/1997 | No Violations Identified |

### 1.5 Property Inspections

Property inspections were conducted by Mr. Claude Wiblin, CHP, with Mr. Mitchell Belanger on April 13 and 14, 2010. The inspections consisted of a review of the use of radioactive material as authorized by the NRC license. During the walk-down of the building, no presence of radioactive material was observed. No exit signs containing radium or tritium were observed; none were identified by the radiation safety staff.

All material and furniture was removed prior to the conduct of the radiation survey.

### 1.6 Personnel Interviews

Three prior employees of Building 2, the current RSO and the previous RSO were interviewed as to the overall operation and use of radioactive materials at Building 2. The interviews followed the questions identified in the Historical Site Interview Form in Appendix A. To assure as much recall as possible, all were provided a copy of the form prior to the interview.

- Belanger, Mitchell J. , RSO
- Ying Hsu, Prior RSO
- Jau-Shyong Deng, Chief, Dermatology, 23 years at facility
- Chandrashekhar, R. Ghandi, PhD, Deputy Associate Chief of Staff/R&D
- John Prelich, Health Science Specialist

### 1.7 History

The radionuclides authorized for use in research and development as defined in 10 CFR 30.4 in the license are given, with their half lives, in Table 2.

**Table 2. Radioactive Materials Authorized for Research Activities, and their Half Lives**

| Nuclide | Half Life |
|---|---|
| Hydrogen 3 | 12.33 years |
| Carbon 14 | 5,730 years |
| Phosphorous 32 | 14 days |
| Phosphorous 33 | 25 days |
| Sulfur 35 | 87 days |
| Calcium 45 | 163 days |
| Chromium 51 | 28 days |
| Iodine 125 | 59 days |

The table indicates that three radionuclides of concern have half-lives greater than 150 days. Although plans indicated potential use of $^{45}Ca$ with half-life of just 163 days, no records of receipts or use were noted. February 2005 was the last identified delivery of any radionuclide.

The last laboratory use of radioactive materials was reported as not later than October 2007 when the current RSO was hired. Storage ended on April 20, 2010.

- Historical records indicated liquid discharges to the sanitary sewer system but no burial of radioactive material on site.

- There are no hold-up tanks or septic fields associated with the drains in Building 2. The laboratory drains tie into the building drains and then into the site sanitary sewerage system which is part of the city of Pittsburgh system. No irregular plumbing was reported to be associated with the laboratory drains.
- The building does have a central vacuum tank for all laboratories located in Room 1A137.
- No animal research was reported in Building 2.
- No environmental studies were reported.

The following table indicates the various rooms and grouping as survey units. Floor area, number of fume hoods, and sinks are provided. One area was deemed as non-impacted which was Room 1A137, Mechanical Room.

## Table 3. Survey Unit Grouping of Rooms Indicating Area, Fume Hoods, and Sinks

| Survey Unit | Room | Name | Fume Hoods | Sinks | Floor ($ft^2$) |
|---|---|---|---|---|---|
| 1 | 1A101 | Cold Room | | 1 | 436 |
| | 1A101A | Toilet | | | |
| | 1A102 | Office | | | |
| 2 | 1A103 | Laboratory | 1 | 2 | 455 |
| 3 | 1A104 | Office | | 1 | 442 |
| | 1A104A | Toilet | | | |
| | 1A105 | Laboratory | | 1 | |
| 4 | 1A106 | Laboratory | 1 | 1 | 455 |
| 5 | 1A108 | Laboratory | | 2 | 444 |
| | 1A108A | Closet | | | |
| | 1A109 | Laboratory | | | |
| 6 | 1A110 | Laboratory "C" | 1 | 1 | 431 |
| 7 | 1A128 | Histo/Chem Laboratory | | 2 | 486 |
| | 1A129 | Conference | 1 | | |
| 8 | 1A133 | Entrance | | 1 | 351 |
| | 1A133A | Microscope Room | | | |
| | 1A133B | Dark Room | | | |
| | 1A133C | Microscope Room | | | |
| 9 | 1A132 | Tissue Preparation Room | 1 | 1 | 681 |
| | 1A134 | Cut Room | | 1 | |
| | 1A135 | Dark Room | | | |
| 10 | 1A111 | Telephone Closet | | 1 | 799 |
| | 1A112 | Equipment Room | | | |
| | 1A112A | Toilet | | | |
| | 1C1 | Corridor | | | |
| | 1C2 | Corridor | | | |

| Survey Unit | Room | Name | Fume Hoods | Sinks | Floor ($ft^2$) |
|---|---|---|---|---|---|
| 11 | 1A100 | Storage | | 1 | 571 |
| | 1A113 | Janitor | | 1 | |
| | 1A130 | Toilet | | | |
| | 1A136 | Storage | | | |
| | 1C2B | Telephone Closet | | | |
| | 1C3 | Corridor | | | |
| 12 | 2A112 | Laboratory | 1 | 3 | 915 |
| | 2A113 | Laboratory | | | |
| | 2A114 | Laboratory | | | |
| 13 | 2A116 | Sterilizer Room | | | 190 |
| | 2A116A | Closet | | | |
| | 2A116B | Equipment Room | | | |
| 14 | 2A117 | Laboratory "B" | 1 | 1 | 688 |
| | 2A118 | Office "B" | | | |
| 15 | 2A120 | Laboratory "A" | 1 | 1 | 482 |
| 16 | 2A121 | Lab | 1 | 1 | 222 |
| 17 | 2C1 | Corridor | | 1 | 898 |
| | 2A122 | H.A.C | | | |
| | 2A119 | Office "A" | | | |
| 18 | 2C2 | Corridor | | | 136 |
| | 2A123 | Storage | | | |
| | 2A123A | Room G | | | |

## 2.0 ORGANIZATION AND TRAINING

### 2.1 Organization

The HSA and the final status survey were performed by Tidewater, Inc., using a qualified team composed of technical experts and radiation safety technicians. Figure 6 shows the organizational chart for the survey activities.

The Tidewater team was under the supervision of Claude Wiblin, CHP. Mr. Wiblin had the authority to make appropriate changes to the survey plan (subject to the established QA/QC program) as deemed necessary as the survey progressed. Mr. Wiblin also directed laboratory services for smear analyses.

Field measurements of radiological parameters and sample collection were under the direction of Mr. Angel Reyes.

QA/QC responsibilities were handled by a QA officer whose work responsibilities are otherwise separate from those on the survey team. Mr. Wayne Gaul, PhD, CHP, CHMM, served as the QA officer and coordinated all interface requirements during the survey process. Applicable Tidewater QA procedures are developed from guidelines presented in ANSI/ASTM NQA-1, Quality Assurance Program Requirements for Nuclear Facilities (1989).

Mr. Mitchell Belanger is the facility Radiation Safety Officer (RSO).

### 2.2 Training

Tidewater provides continuing training for its survey personnel and other workers who may be exposed to radioactive materials. Training varies according to potential exposure and the nature of the employee's job duties, which is consistent with 10 CFR Part 19.12, "Instruction to Workers". In addition to the regular training, special training was provided on equipment, special techniques, and practices relative to the survey activities for those employees who were involved in taking radiological measurements and samples. All members of the final status survey team attended an in-house training session regarding radiation protection, survey procedures, and quality assurance activities. Documentation of training participation was retained in the Tidewater training files.

Mr. Belanger, RSO, presented a briefing on radiological safety and administrative procedures to the survey team; this briefing was documented.

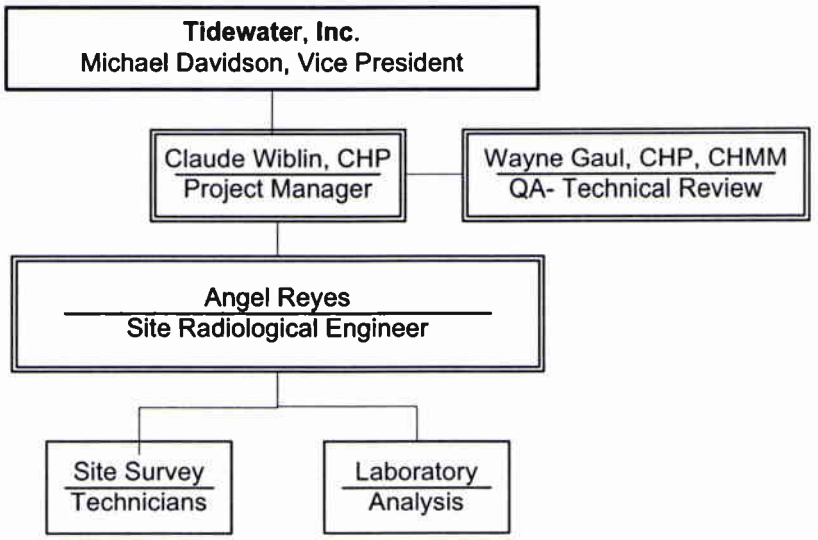



**Figure 6. Organization Chart for Final Status Survey Activities**

## 3.0 PROJECT DATA QUALITY OBJECTIVES

The general objectives of the survey were to provide sufficient information to:

- Confirm whether one or more radionuclides of concern exceed the release criteria in areas with known or suspected radioactive contamination.
- Verify assumptions used to develop the survey design.
- Delineate areas where no radionuclide concentrations exceed the action levels and support recommendation for unrestricted release.

Quality assurance (QA) measures were implemented throughout the project to ensure data met known and suitable data quality criteria such as precision, accuracy, representativeness, comparability, and completeness. The quality of analytical data was also controlled through the performance of quality control (QC) measurements and the calibration of field and laboratory equipment. On-site radiological measurement techniques were used based on radiological characteristics of the potential contaminants and the reasonable implementation of best available technology.

### 3.1 Step 1 – State the Problem

The problem was the potential presence of concentrations of radionuclides of concern (i.e., those resulting from NRC licensed activities) in structure surfaces and surface soil exceeding the project investigation levels. Two long-lived radionuclides of concern were identified: $^{3}H$ and $^{14}C$.

### 3.2 Step 2 – Identify the Decision

The principal study question for the survey was to determine if the activity of radionuclides of interest exceed established Derived Concentration Guideline Levels (DCGLs). The investigation level (IL) was set as any measurement greater than minimum detection concentrations (MDC). DCGLs are those concentrations equivalent to the NRC's 25 mrem/year release criterion and are used interchangeably as NRC screening levels. Survey instruments would be selected such that their minimum detectable count rate (MDCR) would be 50% or less of any DCGL. Scanning for both $^{3}H$ and $^{14}C$ would be performed on counter tops and work areas while floor areas would be scanned for $^{14}C$.

### 3.3 Step 3 – Identify Inputs to the Decision

The following information was utilized to support decisions:

- Radionuclides of concern (Section 1.7)
- Project investigation levels and DCGLs (Section 3.0)
- Measurement inputs (Section 6.0)

### 3.4 Step 4 – Define the Study Boundaries

The study boundaries were limited to the two floors of Building 2, including corridors.

### 3.5 Step 5 – Develop a Decision Rule

The decision rules developed from MARSSIM given in Tables 4 and 5 were applied. Decisions on whether to perform additional investigations were made during performance of onsite field work based on the evaluation of scan data, direct measurement data, and smear data. In no case was additional data collection required. Decisions were made on whether to recommend release on each of the survey units for unrestricted use.

**Table 4. Decision Rules for Flags**

| Survey Unit Classification | Flag Direct Measurement or Sample Result When: | Flag Scanning Measurement Result When: |
|---|---|---|
| Class 2 | > fraction of DCGL* | >MDCR** |
| Class 3 | >fraction of DCGL* | >MDCR** |

*Not defined by MARSSIM but for this survey it was considered as 0.1% of DCGL which is actually a very small fraction. Class 2 flags are usually set much higher at >DCGL.

**Usually scan flags are set at >DCGL; lower values required here provide closer scrutiny.

**Table 5. Decision Rules for Release Recommendations**

| Radionuclide non-specific (gross) measurements made: Survey Result | Conclusion |
|---|---|
| All measurements < DCGL | Survey unit meets release criterion |

### 3.6 Step 6 – Specify Limits on Decision Errors

The survey was designed as a graded approach using a combination of scanning, direct measurements, and smears. Analytical uncertainty was controlled by use of appropriate instruments, methods, techniques, and QC. Minimum detectable concentrations (MDCs) for individual radionuclides using specific analytical methods were established. Uncertainty in the decision to release areas for unrestricted use was controlled by the number of data points in each area and the uncertainty in the estimate of the mean radionuclide concentrations. The null hypothesis used to design the survey was the radioactivity in the survey unit exceeds the release criterion. A Type I decision error would occur if a decision was made to incorrectly release a survey unit that exceeds the release criterion. A Type II decision error would occur if a decision was made to incorrectly maintain control of a survey unit that demonstrated compliance with the release criterion. The error rate for both types of decision errors was set at 0.05, or 5%.

### 3.7 Step 7 – Optimize the Design for Obtaining Data

Sampling and analysis processes were designed to provide near real-time data during implementation of field activities. Scanning was used to determine if elevated areas were present and if those areas should be quantified. These data were evaluated and used to refine the scope of field activities to optimize implementation of the survey design and ensure the data quality objectives (DQOs) were met.

## 4.0 DERIVED CONCENTRATION GUIDELINE LEVELS (DCGLs)

NUREG-1757, Vol. 1, indicates that a licensee may perform a screening analysis to demonstrate compliance with the radiological criteria for license termination specified in Part 20, Subpart E. The screening analysis described in Chapter 2 of NUREG-1757 requires that the licensee either: (1) refer to radionuclide-specific screening values listed in the *Federal Register* (63 FR 64132 and 64 FR 68395); or (2) use the DandD computer code. As there are two radionuclides of concern, the sum of fractions rule applies and the individual screening levels are shown in Table 6.

**Table 6. Acceptable Screening Levels for Unrestricted Release**

| Radionuclide | Screening Levels (dpm/100cm$^2$) |
|---|---|
| $^3$H | 1.2 x 10$^8$ |
| $^{14}$C | 3.7 x 10$^6$ |

The gross activity DCGL for surfaces with two radionuclides is calculated as follows.

$$\text{gross activity DCGL} = \frac{1}{\left(\frac{f_1}{DCGL_1} + \frac{f_2}{DCGL_2}\right)}$$

The gross activity DCGL would be used only if components of elevated measurements $^3$H and $^{14}$C could be identified.

Flags for direct measurements were set as 0.1% of DCGL which is actually a very small fraction: 120,000 dpm/100cm$^2$ for $^3$H, and 3700 dpm/100cm$^2$ for $^{14}$C.

## 5.0 FINAL STATUS SURVEY OVERVIEW

In accordance with MARSSIM, the null hypothesis ($H_o$) tested for this plan is that residual contamination exceeds the release criteria. The alternative hypothesis ($H_a$) is that residual contamination meets the release criteria. The statistical tests used will attempt to reject the null hypothesis.

The radionuclide contaminants of concern are hydrogen-3 ($^3H$), also referred to as tritium, and carbon-14 ($^{14}C$). Other radionuclides listed in the license have short half-lives and radioactive material has not been used in these rooms in sufficient amount of time such that they have decayed below detectable levels. The release limits are presented in Section 4.0 and these are the DCGLs that will be tested in the hypothesis testing.

The final status survey is used to demonstrate compliance with regulations. The primary objectives of the final status survey were to:

- Select/verify survey unit Classification;
- Demonstrate that the potential dose or risk from residual contamination is below the release criterion for each survey unit ; and
- Demonstrate that the potential dose or risk from small areas of elevated activity, if any, is below the release criterion for each survey unit.

The final status survey provides data to demonstrate that all radiological parameters satisfy the established guideline values and conditions. Professional judgment and biased sampling are important for locating contamination and characterizing the extent of contamination at a site. However, the MARSSIM focus is on planning the final status survey, which utilizes a more systematic approach to sampling. Systematic sampling is based on rules that endeavor to achieve the representativeness in sampling consistent with the application of statistical tests.

The survey plan consisted of systematic processes and procedures that have been deemed acceptable by industry practices and the NRC. MARSSIM methodology and its graded approach were afforded particular attention. Activities (organized units of work needed to complete a function) were defined and tasks (specific work assignments within a specific activity) were delegated to the appropriate team members. Table 7 provides an overview of final status survey activities and tasks.

**Table 7. Overview of Final Status Survey Activities and Tasks**

| Activities | Tasks |
|---|---|
| Evaluate contamination potential | 1. Review radiological data from facility surveys. |
| | 2. Identify radionuclides of concern and determine DCGLs. |
| | 3. Identify boundaries of survey units and Classes. |
| Establish reference system | 1. Determine frequency and locations of measurements to meet criteria. |
| | 2. Prepare facility survey maps and work packages. |
| Determine background levels | 1. Review HSA. |
| | 2. Measure indoor beta levels on various materials. |
| Perform Measurements | 1. Perform surface scans. |
| | 2. Perform fixed point measurements. |
| | 3. Collect smears. |
| Analyze samples | 1. Analyze smears |
| Interpret data | 1. Convert data to standard units. |
| | 2. Calculate average levels. |
| | 3. Compare data with criteria. |
| Prepare report | 1. Construct data tables. |
| | 2. Develop graphics. |
| | 3. Prepare text. |
| | 4. Submit report. |

An example work process flow chart is shown in Figure 7.

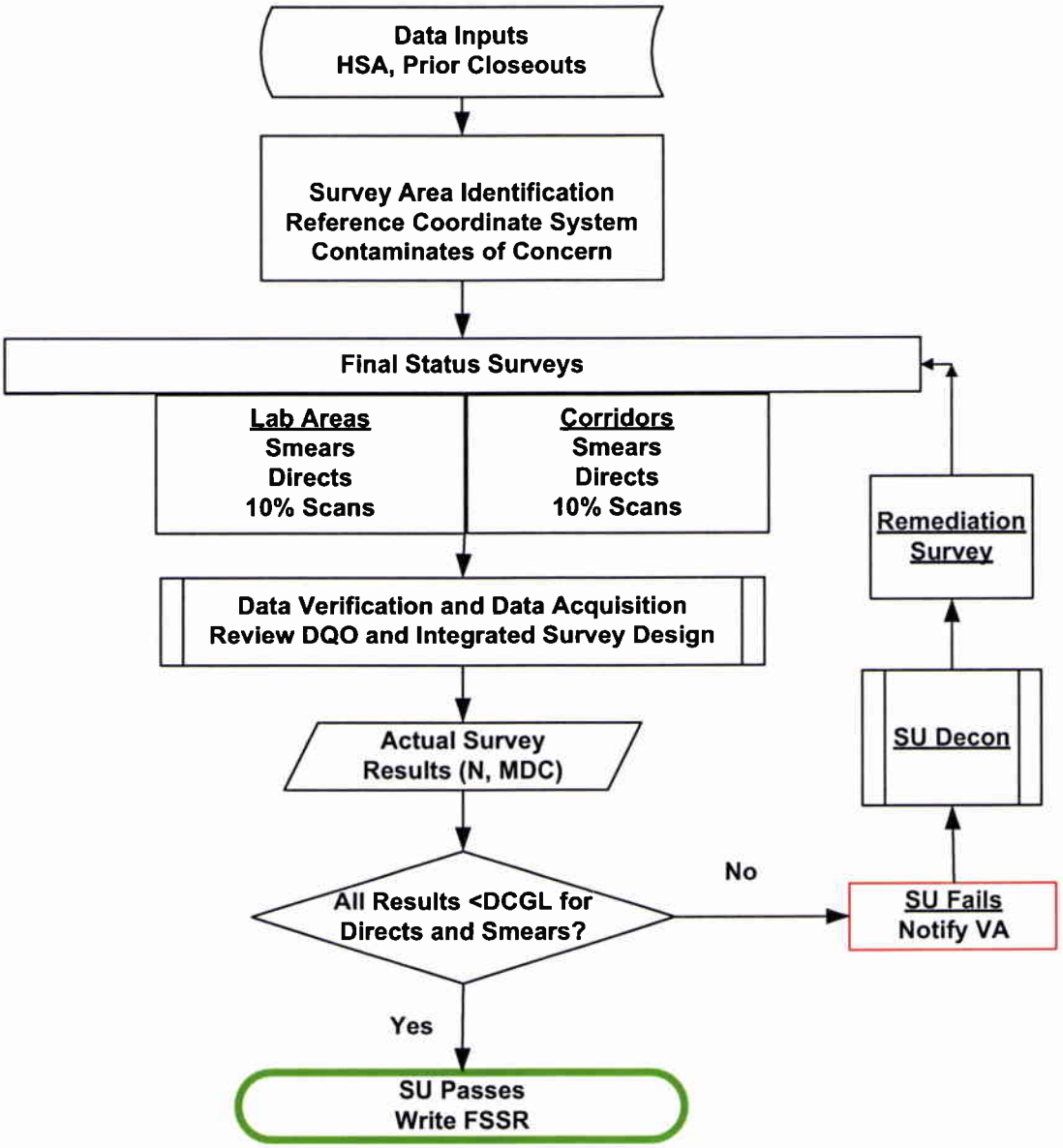



**Figure 7. Work Process Flow Chart**

## 5.1 Area Classification

MARSSIM provides guidance on Classifying areas based on the potential level of residual radioactive material contamination relative to the established release criteria. Survey requirements are specific to each Class with more detailed requirements for those areas with potentially higher levels of contamination. The HSA was used to determine the Classification of the areas in Building 2. The Classifications and associated survey requirements are:

- Class 1 areas are those where residual contamination, prior to any remediation, are likely to exceed applicable unrestricted release criteria. A Class 1 area requires 100% scan survey coverage. The survey unit size is restricted to 100 $m^2$ or less. There were no Class 1 areas identified in Building 2.

- Class 2 areas are those where the potential for residual contamination exists, but is unlikely to exceed the applicable unrestricted release criteria. Class 2 areas require that at least 10% of the survey unit area be scanned. The survey unit size can be up to 1,000 $m^2$ area. All research laboratories were deemed to have the potential as Class 2 areas but considered close to a Class 3 level.

- Class 3 areas are those where measurable levels of residual contamination are unlikely, with any levels being a small fraction of the unrestricted release criteria. Scanning in Class 3 areas is judgmental and is performed in high traffic areas. The survey unit size has no limit in area. Class 3 areas in Building 2 were deemed to be the corridors and related rooms such as a telephone booth, office, or janitorial closet.

## 5.2 Selection of Area Size for Survey Units

Suggested survey unit sizes from MARSSIM are given in Table 8. These areas are suggested in MARSSIM because they give a reasonable sampling density and they are consistent with most commonly used dose modeling codes. The limitation on survey unit size for Class 1 and Class 2 areas ensures that each area is assigned an adequate number of data points. To facilitate survey design and ensure that the number of survey data points is relatively uniformly distributed among areas of similar contamination potential, the Building was divided into survey units that share a common history or other characteristics, or are naturally distinguishable from other portions of the building. However, the size and shape of a particular survey unit was adjusted to conform to the existing features of the floor area. MARSSIM suggests that a survey unit have a minimum floor area of 10 $m^2$ (108 $ft^2$), so smaller rooms were combined with similar nearby areas. Areas and rooms in close proximity were combined to form survey units while maintaining MARSSIM suggested area limits. Note that the largest of the selected survey unit areas identified in Table 3 is only 8.5% of the maximum MARSSIM suggested area limit shown in Table 8.

**Table 8. MARSSIM Suggested Area Limits for Survey Units**

| Class | Structures - floor area |
|---|---|
| 1 | Up to 100 $m^2$ (1,076 $ft^2$) |
| 2 | 100 to 1000 $m^2$ (1,076 to 10,763 $ft^2$) |
| 3 | no limit |

A diagram of each survey unit is provided in Appendix B.

### 5.3 Determining the Number of Survey Points

The facility does not qualify for simplified survey procedures described in MARSSIM Appendix B as $^3H$ and $^{14}C$ with long half-life radionuclides ($t_{1/2} \geq 120$ days) are of concern. The simplified procedure requires 30 measurements, but the following technique was used to determine the actual number of samples required by MARSSIM.

The Sign test was selected for this survey for the following reasons:

- Each survey unit consists of a number of different surface materials.
- DCGLs were anticipated to be several magnitudes higher than residual contamination.

Since $^3H$ and $^{14}C$ are not found in appreciable quantities in background, no material specific backgrounds were needed. Certain naturally occurring radioactive material (NORM) was expected to increase gross beta measurements but not to any appreciable level that could ever challenge the DCGLs. Only intrinsic instrument backgrounds were subtracted to obtain results in dpm/100$cm^2$.

MARSSIM describes the process for determining the number of survey measurements necessary to ensure a data set sufficient for statistical analysis. The method for determining the combined number of data points (N) for the survey unit and reference area is based on the expected contaminant variability and the predetermined acceptable Type I and Type II error rates. The project data quality objectives (DQO) established the Type I and Type II error rates ($\alpha$ and $\beta$ respectively) at 0.05.

The "relative shift" ($\Delta/\sigma$) is the ratio involving the concentration to be measured ($\Delta$) relative to the expected variability in that concentration sigma ($\sigma$), and can be thought of as an expression of the resolution of the measurements. The sigma ($\sigma$) is selected from the larger of that found in the survey unit or the reference area. The shift ($\Delta$) is the width of the statistical gray region or difference in the release criterion and the lower bound of the gray region (LBGR). The gray region is the area where the impact of making an incorrect error decision (Type I or Type II error)

is small. The LBGR is the concentration at which the type II error rate is set. It is advantageous to set the LBGR at or above the expected median contaminate concentration in the survey unit; characterization data from the HSA indicated that 50% of the DCGL was well above the expected concentration levels. The Lower Bound of the Gray Region (LBGR) represents average concentrations that one expects to find after remediation is complete; by definition, the LBGR is something less than the DCGL.

MARSSIM recommends assuming a coefficient of variation of 30% for sigma when preliminary data are not available, an assumption of 0.3 times a DCGL. Routinely the LBGR is set at one-half of the DCGL or the mean of any scoping/characterization surveys. All of this is summarized in the following formulas, but this approach is obviously conservative as the chosen coefficient of variation represents contamination levels which would not be tolerated in common laboratory areas, e.g., approximately one million dpm/100cm$^2$.

$$\frac{\Delta}{\sigma} = \frac{DCGL - 0.5 * DCGL}{\sigma}$$

$$\frac{\Delta}{\sigma} = \frac{0.5}{0.3}$$

$$\frac{\Delta}{\sigma} \approx 1.7$$

To determine the number of data points needed in each survey unit, MARSSIM Table 5.5 is used. For this survey, each survey unit requires 17 survey points. For simplicity, 17 to 20 routine survey points were required in each survey unit with an allocation of bias locations to a total of 30 measurement locations. Bias locations were determined by professional judgment such as hoods, sinks or floor drains, etc.

### 5.4 Determination of Survey Point Locations

Before the surveys were conducted within a survey unit, a fixed reproducible starting point was selected, such as the southwestern corner of the survey unit at ground level. The survey unit points were based on an X-Y reference-coordinate system, as provided with the drawings in Appendix B. Equipment such as tape and laser measurers were used in the measurement of the survey units for the FSS. SAE units (feet and inches) were used for measuring the survey units. Visual aids such as chalk or ink marker were used to mark survey point locations within the survey unit.

Since the number of data points was considered as conservative for MARSSIM requirements, all Class 2 survey points were based on a square grid versus a triangular one. Class 3 survey points were randomly selected.

The location of starting grid node within each survey unit was determined using a random number generator to generate an X and Y coordinate in meters from a reference point (0, 0). Locations of the remaining survey points were gridded from that location. The initial grid node is only one of the several to be identified and is not considered the first survey point.

The (0, 0) point was generally taken as the left corner of the entrance to the survey unit or survey area at ground level. The referenced points are clearly identified on each survey unit map. For an X or Y coordinate to be valid, it must fall on the survey map within the survey unit.

Survey unit maps are provided in Appendix B. These show the random start survey points with their (X, Y) coordinates for the Class 2 survey units. The distance between each survey point "L" is shown on the Class 2 drawings and is different for each survey unit. A table is presented on the Class 3 survey unit maps for all of the randomly selected coordinates.

### 5.5 Surface Activity Measurements

The survey units and the reference area material were designed to have measurements of $^{3}H$ and $^{14}C$ on counter tops and relatively smooth areas such as fume hood surfaces, while floor areas (rough surface areas) were scanned for $^{14}C$. All fixed (or direct) measurements were made with both the Ludlum 44-110 probe and the Ludlum 43-68 probe. A wet smear was performed at fixed survey points, selected by the surveyor, and also at bias locations such as floor drains, sinks, vacuum lines, etc., for a total of 15 smears in each Class 2 Survey Unit.

For laboratory areas, the affected area was considered the entire floor footprint and four feet up the walls or the bench drawer areas. The footprint included the bench tops for the lab areas. If there was an island in the room, the bench top was included. The area of each room was determined from scale drawings of the facility; see Appendix B.

For Class 3 corridor-related areas, only the floor was considered to be affected. These survey units are larger than laboratory areas. The approximate areas, perimeters, and scanned surface areas are given in Appendix B. Five wet smears were performed at fixed survey points in each corridor survey unit; as selected by the surveyor.

#### 5.5.1 Static Measurements

Static surveys were taken at locations throughout the survey units. The pre-determined 17-20 locations were used and additional bias points for a total of 30 were included. One-minute static counts were performed for $^{3}H$ and then repeated for $^{14}C$ at each location. The data was recorded on a survey form and logged on drawings for each room that are given in Appendix B. Measurements were performed using instrumentation listed in Table 9.

#### 5.5.2 Scan Measurements

As directed by MARSSIM, each survey unit received a surface scan using appropriate survey instruments. Scan speed (observation time) was pre-determined based upon the DCGL and area size; minimum scanning time goals were set. For beta contamination detectors, scanning at one-half to three-quarter detector width per second was required to ensure that the scan MDC met the project DQOs. A goal was set to be close to the scan rate of one-half detector width per second. An investigation level (IL) was set at the MDC of the survey meters such that

at that level further investigation would be performed and possible remediation would be needed. Instruments were selected to be able to detect well below 1% of the respective DCGL.

The area scanned was routinely the floor along the perimeter out to one meter from the wall or lab bench. Professional judgment was used to include areas in the floor that were outside the perimeter footprint. This included areas where a floor drain existed or where some obvious disturbance or feature was located. When this was done, a one meter area was surveyed. Material was removed from counter tops prior to surveying and then returned in place. Cabinet floors and shelving were scan surveyed on an intermittent basis by moving items and surveying before moving the items back in place. Fume hoods were surveyed by removing all items from the hood working surface and the floor of the cabinet underneath the hood. Approximately ten percent of the working surfaces and floors were scan surveyed. Ten percent of corridor floor areas were scanned toward the center.

Scan measurements of beta surface activity were performed using instrumentation listed in Table 9.

### 5.5.3 Removable Contamination Measurements

MARSSIM cautions that measurements of smears are very difficult to interpret quantitatively. Therefore, the results of smear samples should not be used to determine compliance - but should be used as a diagnostic tool to determine if further investigation is necessary. Reports of smear results should be considered a semi-quantitative evaluation of removable contamination.

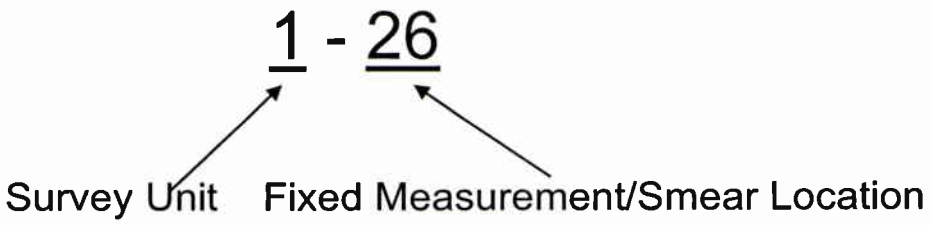
A standardized method for smear testing of a relatively uniform area was used to aid in comparing contamination at different times and places. Wet swipe surveys were taken at locations described on the survey sheets and were collected over an area approximating 100 $cm^2$. Professional judgment was used to take smears in locations that would be considered highly suspect for contamination to collect, such as vacuum line entrances, drains, work surfaces, sinks, and counters around sinks.

A total of 15 smears were taken in Class 2 areas. The locations were selected based on the 30 fixed measurements. A minimum of 10 smears were taken in biased locations with the remaining taken at preselected locations. In cases where less than 20 preselected areas existed, the balance were used as biased locations. For example, Survey Unit 1 contained 18 preselected fixed measurement locations - therefore 12 biased locations existed. All biased locations were smeared with the remaining 3, selected at random from the preselected locations.

- Biased smears on counter tops are for vacuum lines; all vacuum lines were smear tested.
- The fume hood exhaust smears are labeled H1 thru H9 and are shown on the SU drawings; all fume hoods were smear tested.
- All sinks were tested with bias smears.

A total of 5 smears were taken in Class 3 areas. These were selected at random from 10 biased fixed measurement locations.

Wipe locations were numbered to reflect the survey unit and fixed measurement location. In order to prevent duplicate numbering of smears, biased locations were numbered as a continuation to preselected locations. Using survey unit 1 as our example, biased location 1 was numbered as 1-19, biased location 2 was numbered 1-20. Preselected areas maintained their numbered location, i.e. 1-10 reflects Survey Unit 1, preselected location 10. This naming system is described below.




Additionally, the survey team thought it prudent to collect smears inside the central vacuum tank located in the equipment Room1A137. Results of these smears identified as VAC-1 and VAC-2 are provided in Appendix D.

Smears were analyzed for $^{3}H$, $^{14}C$, and $^{32}P$ by Radiation Services Organization, Inc., (RSO), Laurel, MD and chain of custody was maintained. Though $^{32}P$ is not considered a radionuclide of concern due to its short half-life, the liquid scintillation counting technique selected provides for concurrent analysis for $^{3}H$, $^{14}C$, and $^{32}P$. Minimum detectable activity (MDA) reported by RSO for $^{3}H$, $^{14}C$, and $^{32}P$ were 26 dpm, 21 dpm and 15 dpm; respectively. Smear results and chain of custody forms are provided in Appendix D.

### 5.6 Instrumentation

Tidewater, Inc. performed the specified radiation scan and measurements using its proprietary Mapping and Radiation Survey System (*MARSS-Surveyor*). *MARSS - Surveyor* is an integrated radiation survey system. It was specifically designed to plan, perform, and coordinate radiological surveys coupled with management, evaluation, and reporting of radiation measurement data. Its survey planning and data collection capability support MARSSIM site characterization and final status surveys. Scan measurements are continually recorded on a hand-held personal data assistant (PDA) on a user-defined frequency, typically set at about once every second. Static measurements are collected and recorded directly into the system data management system, linking the location, survey unit, and instrument data for automated data evaluation and reporting. This approach provides automated survey records, and does not have to rely on the user alone to identify elevated measurements.

The base unit is designed to manage the overall radiological survey project data. At the initiation of a project, survey requirements are established in the Base Unit for use in guiding the overall survey performance and evaluation. The *MARSS-Surveyor* field units provide the scan

and static measurement devices, collecting the prescribed radiation measurements coupled with other key information, such as survey unit, designated locations, date and time, user selected background, and key instrument information. *MARSS-Surveyor* has built-in data summary and reporting functions that support timely preparation of the required FSS reports.

Table 9 lists the characteristics and application of the instruments selected for use during the FSS and their applications. All instruments were calibrated using NIST-traceable standards. Instruments were response checked daily to ensure they were operating properly. In keeping with ANSI guidance, an acceptable ± 20% response range was determined *a priori*.

Instrument records, including dates of use, efficiencies, probe areas, calibration due dates, and source traceability were maintained. These records are integral to the application of *MARSS-Surveyor* to this project.

For field applications, it is important that the values of the MDC, Investigation Level, and acceptable release criteria are well documented and understood in the field. From a project planning standpoint, these values/criteria are typically expressed in dpm/100cm$^2$. The *MARSS-Surveyor* system provides the mechanism for integrating these values/criteria directly to the field surveys. MDCs were verified; Investigation Level alarms were established for the field instruments; and data for documenting compliance with the release criteria were automatically stored and evaluated.

**Table 9. Instruments**

| Application | Instrument | Probe Physical Area | Typical Background (cpm) |
|---|---|---|---|
| Static measurements | Ludlum 2360 data-logger with Ludlum 43-68 Gas Flow Proportional | 126 cm$^2$ | 180 |
| | Ludlum 2360 data-logger with Ludlum 44-110 Gas Flow Proportional | 126 cm$^2$ | 250 |
| Scan-Smooth Surfaces (Bench tops, sinks, etc.) | Ludlum 2360 data-logger with Ludlum 44-110 Gas Flow Proportional | 126 cm$^2$ | |
| Floor Scans | Ludlum 2360 data-logger with Ludlum 43-37 Gas Flow Proportional | 582 cm$^2$ | 265 |

The instruments were checked daily for a proper response to beta sources and the background. The instrument calibration sheets, set up forms and daily response checks are given in Appendix C.

Ludlum probes Model 43-37, Model 43-68, and Model 44-110 were used with Ludlum data-loggers utilizing P-10 counting gas (10% methane, 90% argon). The 43-37 and 43-68 probes were calibrated with $^{14}C$ and $^{99}Tc$. The 44-110 probes were calibrated with $^{3}H$ and $^{14}C$. The 44-110 probe was specifically designed for detection of $^{3}H$ and voltage calibration curves indicate a (smaller) detection efficiency for $^{14}C$, as well. The 43-68 probe does not detect the low energy betas from $^{3}H$. Although the 44-110 probe was calibrated to detect $^{14}C$, the primary use was for $^{3}H$ and the 43-68 and 43-37 probes were used for $^{14}C$. Both instruments were used in required static measurements; any paired measurements indicating elevated levels could be reviewed to confirm the absence or presence of $^{3}H$.

The data-logging devices for scan and static measurements collect the prescribed radiation measurements coupled with other key information, such as survey unit, designated locations, date and time, and key instrument information. Static measurements were collected and recorded directly into the system data management system - linking the location, survey unit, and instrument data for automated data evaluation and reporting. Scan measurements were continually recorded on a Ludlum data-logger Model 2360 on a user-defined frequency, set at once every two seconds. This approach provided automated survey records, and did not rely on the user alone to identify potential elevated measurements.

Table 10 provides the average efficiencies for the matched sets of data-loggers and probes which were calibrated by the manufacturer on the same date. Certificates of calibration are provided in Appendix C; data regarding the surface emission rates of the calibration sources was included in the preparation of Table 10.

**Table 10. Nominal Instrument Efficiencies**

| Probe Model | Isotope | $\varepsilon_{Instrument}$ | $\varepsilon_{Surface}$ | $\varepsilon_{total}$ |
|---|---|---|---|---|
| 43-37 | $^{14}C$ | 0.298 | 0.25 | 0.075 |
| 43-68 | $^{14}C$ | 0.304 | 0.25 | 0.076 |
| 44-110 | $^{3}H$ | 0.98 | 0.25 | 0.245 |
| | $^{14}C$ | 0.143 | 0.25 | 0.036 |

An instrument control log was used to keep track of background counts and response checks on a daily basis during work activities. Daily response checks were within +/- 20% of the established baseline; see Appendix C.

For field use, the MDCs must be converted to a Minimum Detectable Count Rate (MDCR) which is the sum of the background in cpm plus the minimum detectable concentration in cpm - rounded to the nearest whole number. These values in Tables 11 and 12.

### 5.6.1 Static Minimum Detectable Concentrations (MDC)

NUREG-1507 provides a rigorous derivation of the calculation expression for instrument sensitivity, typically stated as the minimum detectable concentration (MDC).

The MDC equations and example values for both static measurements and swipe analysis are presented in this section.

For static measurements, background and indicator measurements are both five minutes in duration. The following equation for the MDC derived from NUREG-1507, Equation 3-11, applies:

$$StaticMDC = \frac{3 + 3.29\sqrt{R_b t_s (1 + \frac{t_s}{t_b})}}{(\varepsilon_{total}) t_s \left(\frac{a}{100cm^2}\right)}$$

where:

$R_b$ = Background count in analysis time, see Table 9

$t_b$ = Time of background analysis interval (20 minutes)

$t_s$ = Time of sample with background analysis interval (1 minute)

$\varepsilon_{total}$ = total efficiency (cpm/dpm), see Table 10

$a$ = probe area in $cm^2$, see Table 9

Results of these calculations for the Ludlum 44-110 probe are shown in Table 11.

**Table 11. MDCs and MDCRs for the Ludlum 44-110**

| Radionuclide | MDC ($dpm/100cm^2$) | MDCR (ncpm) | MDCR (gcpm) |
|---|---|---|---|
| $^{14}C$ | 1117 | 56 | 306 |
| $^{3}H$ | 223 | | |

Similarly, for the Ludlum 43-37 and 43-68 probes, the MDC for $^{14}C$ and MDCRs are shown in Table 12.

**Table 12. MDCs and MDCRs for the Ludlum 43-37 and 43-68 Probes**

| Probe Model | MDC (dpm/100cm$^2$) | MDCR (ncpm) | MDCR (gcpm) |
|---|---|---|---|
| 43-37 | 226 | 58 | 323 |
| 43-68 | 524 | 48 | 228 |

### 5.6.2 Scan Minimum Detection Concentrations (MDC)

The minimum detectable count rate (MDCR) was calculated using the following equation:

$$MDCR = d' \sqrt{b_i} * (60 / i)$$

Where:

$d'$ = an index of sensitivity that represents a value for a given percentage of correct detections versus false positive readings, taken from Table 6.5 of MARSSIM. A value of 95% for true positives and 60% probability for false positives was chosen. The corresponding value for d' from Table 6.5 of MARSSIM is 1.38.

$b_i$ = the number of background counts in the time interval, i, where the time interval is the amount of time the detector is over the source (counts),

$60/i$ = 60 seconds divided by the time interval (the time the detector is over the source).

With background rates of 250 cpm, 265 cpm, and 180 cpm for the Ludlum probes 44-110 and 43-37 respectively, the MDCRs are calculated with a scan rate of 1 detector width per two seconds as follows:

$$MDCR_{44-110} = 1.38 * \sqrt{2 * 250 / 60} * (60 / 2) = 120 cpm$$

and

$$MDCR_{43-37} = 1.38 * \sqrt{2 * 265 / 60} * (60 / 2) = 123 cpm$$

These values are used to calculate the minimum detectable concentration (MDC) for scanning with:

$$MDC_{scan} = \frac{MDCR}{\sqrt{\rho} * \varepsilon_{total} * \frac{a}{100}}$$

Where:

| | | |
|---|---|---|
| $MDC_{scan}$ | = | minimum detectable concentration for scanning (dpm/100 cm²), |
| $\rho$ | = | surveyor efficiency (0.5, dimensionless quantity), |
| $a$ | = | active probe area (cm²), |
| MDCR | = | minimum detectable count rate (counts per minute). |

For the Ludlum 44-110 probe,

$$MDC_{scan} = \frac{120cpm}{\sqrt{0.5} * \varepsilon_{total} * \frac{126}{100}}$$

With efficiencies of 0.25 cpm/dpm for $^{3}H$ and 0.04 cpm/dpm for $^{14}C$, the $MDC_{scan}$ are 538 dpm/100cm$^2$ and 3,370 dpm/100cm$^2$; respectively. The $MDC_{scan}$ rates are much less than the release limit; about 0.1% of the most restrictive DCGL. Therefore, the instrument is acceptable for scanning.

For the Ludlum 43-37 probe,

$$MDC_{scan} = \frac{123cpm}{\sqrt{0.5} * 0.075cpm/dpm * \frac{582}{100}}$$

The $MDC_{scan}$ rate at 399 dpm/100cm$^2$ is about 0.01% of the DCGL for $^{14}C$. Therefore, the instrument is acceptable for scanning.

Surveyors have difficulty maintaining a constant scanning speed, so a review was made regarding the effect on $MDC_{scan}$ if the scan speed were increased from the desired one-half detector width per second to three-quarter detector width per second. At the faster scan rate, the $MDC_{scan}$ was increased up to 16%. Considering the large DCGLs, variances in surveyor speed was not considered significant within this range. Increasing scan speed would cause the total area scanned to increase and the scan time times the probe area will not necessarily match the area actually scanned. The drawings in Appendix B reflect approximate routes and the general area scanned.

### 5.7 Reporting Activity and Confidence Levels

#### 5.7.1 Surface Activity

Beta measurements for surface activity are performed over an area, represented by the physical surface area of the detector. To convert instrument counts to conventional surface activity units, the following equation is used:

$$\frac{dpm}{100cm^2} = \frac{\frac{C_s}{t_s} - R_b}{(\varepsilon_{total})\left(\frac{a}{100cm^2}\right)}$$

Where $C_s$ is the total instrument counts during the sample analysis time.

### 5.7.2 Confidence Level

The term "measurement uncertainty" is used interchangeably with the term standard deviation. The uncertainty is qualified as numerically identical to the standard deviation associated with a normally distributed range of values. When reporting a confidence interval for a value, the range of values that represent a pre-determined level of confidence (*i.e.*, 95%) is made. To make this calculation, the final standard deviation, or total uncertainty $\sigma_U$ as shown in MARSSIM Equation 6-16, is multiplied by a constant factor k representing the area under a normal curve as a function of the standard deviation. The values of k selected for this report is 1.96 representing a 95% confidence level.

Note that in the formula for surface activity given above, the numerator has an uncertainty associated with the count rates and the denominator has an efficiency term with an uncertainty also. The total efficiency uncertainty was determined through propagation of the uncertainties related to $\varepsilon_{total}$ and the uncertainty of the count rate. Handling only two at a time of the various uncertainties permitted the use of the uncertainty propagation techniques described in paragraph 6.8.3 of MARSSIM.

The MARSSIM equation for error propagation for division or multiplication is used to calculate total uncertainty:

$$\sigma_u = u * \sqrt{\left(\frac{\sigma_x}{x}\right)^2 + \left(\frac{\sigma_y}{y}\right)^2}$$

where u = x / y for division or x * y for multiplication

1) For this work, $t_b$, the total number of one minute counts used to determine the background count rate was 20. The equation used to calculate the standard deviation of a net count rate over a time t with consideration given to background is found in reference 8.8, page 360, considering that the background sigma was determined for a sequence of background counts:

$$\sigma_s = \sqrt{\left(\frac{1}{t_s}\right)^2 C_s + (-1)^2 \sigma_{R_b}^2}$$

2) With substitution, this equation reduces to

$$\sigma_r = \sqrt{\frac{GCPM}{t_s} + \sigma_{R_b}^2}$$

3) The uncertainty for the instrument detector efficiency was estimated as the experimental standard deviation of the mean for the set of 20 measurements of the check source.

   Note that the formula used in Excel for STDEV must be multiplied by $\sqrt{\frac{1}{n}}$ to meet MARSAME's formula 7-26 for experimental standard deviations.

4) The total uncertainty in the measurement activity related to the efficiencies and the net count rate is determined using the equation for error propagation for division:

$$\sigma_A = \sqrt{\left(\frac{1}{\varepsilon_{total}}\right)^2 \sigma_{R_s}^2 + \left(\frac{-R_s}{(\varepsilon_{total})^2}\right)^2 \sigma_{\varepsilon_{total}}^2}$$

The equation used to calculate the standard deviation of a net count rate over a time t with consideration given to background is found as MARSSIM formula (6-15):

$$\sigma_r = \sqrt{\frac{R_s}{t_s} + \frac{R_b}{t_b}}$$

Where:

$\sigma_r$ = Standard deviation of net count rate (cpm)

$R_s$ = Sample count rate (cpm)

Similar equations and techniques were used for scanning measurements.

## 6.0 DATA INTERPRETATION

During this survey, data was documented so that all aspects can be referenced in the future if desired. The survey documentation is of sufficient detail to allow for the recreation of the survey procedure, location, instrumentation used, and results.

All of the data taken - including fixed measurements, scanning measurements, and removable contamination - were documented in detail. Instrument measurements and analytical results include the following data:

- Daily background measurements;
- Location of the measurement or sample;
- Date and time of the measurement or sample;
- Gross or net instrument readings. Net instrument readings will often be negative since samples without any added radioactivity will often be below the background count. These numbers were recorded since they may be necessary for statistical evaluation of the data.
- Measured concentrations in dpm/100 $cm^2$ for surface contamination;
- Name of surveyor, sampler, or analyst;
- Instrument specifications and calibration date;
- Minimum detectable concentrations or activity; and
- Other relevant information.

Per NUREG-1757, Vol.2, the survey results in Appendix A for each survey unit include the following:

- the number of samples taken for the survey unit;
- a description of the survey unit, including (a) a drawing of the survey unit showing the random locations for Class 3 survey units, and (b) discussion of unique material features and remedial actions;
- the measured sample concentrations, in units that are comparable to the DCGLs; and
- the statistical evaluation of the measured concentrations.

Results for bias measurements are presented separately from routine measurements.

The locations of static and smear measurements and scanning sections are illustrated in Appendix B. Statistical data in the appendices are shown by rounding and minor errors in calculations may propagate.

Prior experience with these survey instruments and current calibration indicates that naturally occurring radioactive material (NORM) will increase the background rate and should be considered when reviewing concentrations that are very low compared to the DCGL but greater than the nominal MDC. Table 13 indicates the influence that NORM has on measurements of various materials by the Ludlum 44-110 and the Ludlum 43-68.

**Table 13. Increases in Background Rates from Various Materials**

| Material | Probe Model | |
|---|---|---|
| | 44-110 | 43-68 |
| Nominal | 1.0 | 1.0 |
| Wood | 1.0 | 1.1 |
| Green Metal | 1.2 | 1.2 |
| Polycarbonite Sink | 1.3 | 1.3 |
| Vinyl Tile (White) | 1.1 | 1.2 |
| Asphalt Tile (Skyros) | 1.4 | 1.3 |
| Black Laminate Counter Top | 1.1 | 1.2 |
| Black Stone Counter Top | 2.3 | 2.6 |
| Ceramic (small) | 3.8 | 3.1 |
| Unpainted Concrete | 1.9 | 1.8 |
| Stainless Steel | 1.3 | 1.1 |
| Porcelain | 2.8 | 2.9 |

## 7.0 SUMMARY OF RESULTS

Scan, static and swipe surveys were performed in the various rooms of concern in Building 2 to determine if residual radioactive material was above the release criteria. During scan surveys, biased static surveys and smear surveys, surveyors migrated to the places most likely to contain residual material.

Tables 14 and 15 present summaries of the scan and static measurement results for each survey unit and structure. Details of scan and static measurement results including standard deviations and uncertainty for each individual location are provided in Appendix B. Measurement locations are provided on the drawings found in Appendix B.

**Table 14. Scan Results Summary**

| Location | Number of Records | Activity as $^{14}C$ (dpm/100cm$^2$) | | Number of Records | Activity as $^{3}H$ (dpm/100cm$^2$) | |
|---|---|---|---|---|---|---|
| | | Maximum | Average | | Maximum | Average |
| SU 1 | 160 | 475 | 90 | 158 | 395 | 16 |
| SU 2 | 159 | 276 | 48 | 162 | 677 | 208 |
| SU 3 | 153 | 434 | -130 | 164 | 538 | 163 |
| SU 4 | 165 | 337 | 19 | 184 | 654 | 230 |
| SU 5 | 156 | 183 | -7 | 163 | 100 | -152 |
| SU 6 | 168 | 226 | -65 | 159 | 554 | 11 |
| SU 7 | 189 | 203 | -79 | 156 | 489 | 121 |
| SU 8 | 191 | 346 | -6 | 161 | 505 | 45 |
| SU 9 | 161 | 185 | -40 | 186 | 382 | -160 |
| SU 10 | 170 | 346 | 96 | 158 | 544 | 221 |
| SU 11 | 165 | 255 | -14 | 161 | 211 | -66 |
| SU 12 | 234 | 405 | 4 | 180 | 839 | 437 |
| SU 13 | 157 | 231 | 7 | 253 | 428 | 74 |
| SU 14 | 152 | 138 | -104 | 158 | 149 | -184 |
| SU 15 | 155 | 95 | -87 | 159 | 693 | -159 |
| SU 16 | 191 | 348 | 74 | 156 | 376 | 86 |
| SU 17 | 159 | 235 | 8 | 165 | 272 | -21 |
| SU 18 | 158 | 289 | 51 | 163 | 360 | 72 |

## Table 15. Static Results Summary

| Location | MARSSIM REQUIRED LOCATIONS | | | | | BIAS LOCATIONS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Activity as $^{14}C$ (dpm/100cm$^2$) | | Activity as $^{3}H$ (dpm/100cm$^2$) | | N | Activity as $^{14}C$ (dpm/100cm$^2$) | | Activity as $^{3}H$ (dpm/100cm$^2$) | |
| | | Maximum | Average | Maximum | Average | | Maximum | Average | Maximum | Average |
| SU 1 | 18 | 2160** | 590 | 940** | 78 | 12 | 3090* | 688 | 240 | -30 |
| SU 2 | 19 | 720 | 265 | 220 | 7 | 11 | 720 | 270 | 130 | -37 |
| SU 3 | 18 | 2610* | 344 | 1490* | 68 | 12 | 3190* | 775 | 1050* | 205 |
| SU 4 | 19 | 520 | 297 | 240 | 47 | 11 | 810 | 416 | 140 | 24 |
| SU 5 | 18 | 690 | 291 | 260 | 13 | 12 | 490 | 154 | 300 | 17 |
| SU 6 | 18 | 870 | 250 | 170 | -37 | 12 | 420 | 126 | 250 | 14 |
| SU 7 | 19 | 880 | 275 | 420 | 83 | 11 | 410 | 147 | 150 | 27 |
| SU 8 | 20 | 540 | 109 | 180 | -60 | 10 | 560 | 107 | -50 | -184 |
| SU 9 | 19 | 580 | 142 | 110 | -84 | 11 | 290 | 64 | -30 | -160 |
| SU 10 | 20 | 680 | 463 | 90 | -94 | 10 | 710 | 445 | 130 | -72 |
| SU 11 | 20 | 930 | 352 | 170 | 0 | 10 | 320 | 119 | 160 | -31 |
| SU 12 | 18 | 370 | -53 | 260 | 47 | 12 | 190 | -55 | 200 | 72 |
| SU 13 | 20 | 410 | 185 | 300 | 84 | 10 | 250 | 151 | 130 | -15 |
| SU 14 | 20 | 240 | -91 | 170 | -21 | 10 | 290 | 19 | 150 | -48 |
| SU 15 | 20 | 470 | -109 | 80 | -30 | 10 | 190 | -17 | 230 | -52 |
| SU 16 | 20 | 2310* | 1120 | 1160* | 513 | 10 | 440 | 213 | 300 | 133 |
| SU 17 | 20 | 500 | -28 | 80 | -111 | 10 | 240 | 21 | -30 | -97 |
| SU 18 | 20 | 2850* | 677 | 1130* | 124 | 10 | 2670* | 611 | 970* | 33 |

* Measurements performed on ceramic material; SU-16 had 10 measurements on ceramic material.

** Certain measurements on brick.

Only one smear result was reported as being greater than MDA - smear number 2 in SU-5. The result of this smear was 28 dpm as $^{3}H$. The MDAs reported by RSO, Inc. for $^{3}H$, $^{14}C$, and $^{32}P$ were 26 dpm, 21 dpm and 15 dpm; respectively. This result is slightly greater than the two sigma confidence level and is considered a false positive considering that at least one result should exceed the MDA when 259 samples at background levels are analyzed. Smear results and chain of custody forms are provided in Appendix D.

The swipe results are given in dpm/swipe; routine static point smears were approximately 100 $cm^2$ while smaller areas were necessarily used in drains and vacuum lines.

## 8.0 CONCLUSION

Radiological surveys were performed during April 2010 in Building 2 with the intent of determining if residual radioactive material above the release criteria were present. The surveys were performed in accordance with the regulatory guidance found in MARSSIM (NUREG-1575 and NUREG -1757). The FSS included: a) a minimum of 30 measurement locations in each of 18 survey units; b) an investigative scan measurement in 10% of each survey unit; and c) bias and routine smears to evaluate the presence of removable contamination. The 30 measurements were performed first for $^{3}H$ with a detector designed specifically for that radionuclide and then with a different detector calibrated for $^{14}C$; for a total of 60 measurements per survey unit. Hoods and sinks were part of the bias investigations which required direct measurements and smears.

Following is an interpretation of the final status survey results for each survey unit. All DQOs were met for each particular survey unit. Summary results of scans and direct measurements are provided in Tables 13 and 14 above; a summary of smear results is provided also. Many of the results indicate negative values which are expected when residual radioactivity, if any, is close to background levels. Maps indicating measurement locations and the results of data reviews including maximums, means and standard deviations are found in Appendix B. Smear results are in Appendix D.

### 8.1 Survey Unit 1

This was a Class 2 Survey Unit which consisted of Rooms 1A101-Cold Room, 1A101A- Toilet, and 1A102-Office. The walls of Room 1A101 were brick. The toilet had ceramic walls/floor and one sink. Measurements were performed on the floor of 1A102 following removal of carpet squares, 18-inch by 18-inch, on designated areas.

- Scan results for $^{14}C$ which exceeded MDCR were attributed to NORM. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.2 Survey Unit 2

This was a Class 2 Survey Unit which was a laboratory, room 1A103. This laboratory had one fume hood which vented to the exterior of the building and 2 sinks.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.

- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.3 Survey Unit 3

This was a Class 2 Survey Unit which consisted of rooms 1A104-Office, 1A104A-Toilet, and 1A105-Laboratory. The toilet had ceramic walls/floor. The toilet had one sink and the laboratory had a double sink basin.

- Scan results for $^{14}C$ which exceeded MDCR were attributed to NORM. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.4 Survey Unit 4

This was a Class 2 Survey Unit which was a laboratory, room 1A106. This laboratory had one fume hood with self-contained ventilation and another which vented to the exterior of the building. There was one sink.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.5 Survey Unit 5

This was a Class 2 Survey Unit which consisted of rooms 1A108-Laboratory, 1A108A-Closet,1A109-Laboratory. There were two sinks located in Room 1A108. Measurements were performed on the floors following removal of carpet squares, 18-inch by 18-inch, on designated areas.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements did not exceed 0.1% of DCGLs.
- Fifteen results of smear measurements (bias, routine, and sinks) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$. One result was reported at 28 dpm for $^{3}H$ which is slightly greater than the MDA but considered statistically as a false positive.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.6 Survey Unit 6

This was a Class 2 Survey Unit which was room 1A110-Laboratory "C". This survey unit had one self-contained fume hood which was not vented. There was one sink.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.7 Survey Unit 7

This was a Class 2 Survey Unit which consisted of two rooms: 1A128 Histo/Chem Laboratory and 1A129 designated as a Conference Room but was identified as a laboratory. Room 1A129 had two sinks. Room 1A129 had one fume hood vented to the exterior of the building.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sinks) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.8 Survey Unit 8

This was a Class 2 Survey Unit which consisted of four rooms: 1A133-Entrance, 1A133A-Microscope Room, 1A133B-Dark Room, and 1A133C-Microscope Room. There had been a sink in Room 1A133A.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.9 Survey Unit 9

This was a Class 2 Survey Unit which consisted of four rooms: 1A132-Tissue Preparation Room, 1A134- Cut Room, and 1A135-Dark Room. The fume hood in Room 1A132 was vented through the ceiling. A sink was in Room 1A132 and also in 1A134.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sinks) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.10 Survey Unit 10

This was a Class 3 Survey Unit which was a corridor and related rooms: 1C1-corridor, 1C2-corridor, 1A111-Telephone Closet, 1A112-Equipment Room, and 1A112A-Toilet. The toilet had ceramic walls/floor and one sink.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

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**8.11 Survey Unit 11**

This was a Class 3 Survey Unit which was a corridor and related rooms: 1C3-corridor, 1A100-Storage, 1A113-Janitor, 1A130-Toilet, 1A136-Storage, and 1C2B-Telephone Closet. The toilet had ceramic walls/floor and one sink. The janitor closet also had a sink basin.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

**8.12 Survey Unit 12**

This was a Class 2 Survey Unit which included three laboratories: 2A112, 2A113, and 2A114. Room 2A112 had one fume hood vented through the roof. Including the drain in the fume hood, there were three sinks in the room.

- One scan result for $^{14}C$ exceeded the MDCR by a mere 6 dpm/100cm$^2$; the overall scan was reviewed and the level was determined to be small and insignificant to overall results. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sinks) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.13 Survey Unit 13

This was a Class 2 Survey Unit which included three rooms: 2A116-Sterilizer Room, 2A116A-Closet, and 2A116B-Equipment Room. There were no fume hoods or sinks associated with this survey unit.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias and routine) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.14 Survey Unit 14

This was a Class 2 Survey Unit which consisted of two rooms: 2A117-Laboratory "B", and 2A118-Office B. Room 2A117 had one sink and one fume hood vented to the roof.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.15 Survey Unit 15

This was a Class 2 Survey Unit which was one laboratory, 2A120-Laboratory "A". This laboratory had one sink and one fume hood vented to the roof.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present

above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.16 Survey Unit 16

This was a Class 2 Survey Unit which was one laboratory, 2A121. This room had ceramic walls/concrete floor, one sink, and one fume hood vented to the roof.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, hood, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.17 Survey Unit 17

This was a Class 3 Survey Unit which was a corridor and related rooms: 2C1-corridor, 2A122-Storage, and 2A119-Office "A". Room 2A122 had ceramic walls and floor and one sink.

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (bias, routine, and sink) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias, routine, and sink) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.18 Survey Unit 18

This was a Class 3 Survey Unit which was a corridor and related rooms: 2C2-corridor, 2A123-Storage, and 2A-123A Room "G".

- No scan result for $^{14}C$ exceeded the MDCR. No scan result for $^{3}H$ exceeded the MDCR. Results of scan measurements did not exceed DCGL values.
- Results of direct measurements (both bias and routine) did not exceed 0.1% of DCGL.
- Results of smear measurements (bias and routine) were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

Results from scan, static and swipe surveys indicate the survey unit meets the criteria for unrestricted release by rejecting the null hypothesis which assumes contamination is present above the limit. The maximum measurement results were less than 0.1% of the NRC screening release levels. As no result exceeded NRC screening release level, no additional statistical test was needed.

### 8.19 Central Vacuum Receiver Tank

The Mechanical Room was the location of the central vacuum receiver tank for the Building. The tank was opened and two smears were collected and identified as VAC-1 and VAC-2. Results of these smears were less than MDA values of 26 dpm for $^{3}H$ and 21 dpm for $^{14}C$.

- Results of smear measurement VAC-1 were -2 dpm for $^{3}H$ and 5 dpm for $^{14}C$.
- Results of smear measurement VAC-2 were 5 dpm for $^{3}H$ and 0 dpm for $^{14}C$.

These results confirm that the Mechanical Room 1A137 was not impacted.

## 9.0 REFERENCES


9.1 Materials License 37-01230-03 U.S. NRC.

9.2 *Evaluation of Surface Contamination-part1, Beta Emitters and Alpha Emitters* (ISO 7503-1), International Organization for Standardization, 1988.

9.3 *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG 1507, U.S. NRC, June, 1998.

9.4 *Multi-Agency Radiation Survey and Site Investigation Manual*, EPA/402/R-97-016, Revision 1. NUREG-1575, U.S. NRC, August, 2000.

9.5 *Multi-Agency Radiation Survey and Assessment of Materials and Equipment*, EPA/402-R-09-001. NUREG-1575, Supp 1, U.S. NRC, January 2009.

9.6 *Consolidated NMSS Decommissioning Guidance,* NUREG-1757 Volumes 1 and 2, U.S. NRC, 2003.

9.7 Standards for Protection Against Radiation," Title 10 Code of Federal Regulations, Part 20, U.S. NRC, as amended.

9.8 "Instructions to Workers," Title 10 Code of Federal Regulations, Part 19, U.S. NRC, as amended.

9.9 *Decommissioning Health Physics*, EW Abelquist, IOP Publishing Ltd, 2001.

9.10 *The Health Physics and Radiological Handbook,* Revised Edition, Scinta, Inc., Silver Spring, MD 20902, 1992.

9.11 *Ludlum User Manual – Ludlum Model 44-110 & 44-110-1, September 2006,* Ludlum Measurements, Inc., Sweetwater, Texas, 79556.

9.12 *Ludlum User Manual – Ludlum Model 239-1F Floor Monitor, January 1999,* Ludlum Measurements, Inc., Sweetwater, Texas, 79556.

9.13 Tidewater Procedure, RS-13.0 Routine Operability of Field Instruments.

9.14 Tidewater Procedure, RS-010.2 Static Survey Procedure.

# APPENDIX A

## HSA QUESTIONNAIRES

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**QUESTIONNAIRE FOR PERSONNEL INVOLVED WITH RADIOACTIVE MATERIALS**

The purpose of this questionnaire is to assist TIDEWATER, Inc. in collecting information for a Historical Site Assessment (HSA) in support of radiological final status surveys for the facility at VAPHS University Drive C, Building 2. The HSA findings will be used to design and perform radiological surveys, as necessary to support release of the selected installation. Please complete this questionnaire to the best of your recollection, and include any additional explanations in the Additional Notes/Comments section on the last page of this questionnaire or on an attached sheet of paper.

Date of Interview: 4/13/2010

Name of Interviewer:
Mode of Communication(s): Completed by M. Belanger

1. What is your name and what is/was your job title/position?
Mitch Belanger, RSO

Contact Information: Phone(412) 360-3221
E-mail:mitch.belanger@va.gov

2. During what span of years have you worked, or did you work, at this facility with radioactive materials?

10/07 to present

3. Can you name or identify the radioactive material or devices that you or anyone else might have worked on within the selected installation? What isotopes were involved?

| Radionuclide | Quantity |
|---|---|
| H-3 | 1.5 mCi |
| I-129 | -- |
| C-14 | " |
| P-33 | " |

Others? __X__Yes ____No If yes, which ones? P-32, S-35, I-125 (possible)

Were there alpha emitters? ____Yes __X__No If yes, which ones?

Any sealed sources? __X__ Yes ____No
Any leak tests results 0.005 uCi? ____ Yes __X__No

Were there detector cells? Were titanium tritide foil or scandium tritide foils vented to outside?
____ Yes ____No Unknown

4. In what rooms or areas were radioactive materials used or stored? Can you identify any locations/areas/buildings of known use or storage of radioactive material used at the selected installation, including fuel, raw materials, experiments, products, and liquid and solid effluents and wastes? Are there biological hazards that a survey team should be made aware? (Be specific; Bldg/room numbers, outdoor areas, etc.)

Assume all lab spaces were RAM approved.

5. Where and how was the shipping and receiving of radioactive material handled (central location, straight to lab, etc)? RAM pkgs were delivered to Receiving, picked up by RSO, surveyed for contamination then delivered to lab.

6. Was work performed in fume or biological hoods? __X__ Yes ____No (assumption)
If Yes, please answer the following: Unknown

Exhaust Ductwork? ____ Yes ____No
Exhaust filters? ____ Yes ____No
Reactive chemicals (perchloric acid, picrates and azides)? ____ Yes ____No

7. Did you use a vacuum system? _X__ Yes ____No If Yes, where was the receiver tank?

8. Was radioactive material disposed into sinks? __X__ Yes ____No

If Yes, were special sinks designated? Were disposal logs kept and where might they be today? Assume all sinks

Does the building have hold-up tanks for laboratory waste? ____ Yes _X__No
If Yes, please provide a general location.

Is there a special washing location for lab dishware and equipment? ____ Yes _X__No
If Yes, please provide a location.

9. Where did laboratory waste go; interim storage?
< 120 day half-life material ____All waste goes to Building 6 rad waste storage_____
> 120 day half-life material (H-3, C-14, etc.) _____

Are you aware of any burial, disposal, or incineration, of radioactive material? ____ Yes ____No
Unknown
10. Was animal research, with radioactive material, ever performed at the site? Where were animals kept during studies? Animal carcasses? Please describe. Unknown

11. Do you recall any instance of broken or leaking sources or any other contamination incidents or accidents? Where there ever small spills or large ones? ____ Yes __X__No

Describe as accurately as can be recalled, including dates, specific rad materials and forms, contamination levels, areal extent of contamination, and disposition.

12. Are you aware of any studies/reports that may have identified contaminated areas and the isotopes activated? ____ Yes __X__No Please describe if yes.

Where are records of survey kept?

13. Are you aware of any chemical use/storage/spills/releases involving any type of solvents or fuels? ____ Yes _X__No Please describe if yes.

14. Are you aware of the presence of any radionuclide-containing exit signs or smoke alarms?

____ Yes _X_No

15. Are you aware of any other radioactive material currently on site? __X__ Yes ____No Please describe if yes. Building 1 an d6

16. Do you recall any modifications/renovations of the labs where radioactive material was once used, e.g., carpet installed? __X__ Yes ____No Please describe if yes.

Rm 1A108 & 1A109

17. Are there any other individuals you feel should be interviewed regarding the above items?

PIs and former RSO have been emailed.

18. What areas would you concentrate on if you were conducting a radiological close out survey of the selected installation?

All laboratory space

19. Additional Notes / Comments: Little if any RAM use occurred in Building 2 since I started working at VAPHS in Oct 2007.

**QUESTIONNAIRE FOR PERSONNEL INVOLVED WITH RADIOACTIVE MATERIALS**

The purpose of this questionnaire is to assist TIDEWATER, Inc. in collecting information for a Historical Site Assessment (HSA) in support of radiological final status surveys for the facility at __Building 2, University Drive Campus, VAPHS,___. The HSA findings will be used to design and perform radiological surveys, as necessary to support release of the selected installation. Please complete this questionnaire to the best of your recollection, and include any additional explanations in the Additional Notes/Comments section on the last page of this questionnaire or on an attached sheet of paper.

Date of Interview: _04_/ 13_/2010

Name of Interviewer:
Mode of Communication(s): ____Direct interview ____ Telephone

1. What is your name and what is/was your job title/position?
   Jau-Shyong Deng, Chief, Dermatology

Contact Information: Phone: 412-360-3080
E-mail:jaushyong.deng@va.gov

2. During what span of years have you worked, or did you work, at this facility with radioactive materials?

From July of 1984 to December 31, 2007.

3. Can you name or identify the radioactive material or devices that you or anyone else might have worked on within the selected installation? What isotopes were involved?

| Radionuclide | Quantity |
|---|---|
| H-3 | x |
| I-129 | |
| C-14 | |
| P-33 | X |

Others? ____Yes ____No If yes, which ones?

Were there alpha emitters? ____Yes ___X_No If yes, which ones?

Any sealed sources? ____ Yes ___X_No
Any leak tests results 0.005 uCi? ____ Yes __X__No

Were there detector cells? Were titanium tritide foil or scandium tritide foils vented to outside?
____ Yes __X__No

4. In what rooms or areas were radioactive materials used or stored? Can you identify any locations/areas/buildings of known use or storage of radioactive material used at the selected installation, including fuel, raw materials, experiments, products, and liquid and solid effluents and wastes? Are there biological hazards that a survey team should be made aware? (Be specific; Bldg/room numbers, outdoor areas, etc.)

Room 5 and Room 10

5. Where and how was the shipping and receiving of radioactive material handled (central location, straight to lab, etc)?

Straight to lab

6. Was work performed in fume or biological hoods? ___X_ Yes ____No
If Yes, please answer the following:

Exhaust Ductwork? __X__ Yes ____No
Exhaust filters? __X__ Yes ____No
Reactive chemicals (perchloric acid, picrates and azides)? ____ Yes ___X_No

7. Did you use a vacuum system? ____ Yes __X__No If Yes, where was the receiver tank?

8. Was radioactive material disposed into sinks? ____ Yes __X__No

If Yes, were special sinks designated? Were disposal logs kept and where might they be today?

Does the building have hold-up tanks for laboratory waste? ____ Yes ___X_No
If Yes, please provide a general location.

Is there a special washing location for lab dishware and equipment? ____ Yes __X__No
If Yes, please provide a location.

9. Where did laboratory waste go; interim storage?
< 120 day half-life material _____drum and Refrigerator_____
> 120 day half-life material (H-3, C-14, etc.) _____drum and refrigerator____

Are you aware of any burial, disposal, or incineration, of radioactive material? ___X_ Yes ____No

10. Was animal research, with radioactive material, ever performed at the site? Where were animals kept during studies? Animal carcasses? Please describe.

No

11. Do you recall any instance of broken or leaking sources or any other contamination incidents or accidents? Where there ever small spills or large ones? ____ Yes __X__No

Describe as accurately as can be recalled, including dates, specific rad materials and forms, contamination levels, areal extent of contamination, and disposition.

12. Are you aware of any studies/reports that may have identified contaminated areas and the isotopes activated? ____ Yes ___X_No Please describe if yes.

Where are records of survey kept? Radiation Safety Officer

13. Are you aware of any chemical use/storage/spills/releases involving any type of solvents or fuels? ____ Yes __X__No Please describe if yes.

14. Are you aware of the presence of any radionuclide-containing exit signs or smoke alarms?

___X_ Yes ____No

15. Are you aware of any other radioactive material currently on site? ____ Yes ___X_No Please describe if yes.

16. Do you recall any modifications/renovations of the labs where radioactive material was once used, e.g., carpet installed? ____ Yes __X__No Please describe if yes.

17. Are there any other individuals you feel should be interviewed regarding the above items?

18. What areas would you concentrate on if you were conducting a radiological close out survey of the selected installation?

19. Additional Notes / Comments:

**QUESTIONNAIRE FOR PERSONNEL INVOLVED WITH RADIOACTIVE MATERIALS**

The purpose of this questionnaire is to assist TIDEWATER, Inc. in collecting information for a Historical Site Assessment (HSA) in support of radiological final status surveys for the facility at **Bigd 2, VA Pittsburgh Healthcare System , University Drive, Pittsburgh, PA**. The HSA findings will be used to design and perform radiological surveys, as necessary to support release of the selected installation. Please complete this questionnaire to the best of your recollection, and include any additional explanations in the Additional Notes/Comments section on the last page of this questionnaire or on an attached sheet of paper.

Date of Interview: ____/ ___/2010

Name of Interviewer:
Mode of Communication(s): ____Direct interview ____ Telephone

1. What is your name and what is/was your job title/position?
**Chandrashekhar R. Gandhi, PhD, Deputy Associate Chief of Staff/R&D**
Contact Information: Phone: **412.954.5397**
E-mail: **Chandrashekhar.gandhi@va.gov**

2. During what span of years have you worked, or did you work, at this facility with radioactive materials? **NO**

3. Can you name or identify the radioactive material or devices that you or anyone else might have worked on within the selected installation? What isotopes were involved? **NA**

| Radionuclide | Quantity |
|---|---|
| H-3 | |
| I-129 | |
| C-14 | |
| P-33 | |

Others? ____Yes ____No yes, ones?

Were there alpha emitters? ____Yes ____No If yes, ones?

Any sealed sources? ____ Yes ____No
Any leak tests results 0.005 uCi? ____ Yes ____No

Were there detector cells? Were titanium tritide foil or scandiu tritide foils vented to outside?
____ Yes ____No

4. In what rooms or areas were radioactive materials used or stored? Can you identify any

locations/areas/buildings of known use or storage of radioactive material used at the selected installation, including fuel, raw materials, experiments, products, and liquid and solid effluents and wastes? Are there biological hazards that a survey team should be made aware? (Be specific; Bldg/room numbers, outdoor areas, etc.)

**NA**

5. Where and how was the shipping and receiving of radioactive material handled (central location, straight to lab, etc)? **NA**

6. Was work performed in fume or biological hoods? ____ Yes ____No
If Yes, please answer the following:

Exhaust Ductwork? ____ Yes ____No
Exhaust filters? ____ Yes ____No
Reactive chemicals (perchloric acid, picrates and azides)? ____ Yes ____No

7. Did you use a vacuum system? ____ Yes ____No If Yes, where was the receiver tank?

8. Was radioactive material disposed into sinks? ____ Yes ____No

If Yes, were special sinks designated? Were disposal logs kept and where might they be today?

Does the building have hold-up tanks for laboratory waste? ____ Yes ____No
If Yes, please provide a general location. **NA**

Is there a special washing location for lab dishware and equipment? ____ Yes ____No
If Yes, please provide a location. **NA**

9. Where did laboratory waste go; interim storage? **NA**
< 120 day half-life material _____
> 120 day half-life material (H-3, C-14, etc.) _____

Are you aware of any burial, disposal, or incineration, of radioactive material? ____ Yes ____No

10. Was animal research, with radioactive material, ever performed at the site? Where were animals kept during studies? Animal carcasses? Please describe.

11. Do you recall any instance of broken or leaking sources or any other contamination incidents or accidents? Where there ever small spills or large ones? ____ Yes __X__No

Describe as accurately as can be recalled, including dates, specific rad materials and forms, contamination levels, areal extent of contamination, and disposition.

12. Are you aware of any studies/reports that may have identified contaminated areas and the isotopes activated? ____ Yes __X__No Please describe if yes.

Where are records of survey kept?

13. Are you aware of any chemical use/storage/spills/releases involving any type of solvents or fuels? ____ Yes __X__No Please describe if yes.

14. Are you aware of the presence of any radionuclide-containin exit signs or smoke alarms?

____ Yes __X__No

15. Are you aware of any other radioactive material currently on ase describe if yes.

16. Do you recall any modifications/renovations of the labs where radioactive material was once used, e.g., carpet installed? ____ Yes __X__No Please describe if yes.

17. Are there any other individuals you feel should be interviewed regarding the above items?

NA

18. What areas would you concentrate on you were conducting a radiological close out survey of the selected installation?

NA

19. Additional Notes / Comments:

**QUESTIONNAIRE FOR PERSONNEL INVOLVED WITH RADIOACTIVE MATERIALS**

The purpose of this questionnaire is to assist TIDEWATER, Inc. in collecting information for a Historical Site Assessment (HSA) in support of radiological final status surveys for the facility at VA-Pittsburgh, Building 2, The HSA findings will be used to design and perform radiological surveys, as necessary to support release of the selected installation. Please complete this questionnaire to the best of your recollection, and include any additional explanations in the Additional Notes/Comments section on the last page of this questionnaire or on an attached sheet of paper.

Date of Interview: _4_/ _19__/2010

Name of Interviewer: Claude Wiblin
Mode of Communication(s): ____Direct interview _X__ Telephone

1. What is your name and what is/was your job title/position?
Dr. Ying Hsu, RSO

Contact Information: Phone: (480) 374-0930
E-mail:

2. During what span of years have you worked, or did you work, at this facility with radioactive materials? Retired in 2007 after 32 years.

3. Can you name or identify the radioactive material or devices that you or anyone else might have worked on within the selected installation? What isotopes were involved?

| Radionuclide | Quantity |
|---|---|
| H-3 | All small quantities. |
| I-129 | |
| C-14 | |

Others? ____Yes __X__No If yes, which ones?

Were there alpha emitters? ____Yes _X___No If yes, which ones?

Any sealed sources? ____ Yes _X_No
Any leak tests results 0.005 uCi? ____ Yes _X__No

Were there detector cells? Were titanium tritide foil or scandium tritide foils vented to outside?
____ Yes __X_No

4. In what rooms or areas were radioactive materials used or stored? Can you identify any locations/areas/buildings of known use or storage of radioactive material used at the selected

installation, including fuel, raw materials, experiments, products, and liquid and solid effluents and wastes? Are there biological hazards that a survey team should be made aware? (Be specific; Bldg/room numbers, outdoor areas, etc.)

2nd floor used I-125, 1st foor used C-14, H-3, and I-129

5. Where and how was the shipping and receiving of radioactive material handled (central location, straight to lab, etc)? Sometime to him; sometimes to lab.

6. Was work performed in fume or biological hoods? __X__ Yes ____No
If Yes, please answer the following:

Exhaust Ductwork? ____ Yes __X__No No iodinations; no explosives.
Exhaust filters? ____ Yes __X__No
Reactive chemicals (perchloric acid, picrates and azides)? ____ Yes _X___No

7. Did you use a vacuum system? __X__ Yes ____No If Yes, where was the receiver tank? Mechanical room.

8. Was radioactive material disposed into sinks? __X__ Yes ____No

If Yes, were special sinks designated? Were disposal logs kept and where might they be today? See record storage; usually small quantities within allowable.

Does the building have hold-up tanks for laboratory waste? ____ Yes _X___No
If Yes, please provide a general location.

Is there a special washing location for lab dishware and equipment? ____ Yes _X___No
If Yes, please provide a location.

9. Where did laboratory waste go; interim storage? Building 6 Storage Area
< 120 day half-life material _____
> 120 day half-life material (H-3, C-14, etc.) _____

Are you aware of any burial, disposal, or incineration, of radioactive material? ____ Yes _X__No

10. Was animal research, with radioactive material, ever performed at the site? Where were animals kept during studies? Animal carcasses? Please describe.

None at Building 2.

11. Do you recall any instance of broken or leaking sources or any other contamination incidents or accidents? Where there ever small spills or large ones? ____ Yes __X__No

Describe as accurately as can be recalled, including dates, specific rad materials and forms, contamination levels, areal extent of contamination, and disposition.

None.

12. Are you aware of any studies/reports that may have identified contaminated areas and the isotopes activated? ____ Yes _X__No Please describe if yes.

Where are records of survey kept? See RSO files.

13. Are you aware of any chemical use/storage/spills/releases involving any type of solvents or fuels? ____ Yes _X__No Please describe if yes.

14. Are you aware of the presence of any radionuclide-containing exit signs or smoke alarms?

____ Yes _X__No

15. Are you aware of any other radioactive material currently on site? ____ Yes __X__No Please describe if yes.

16. Do you recall any modifications/renovations of the labs where radioactive material was once used, e.g., carpet installed? ____ Yes ____No Please describe if yes.

Could not recall.

17. Are there any other individuals you feel should be interviewed regarding the above items?

John Prelich, researcher

18. What areas would you concentrate on if you were conducting a radiological close out survey of the selected installation?

He has already surveyed; the area is clean.

19. Additional Notes / Comments:
None

**QUESTIONNAIRE FOR PERSONNEL INVOLVED WITH RADIOACTIVE MATERIALS**

The purpose of this questionnaire is to assist TIDEWATER, Inc. in collecting information for a Historical Site Assessment (HSA) in support of radiological final status surveys for the facility at VA-___VA Pittsburgh, Building 2__. The HSA findings will be used to design and perform radiological surveys, as necessary to support release of the selected installation. Please complete this questionnaire to the best of your recollection, and include any additional explanations in the Additional Notes/Comments section on the last page of this questionnaire or on an attached sheet of paper.

Date of Interview: _4/ 22 / 2010

Name of Interviewer:
Mode of Communication(s): ____Direct interview __X__ Telephone

1. What is your name and what is/was your job title/position?

John Prelich, Health Science Specialist

Contact Information: Phone: (412) 688-6000 X-601016

2. During what span of years have you worked, or did you work, at this facility with radioactive materials? Total of 27 years. No use of radioactive materials but stopped working in Building 2 approximately 6 or 7 years ago.

3. Can you name or identify the radioactive material or devices that you or anyone else might have worked on within the selected installation? What isotopes were involved?

None with his group in Building 2.

Researchers on 2nd floor used Cr-51 and a form of iodine.

Were there alpha emitters? ____Yes __X__No If yes, which ones?

Any sealed sources? ____ Yes ____No LSC H-3 and C-14 standards in LSC.
Any leak tests results 0.005 uCi? ____ Yes ____No Not aware.

Were there detector cells? Were titanium tritide foil or scandium tritide foils vented to outside?
____ Yes ____No Not used.

4. In what rooms or areas were radioactive materials used or stored? Can you identify any

locations/areas/buildings of known use or storage of radioactive material used at the selected installation, including fuel, raw materials, experiments, products, and liquid and solid effluents and wastes? Are there biological hazards that a survey team should be made aware? (Be specific; Bldg/room numbers, outdoor areas, etc.)

Researchers on 2nd floor used Cr-51 and I-129.

5. Where and how was the shipping and receiving of radioactive material handled (central location, straight to lab, etc)? Not to his lab.

6. Was work performed in fume or biological hoods? ____ Yes ____No X N/A
If Yes, please answer the following:

Exhaust Ductwork? ____ Yes ____No
Exhaust filters? ____ Yes ____No
Reactive chemicals (perchloric acid, picrates and azides)? ____ Yes ____No

7. Did you use a vacuum system? ____ Yes ____No If Yes, where was the receiver tank?
X N/A

8. Was radioactive material disposed into sinks? ____ Yes ____No X N/A

If Yes, were special sinks designated? Were disposal logs kept and where might they be today?

Does the building have hold-up tanks for laboratory waste? ____ Yes ____No X N/A
If Yes, please provide a general location.

Is there a special washing location for lab dishware and equipment? ____ Yes ____No
If Yes, please provide a location. X N/A

9. Where did laboratory waste go; interim storage? X N/A
< 120 day half-life material _____
> 120 day half-life material (H-3, C-14, etc.) _____

Are you aware of any burial, disposal, or incineration, of radioactive material? ____ Yes ____No

10. Was animal research, with radioactive material, ever performed at the site? Where were animals kept during studies? Animal carcasses? Please describe.

All animal research was in Building 6.

11. Do you recall any instance of broken or leaking sources or any other contamination incidents or accidents? Where there ever small spills or large ones? ____ Yes _X__No

Describe as accurately as can be recalled, including dates, specific rad materials and forms, contamination levels, areal extent of contamination, and disposition.

12. Are you aware of any studies/reports that may have identified contaminated areas and the isotopes activated? ____ Yes __X__No Please describe if yes.

Where are records of survey kept? The RSO should have survey records.

13. Are you aware of any chemical use/storage/spills/releases involving any type of solvents or fuels? ____ Yes __X__No Please describe if yes.

14. Are you aware of the presence of any radionuclide-containing exit signs or smoke alarms?

____ Yes ____No X N/A

15. Are you aware of any other radioactive material currently on site? ____ Yes ____No Please describe if yes. Most research with radioactive material was conducted in Building 6.

16. Do you recall any modifications/renovations of the labs where radioactive material was once used, e.g., carpet installed? ____ Yes ____No Please describe if yes. X N/A

17. Are there any other individuals you feel should be interviewed regarding the above items?

Dr. Deng.

18. What areas would you concentrate on if you were conducting a radiological close out survey of the selected installation? X N/A

19. Additional Notes / Comments: None.

# APPENDIX B

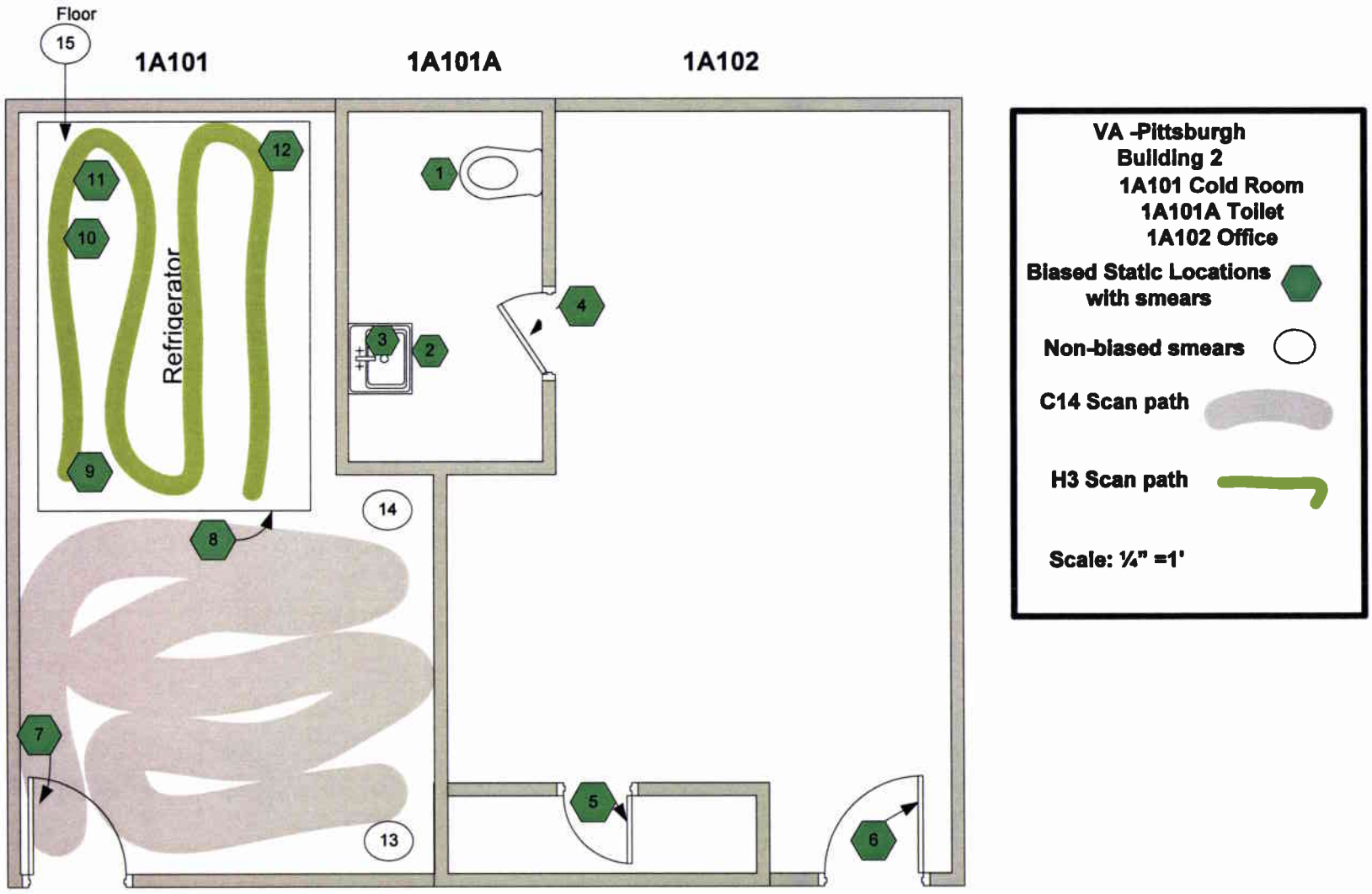
## SURVEY UNIT DRAWINGS AND RESULTS

## Table of Contents

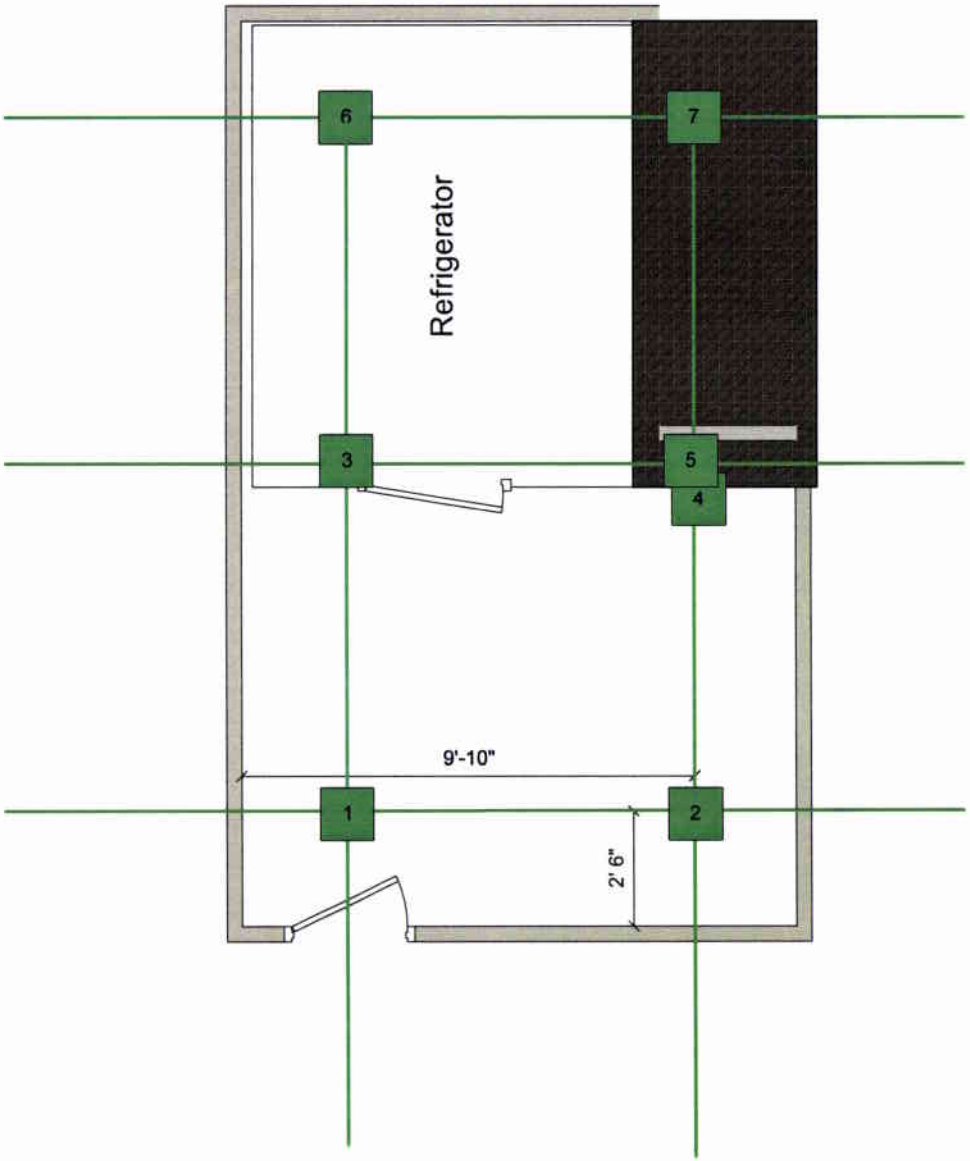
Note that scan paths (areas), smear, and biased locations are identified on the first drawing of each survey unit package indicated below. The regular MARSSIM measurement locations are found on subsequent drawings as showing the grid and up to 20 locations made too much detail on one drawing. Four measurement result data sheets then follow in each package as $^{3}H$, $^{3}H$ (Biased), $^{14}C$, and $^{14}C$ (Biased). Results of biased measurements are reviewed independently from the measurement results at MARSSIM locations.

Scan results are found on pages 122 and 123.

**SURVEY UNIT 1**



**SURVEY UNIT 1**
**CONTINUED**




**VA -Pittsburgh**
**Building 2**

**1A101 Cold Room**

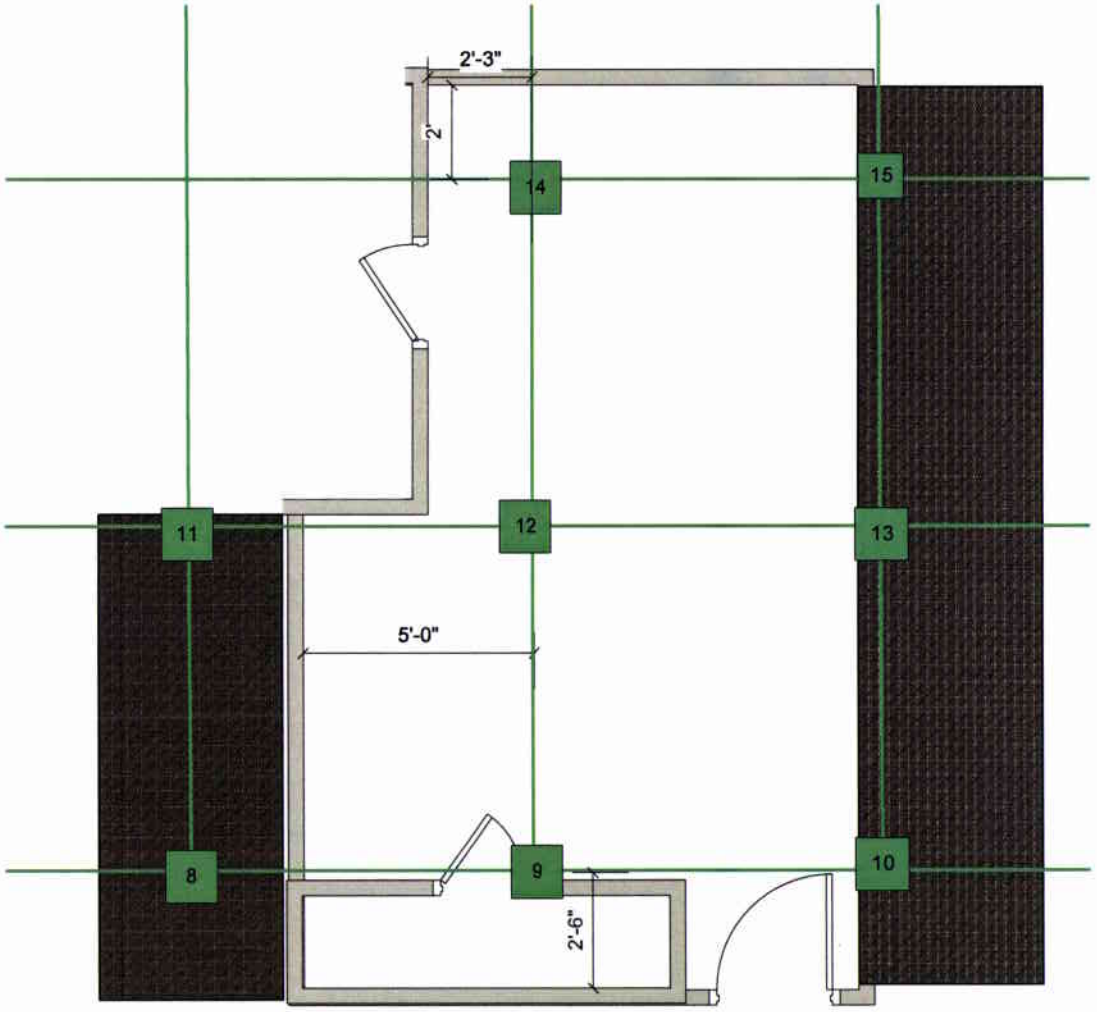
**Static Locations**

**Walls**

**Scale: ¼" =1'**

**L = 7' 6"**
**Random Start (9'10", 2'6")**

**SURVEY UNIT 1**
**CONTINUED**




**VA -Pittsburgh**
**Building 2**

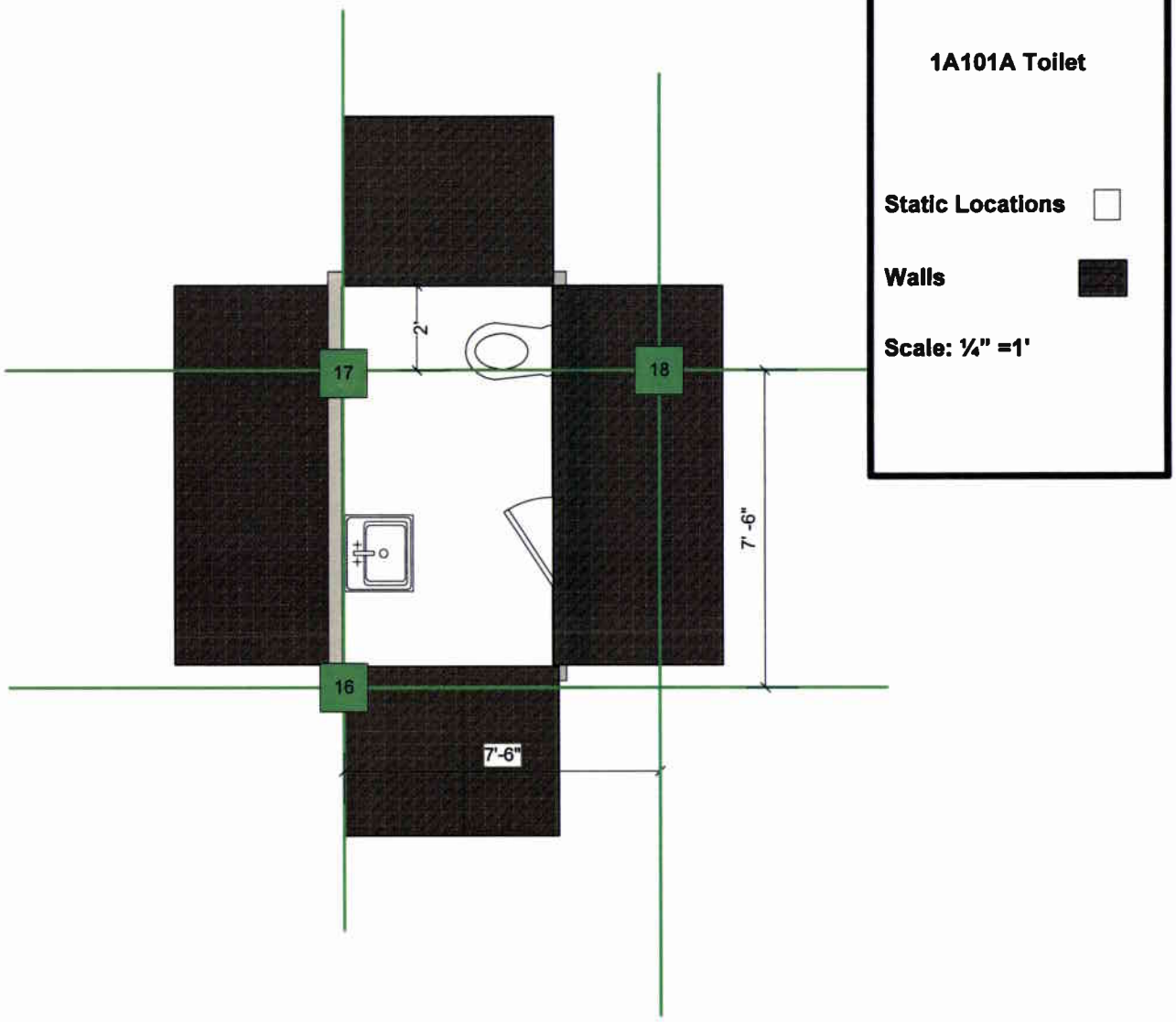
**1A102 Office**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

**SURVEY UNIT 1**
**CONTINUED**



# *Summary of $^{3}$H Static Measurements*

**Survey Unit:** 1
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) | |
|---|---|---|---|---|---|---|
| 1 | 260 | 11 | 29 | 40 | 180 | |
| 2 | 321 | 72 | 30 | 230 | 190 | |
| 3 | 284 | 35 | 29 | 110 | 190 | |
| 4 | 202 | -47 | 28 | -150 | 180 | |
| 5 | 327 | 78 | 30 | 250 | 190 | Brick |
| 6 | 283 | 34 | 29 | 110 | 180 | |
| 7 | 539 | 290 | 33 | 940 | 260 | Brick |
| 8 | 234 | -15 | 28 | -50 | 180 | |
| 9 | 251 | 2 | 28 | 10 | 180 | |
| 10 | 241 | -8 | 28 | -30 | 180 | |
| 11 | 281 | 32 | 29 | 100 | 180 | |
| 12 | 223 | -26 | 28 | -80 | 180 | |
| 13 | 239 | -10 | 28 | -30 | 180 | |
| 14 | 206 | -43 | 28 | -140 | 180 | |
| 15 | 279 | 30 | 29 | 100 | 180 | |
| 16 | 206 | -43 | 28 | -140 | 180 | |
| 17 | 223 | -26 | 28 | -80 | 180 | |
| 18 | 314 | 65 | 30 | 210 | 190 | Ceramic |

**Maximum:** 940
**Average:** 78
**STDEV:** 250

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 1
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 324 | 75 | 30 | 240 | 190 | Ceramic |
| 2 | 234 | -15 | 28 | -50 | 180 | Ceramic |
| 3 | 291 | 42 | 29 | 140 | 190 | |
| 4 | 209 | -40 | 28 | -130 | 180 | |
| 5 | 197 | -52 | 27 | -170 | 180 | |
| 6 | 211 | -38 | 28 | -120 | 180 | |
| 7 | 213 | -36 | 28 | -120 | 180 | |
| 8 | 199 | -50 | 27 | -160 | 180 | |
| 9 | 226 | -23 | 28 | -70 | 180 | |
| 10 | 232 | -17 | 28 | -60 | 180 | |
| 11 | 307 | 58 | 29 | 190 | 190 | |
| 12 | 234 | -15 | 28 | -50 | 180 | |

**Maximum:** 240
**Average:** -30
**STDEV:** 140

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 1
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 219 | 40 | 19 | 420 | 400 | |
| 2 | 240 | 61 | 20 | 640 | 410 | |
| 3 | 240 | 61 | 20 | 640 | 410 | |
| 4 | 223 | 44 | 19 | 460 | 400 | |
| 5 | 386 | 207 | 23 | 2160 | 490 | Brick |
| 6 | 242 | 63 | 20 | 660 | 410 | |
| 7 | 374 | 195 | 23 | 2040 | 480 | Brick |
| 8 | 201 | 22 | 19 | 230 | 390 | |
| 9 | 185 | 6 | 18 | 60 | 380 | |
| 10 | 172 | -7 | 18 | -70 | 370 | |
| 11 | 241 | 62 | 20 | 650 | 410 | |
| 12 | 205 | 26 | 19 | 270 | 390 | |
| 13 | 176 | -3 | 18 | -30 | 370 | |
| 14 | 221 | 42 | 19 | 440 | 400 | |
| 15 | 169 | -10 | 18 | -100 | 370 | |
| 16 | 224 | 45 | 19 | 470 | 400 | |
| 17 | 241 | 62 | 20 | 650 | 410 | |
| 18 | 278 | 99 | 21 | 1030 | 430 | Ceramic |

**Maximum:** 2160
**Average:** 590
**STDEV:** 626

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 1
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) | |
|---|---|---|---|---|---|---|
| 1 | 463 | 284 | 25 | 2970 | 530 | Ceramic |
| 2 | 475 | 296 | 25 | 3090 | 540 | Ceramic |
| 3 | 295 | 116 | 21 | 1210 | 440 | |
| 4 | 186 | 7 | 18 | 70 | 380 | |
| 5 | 170 | -9 | 18 | -90 | 370 | |
| 6 | 190 | 11 | 19 | 110 | 380 | |
| 7 | 208 | 29 | 19 | 300 | 390 | |
| 8 | 201 | 22 | 19 | 230 | 390 | |
| 9 | 179 | 0 | 18 | 0 | 370 | |
| 10 | 179 | 0 | 18 | 0 | 370 | |
| 11 | 194 | 15 | 19 | 160 | 380 | |
| 12 | 198 | 19 | 19 | 200 | 380 | |

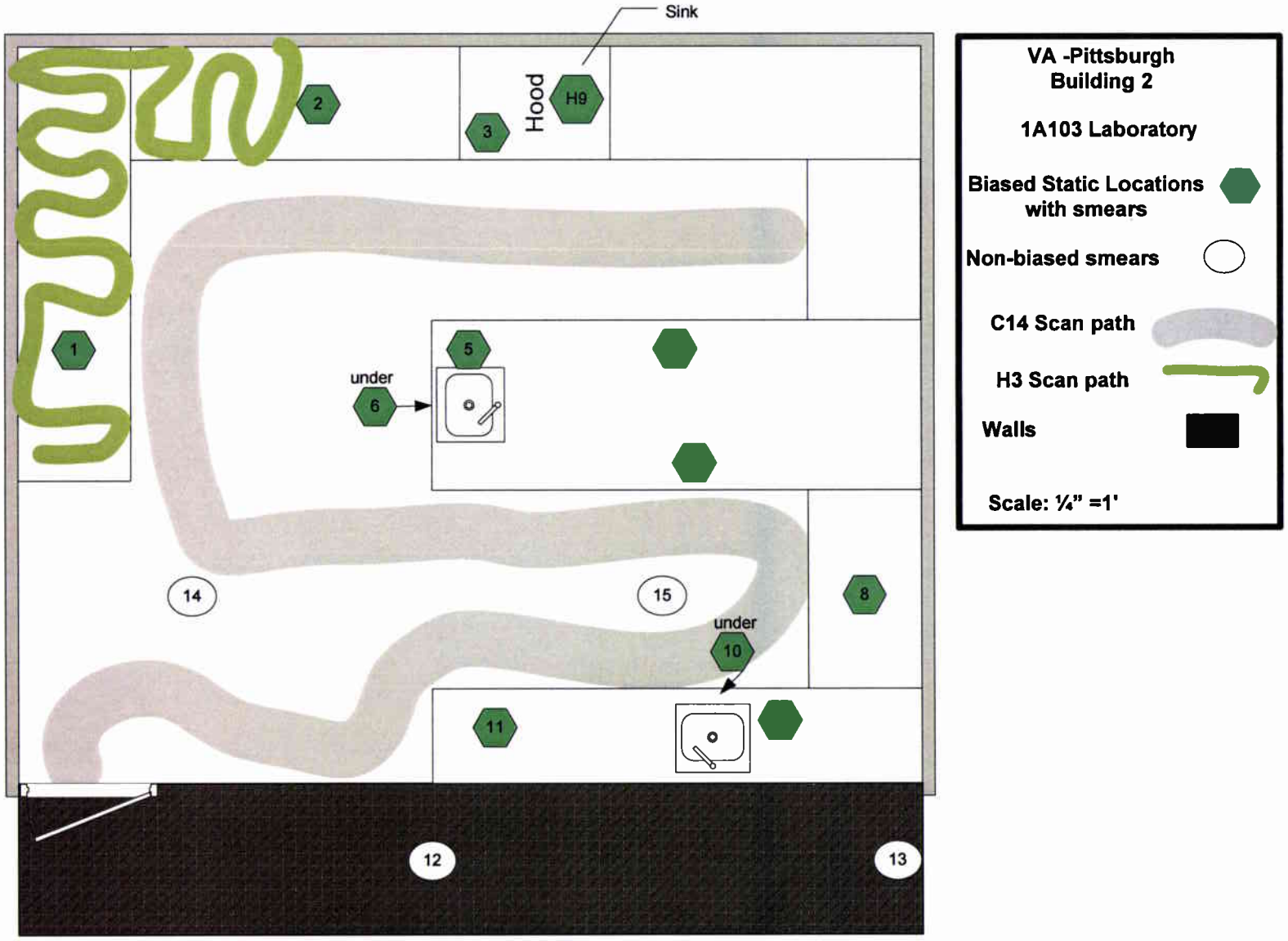
**Maximum:** 3090
**Average:** 688
**STDEV:** 1144

## *Instrument Data and Analysis Parameters*

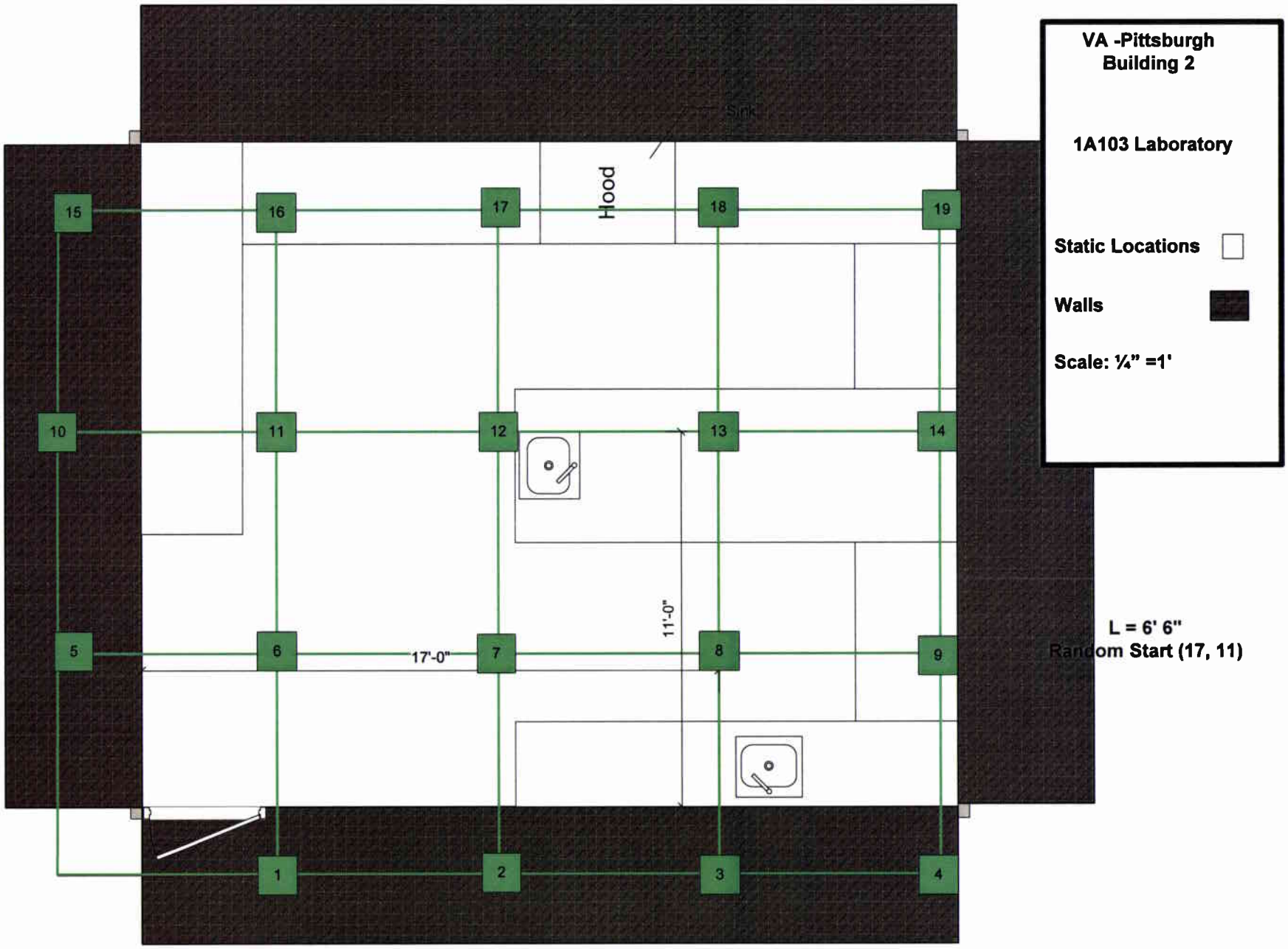
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 2**



## SURVEY UNIT 2 - CONTINUED



# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 2
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 261 | 12 | 29 | 40 | 180 |
| 2 | 268 | 19 | 29 | 60 | 180 |
| 3 | 316 | 67 | 30 | 220 | 190 |
| 4 | 211 | -38 | 28 | -120 | 180 |
| 5 | 271 | 22 | 29 | 70 | 180 |
| 6 | 287 | 38 | 29 | 120 | 190 |
| 7 | 228 | -21 | 28 | -70 | 180 |
| 8 | 285 | 36 | 29 | 120 | 190 |
| 9 | 304 | 55 | 29 | 180 | 190 |
| 10 | 275 | 26 | 29 | 80 | 180 |
| 11 | 206 | -43 | 28 | -140 | 180 |
| 12 | 176 | -73 | 27 | -240 | 180 |
| 13 | 265 | 16 | 29 | 50 | 180 |
| 14 | 300 | 51 | 29 | 170 | 190 |
| 15 | 271 | 22 | 29 | 70 | 180 |
| 16 | 260 | 11 | 29 | 40 | 180 |
| 17 | 221 | -28 | 28 | -90 | 180 |
| 18 | 167 | -82 | 27 | -270 | 180 |
| 19 | 203 | -46 | 28 | -150 | 180 |
| | | | **Maximum:** | 220 | |
| | | | **Average:** | 7 | |
| | | | **STDEV:** | 142 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

## *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 2
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 172 | -77 | 27 | -250 | 180 |
| 2 | 263 | 14 | 29 | 50 | 180 |
| 3 | 243 | -6 | 28 | -20 | 180 |
| 4 | 242 | -7 | 28 | -20 | 180 |
| 5 | 216 | -33 | 28 | -110 | 180 |
| 6 | 229 | -20 | 28 | -60 | 180 |
| 7 | 244 | -5 | 28 | -20 | 180 |
| 8 | 234 | -15 | 28 | -50 | 180 |
| 9 | 199 | -50 | 27 | -160 | 180 |
| 10 | 289 | 40 | 29 | 130 | 190 |
| 11 | 280 | 31 | 29 | 100 | 180 |

**Maximum:** 130
**Average:** -37
**STDEV:** 110

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 2
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 206 | 27 | 19 | 280 | 390 |
| 2 | 201 | 22 | 19 | 230 | 390 |
| 3 | 223 | 44 | 19 | 460 | 400 |
| 4 | 191 | 12 | 19 | 130 | 380 |
| 5 | 188 | 9 | 18 | 90 | 380 |
| 6 | 183 | 4 | 18 | 40 | 380 |
| 7 | 205 | 26 | 19 | 270 | 390 |
| 8 | 191 | 12 | 19 | 130 | 380 |
| 9 | 248 | 69 | 20 | 720 | 410 |
| 10 | 195 | 16 | 19 | 170 | 380 |
| 11 | 166 | -13 | 18 | -140 | 370 |
| 12 | 191 | 12 | 19 | 130 | 380 |
| 13 | 224 | 45 | 19 | 470 | 400 |
| 14 | 238 | 59 | 20 | 620 | 410 |
| 15 | 197 | 18 | 19 | 190 | 380 |
| 16 | 227 | 48 | 20 | 500 | 400 |
| 17 | 195 | 16 | 19 | 170 | 380 |
| 18 | 206 | 27 | 19 | 280 | 390 |
| 19 | 207 | 28 | 19 | 290 | 390 |

**Maximum:** 720
**Average:** 265
**STDEV:** 210

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm² | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 2
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 223 | 44 | 19 | 460 | 400 |
| 2 | 248 | 69 | 20 | 720 | 410 |
| 3 | 206 | 27 | 19 | 280 | 390 |
| 4 | 239 | 60 | 20 | 630 | 410 |
| 5 | 183 | 4 | 18 | 40 | 380 |
| 6 | 187 | 8 | 18 | 80 | 380 |
| 7 | 187 | 8 | 18 | 80 | 380 |
| 8 | 188 | 9 | 18 | 90 | 380 |
| 9 | 176 | -3 | 18 | -30 | 370 |
| 10 | 223 | 44 | 19 | 460 | 400 |
| 11 | 194 | 15 | 19 | 160 | 380 |

**Maximum:** 720
**Average:** 270
**STDEV:** 258

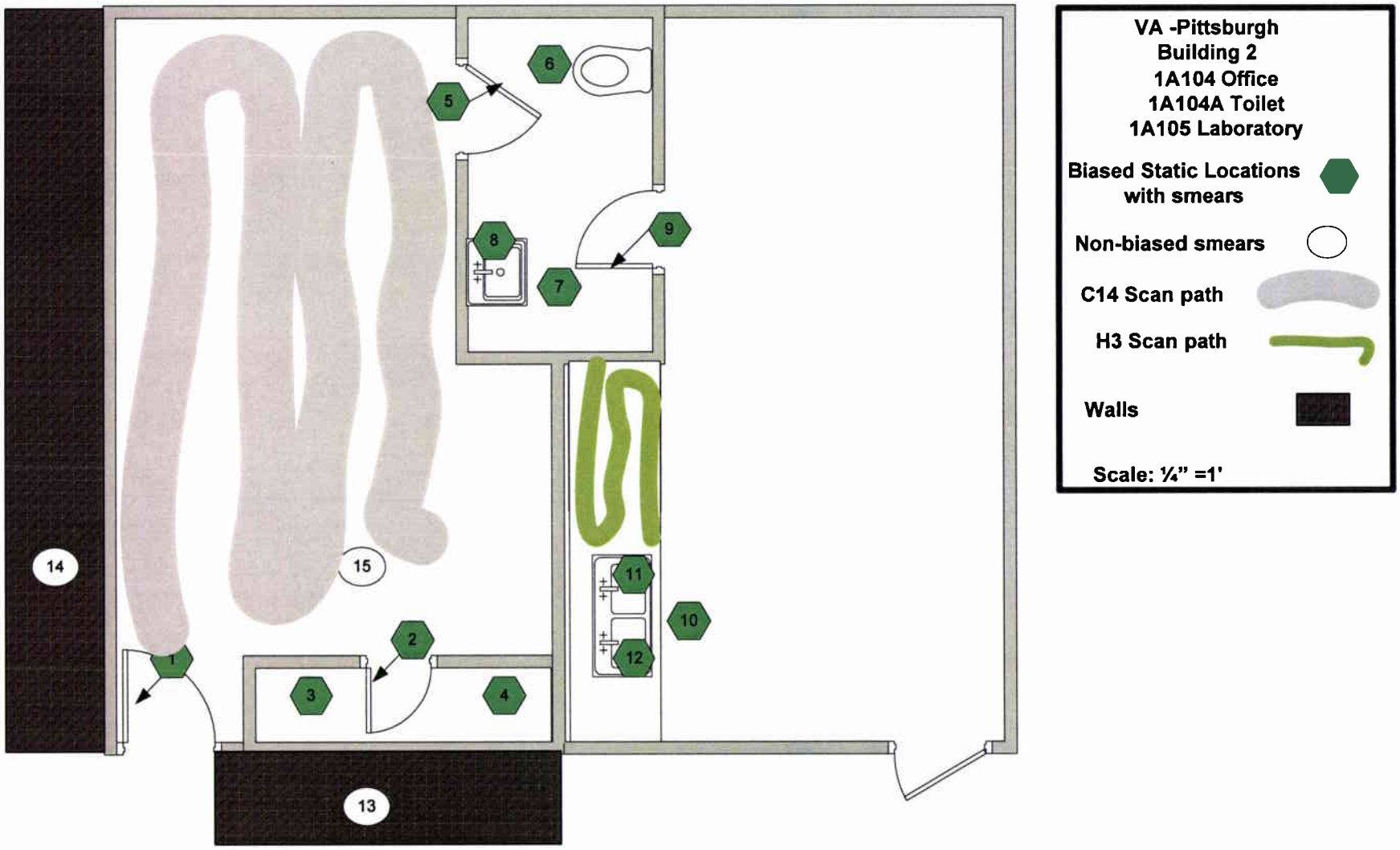
## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

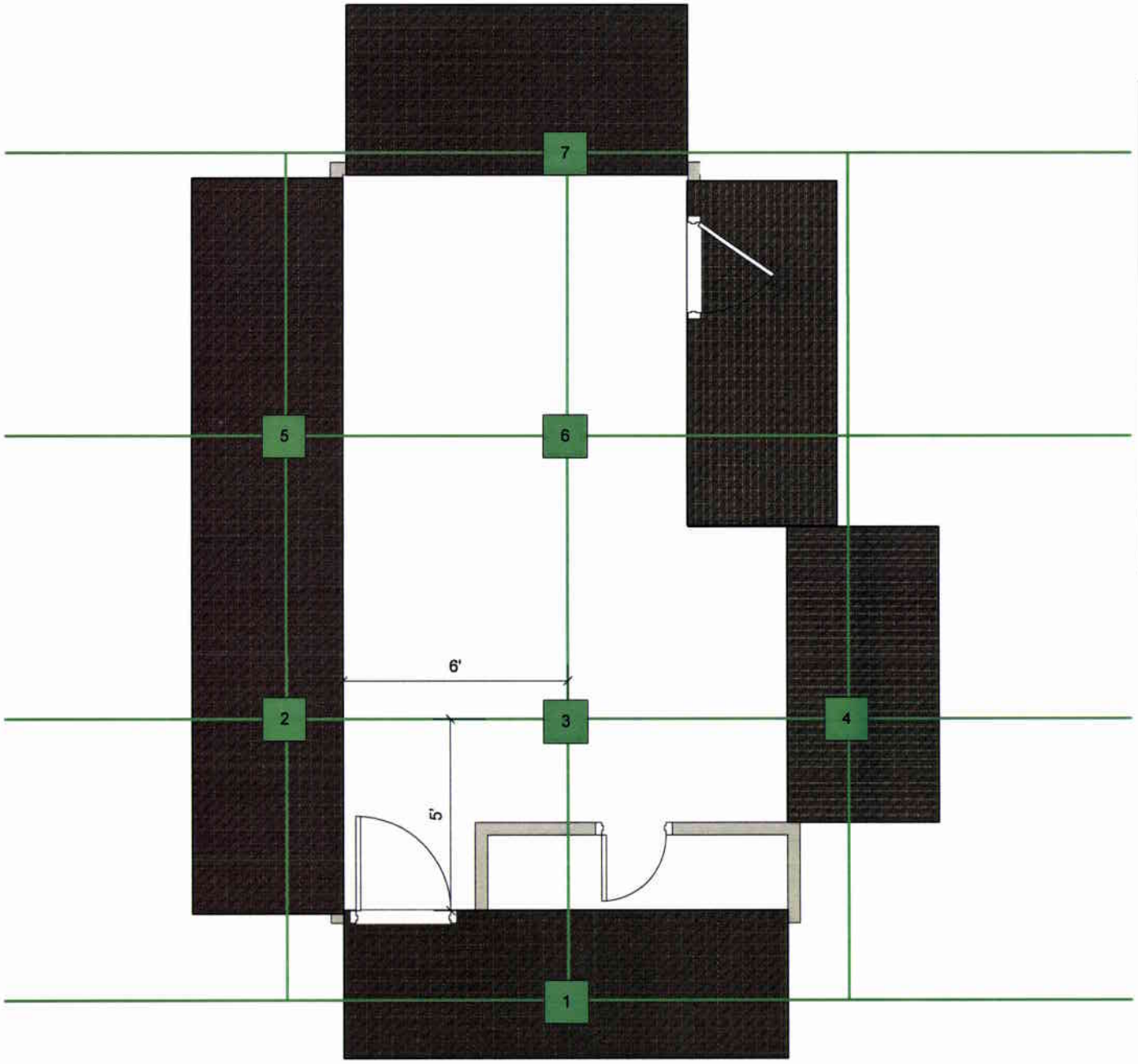
Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 3**

**1A104** **1A104A** **1A105**



## SURVEY UNIT 3 -CONTINUED




**VA -Pittsburgh**
**Building 2**

**1A104 Office**

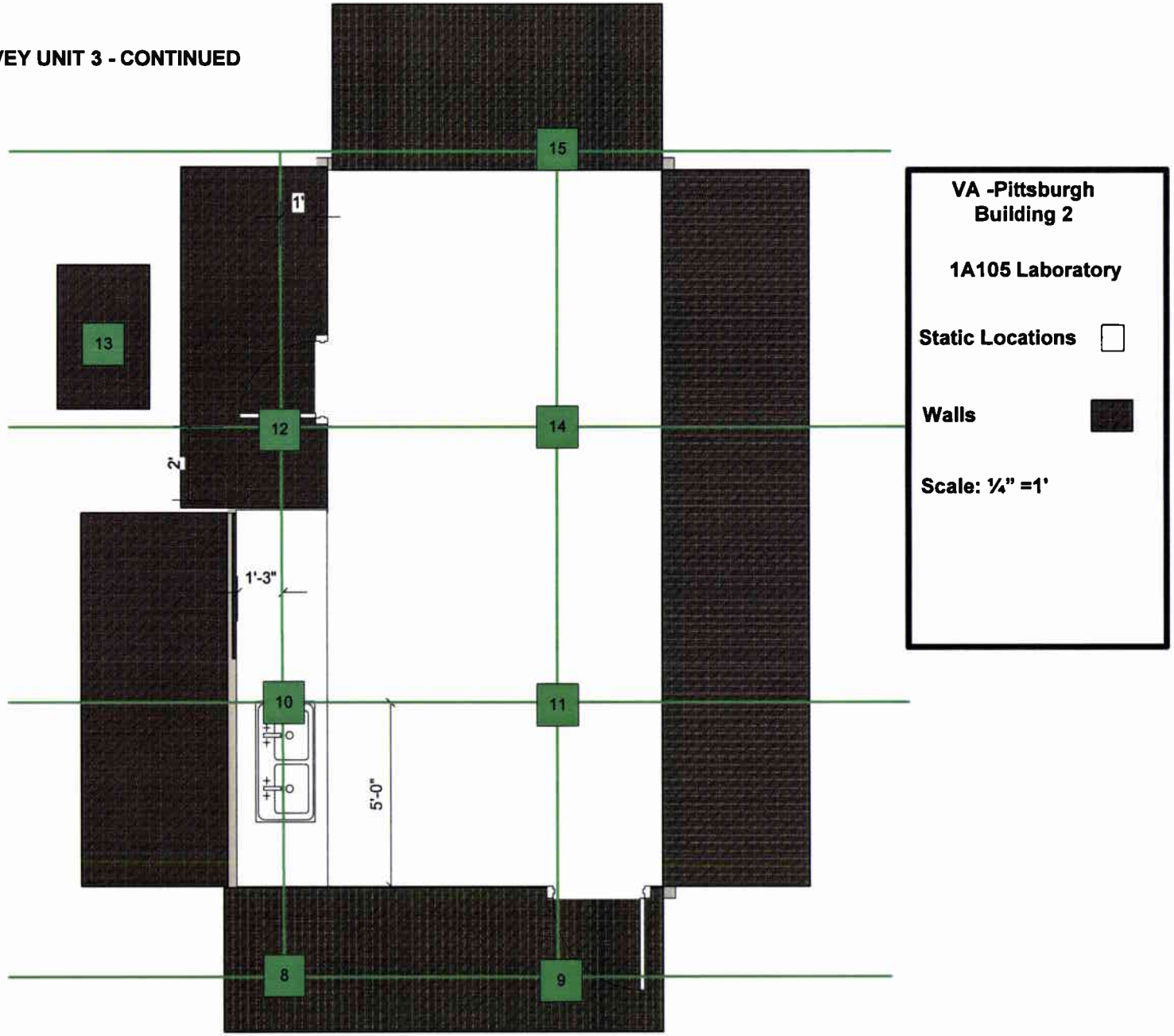
**Static Locations**

**Walls**

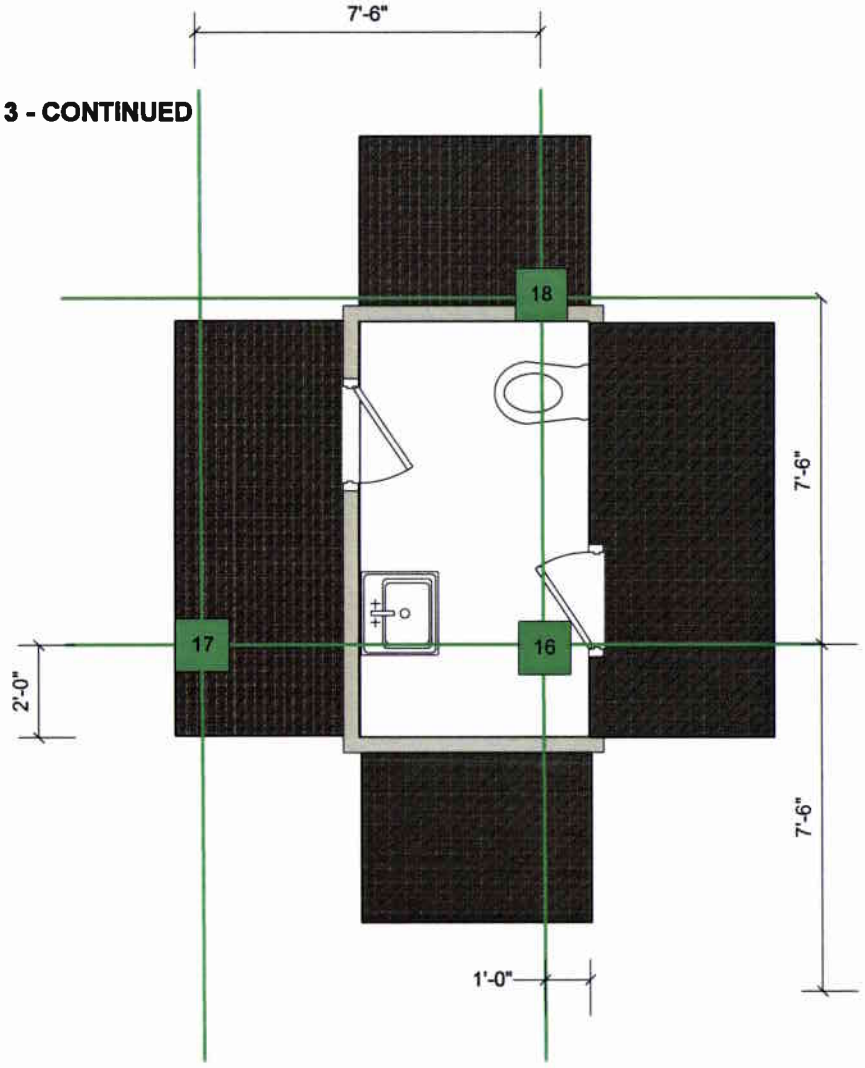
**Scale: ¼" =1'**

**L = 7' 6"**
**Random Start (6', 5')**

**SURVEY UNIT 3 - CONTINUED**



**SURVEY UNIT 3 - CONTINUED**




**VA -Pittsburgh**
**Building 2**

**1A104A Toilet**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

# *Summary of $^{3}$H Static Measurements*

**Survey Unit:** 3
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) | |
|---|---|---|---|---|---|---|
| 1 | 223 | -26 | 28 | -80 | 180 | |
| 2 | 232 | -17 | 28 | -60 | 180 | |
| 3 | 227 | -22 | 28 | -70 | 180 | |
| 4 | 304 | 55 | 29 | 180 | 190 | |
| 5 | 224 | -25 | 28 | -80 | 180 | |
| 6 | 197 | -52 | 27 | -170 | 180 | |
| 7 | 237 | -12 | 28 | -40 | 180 | |
| 8 | 271 | 22 | 29 | 70 | 180 | |
| 9 | 220 | -29 | 28 | -90 | 180 | |
| 10 | 335 | 86 | 30 | 280 | 190 | |
| 11 | 220 | -29 | 28 | -90 | 180 | |
| 12 | 204 | -45 | 28 | -150 | 180 | |
| 13 | 267 | 18 | 29 | 60 | 180 | |
| 14 | 145 | -104 | 26 | -340 | 180 | |
| 15 | 173 | -76 | 27 | -250 | 180 | |
| 16 | 708 | 459 | 36 | 1490 | 330 | Ceramic |
| 17 | 290 | 41 | 29 | 130 | 190 | |
| 18 | 382 | 133 | 31 | 430 | 210 | |

**Maximum:** 1490
**Average:** 68
**STDEV:** 401

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 3
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) | |
|---|---|---|---|---|---|---|
| 1 | 574 | 325 | 34 | 1050 | 270 | Ceramic |
| 2 | 517 | 268 | 33 | 870 | 250 | Ceramic |
| 3 | 176 | -73 | 27 | -240 | 180 | |
| 4 | 292 | 43 | 29 | 140 | 190 | |
| 5 | 264 | 15 | 29 | 50 | 180 | |
| 6 | 247 | -2 | 28 | -10 | 180 | |
| 7 | 205 | -44 | 28 | -140 | 180 | |
| 8 | 327 | 78 | 30 | 250 | 190 | |
| 9 | 292 | 43 | 29 | 140 | 190 | |
| 10 | 258 | 9 | 29 | 30 | 180 | |
| 11 | 324 | 75 | 30 | 240 | 190 | |
| 12 | 275 | 26 | 29 | 80 | 180 | |

**Maximum:** 1050
**Average:** 205
**STDEV:** 382

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 3
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 165 | -14 | 18 | -150 | 370 | |
| 2 | 189 | 10 | 19 | 100 | 380 | |
| 3 | 172 | -7 | 18 | -70 | 370 | |
| 4 | 202 | 23 | 19 | 240 | 390 | |
| 5 | 208 | 29 | 19 | 300 | 390 | |
| 6 | 171 | -8 | 18 | -80 | 370 | |
| 7 | 182 | 3 | 18 | 30 | 380 | |
| 8 | 214 | 35 | 19 | 370 | 390 | |
| 9 | 200 | 21 | 19 | 220 | 390 | |
| 10 | 246 | 67 | 20 | 700 | 410 | |
| 11 | 219 | 40 | 19 | 420 | 400 | |
| 12 | 185 | 6 | 18 | 60 | 380 | |
| 13 | 205 | 26 | 19 | 270 | 390 | |
| 14 | 180 | 1 | 18 | 10 | 370 | |
| 15 | 206 | 27 | 19 | 280 | 390 | |
| 16 | 429 | 250 | 24 | 2610 | 510 | Ceramic |
| 17 | 179 | 0 | 18 | 0 | 370 | |
| 18 | 263 | 84 | 20 | 880 | 420 | |

**Maximum:** 2610
**Average:** 344
**STDEV:** 626

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

# *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 3
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 484 | 305 | 25 | 3190 | 540 | Ceramic |
| 2 | 459 | 280 | 25 | 2920 | 530 | Ceramic |
| 3 | 179 | 0 | 18 | 0 | 370 | |
| 4 | 205 | 26 | 19 | 270 | 390 | |
| 5 | 178 | -1 | 18 | -10 | 370 | |
| 6 | 200 | 21 | 19 | 220 | 390 | |
| 7 | 213 | 34 | 19 | 360 | 390 | |
| 8 | 238 | 59 | 20 | 620 | 410 | |
| 9 | 273 | 94 | 21 | 980 | 430 | |
| 10 | 228 | 49 | 20 | 510 | 400 | |
| 11 | 197 | 18 | 19 | 190 | 380 | |
| 12 | 184 | 5 | 18 | 50 | 380 | |

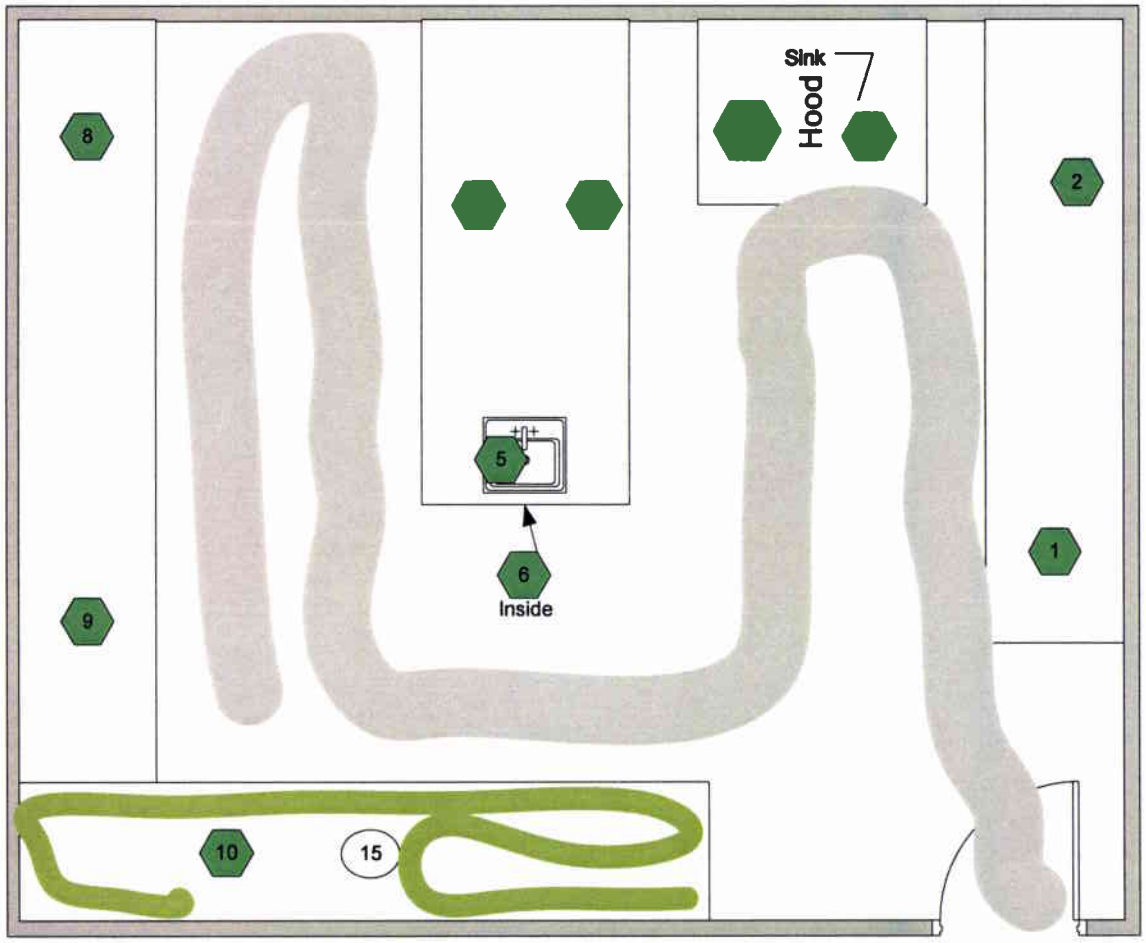
**Maximum:** 3190
**Average:** 775
**STDEV:** 1103

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

**SURVEY UNIT 4**




VA -Pittsburgh
Building 2

1A106 Laboratory

Biased Static Locations with smears

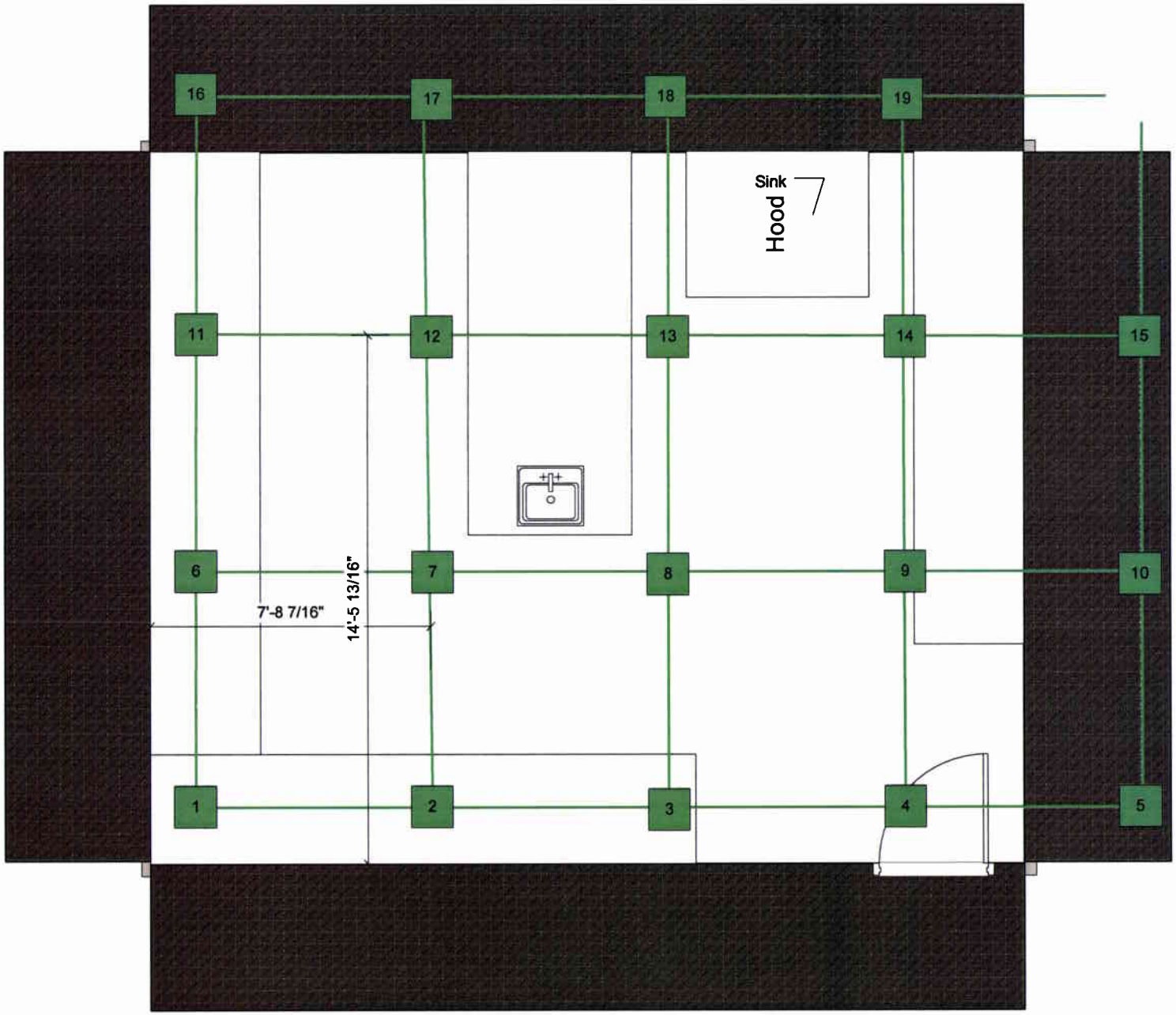
Non-biased smears

C14 Scan path

H3 Scan path

Scale: ¼" =1'

## SURVEY UNIT 4 - CONTINUED




**VA -Pittsburgh**
**Building 2**

**1A106 Laboratory**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

**L = 6' 6"**
**Random Start (7'9", 14'6")**

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 4
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 323 | 74 | 30 | 240 | 190 |
| 2 | 301 | 52 | 29 | 170 | 190 |
| 3 | 275 | 26 | 29 | 80 | 180 |
| 4 | 270 | 21 | 29 | 70 | 180 |
| 5 | 260 | 11 | 29 | 40 | 180 |
| 6 | 250 | 1 | 28 | 0 | 180 |
| 7 | 288 | 39 | 29 | 130 | 190 |
| 8 | 201 | -48 | 28 | -160 | 180 |
| 9 | 258 | 9 | 29 | 30 | 180 |
| 10 | 264 | 15 | 29 | 50 | 180 |
| 11 | 222 | -27 | 28 | -90 | 180 |
| 12 | 213 | -36 | 28 | -120 | 180 |
| 13 | 296 | 47 | 29 | 150 | 190 |
| 14 | 258 | 9 | 29 | 30 | 180 |
| 15 | 250 | 1 | 28 | 0 | 180 |
| 16 | 283 | 34 | 29 | 110 | 180 |
| 17 | 269 | 20 | 29 | 60 | 180 |
| 18 | 263 | 14 | 29 | 50 | 180 |
| 19 | 265 | 16 | 29 | 50 | 180 |
| | | | **Maximum:** | 240 | |
| | | | **Average:** | 47 | |
| | | | **STDEV:** | 97 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | cm² | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

## *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 4
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 197 | -52 | 27 | -170 | 180 |
| 2 | 279 | 30 | 29 | 100 | 180 |
| 3 | 273 | 24 | 29 | 80 | 180 |
| 4 | 172 | -77 | 27 | -250 | 180 |
| 5 | 292 | 43 | 29 | 140 | 190 |
| 6 | 292 | 43 | 29 | 140 | 190 |
| 7 | 249 | 0 | 28 | 0 | 180 |
| 8 | 236 | -13 | 28 | -40 | 180 |
| 9 | 271 | 22 | 29 | 70 | 180 |
| 10 | 269 | 20 | 29 | 60 | 180 |
| 11 | 290 | 41 | 29 | 130 | 190 |

**Maximum:** 140
**Average:** 24
**STDEV:** 130

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 4
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 210 | 31 | 19 | 320 | 390 |
| 2 | 229 | 50 | 20 | 520 | 400 |
| 3 | 227 | 48 | 20 | 500 | 400 |
| 4 | 225 | 46 | 19 | 480 | 400 |
| 5 | 194 | 15 | 19 | 160 | 380 |
| 6 | 177 | -2 | 18 | -20 | 370 |
| 7 | 216 | 37 | 19 | 390 | 390 |
| 8 | 206 | 27 | 19 | 280 | 390 |
| 9 | 220 | 41 | 19 | 430 | 400 |
| 10 | 225 | 46 | 19 | 480 | 400 |
| 11 | 185 | 6 | 18 | 60 | 380 |
| 12 | 217 | 38 | 19 | 400 | 390 |
| 13 | 225 | 46 | 19 | 480 | 400 |
| 14 | 206 | 27 | 19 | 280 | 390 |
| 15 | 199 | 20 | 19 | 210 | 380 |
| 16 | 200 | 21 | 19 | 220 | 390 |
| 17 | 197 | 18 | 19 | 190 | 380 |
| 18 | 185 | 6 | 18 | 60 | 380 |
| 19 | 199 | 20 | 19 | 210 | 380 |
| | | | **Maximum:** | 520 | |
| | | | **Average:** | 297 | |
| | | | **STDEV:** | 166 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 4
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 187 | 8 | 18 | 80 | 380 |
| 2 | 213 | 34 | 19 | 360 | 390 |
| 3 | 244 | 65 | 20 | 680 | 410 |
| 4 | 164 | -15 | 18 | -160 | 360 |
| 5 | 233 | 54 | 20 | 560 | 400 |
| 6 | 206 | 27 | 19 | 280 | 390 |
| 7 | 195 | 16 | 19 | 170 | 380 |
| 8 | 238 | 59 | 20 | 620 | 410 |
| 9 | 257 | 78 | 20 | 810 | 420 |
| 10 | 257 | 78 | 20 | 810 | 420 |
| 11 | 214 | 35 | 19 | 370 | 390 |

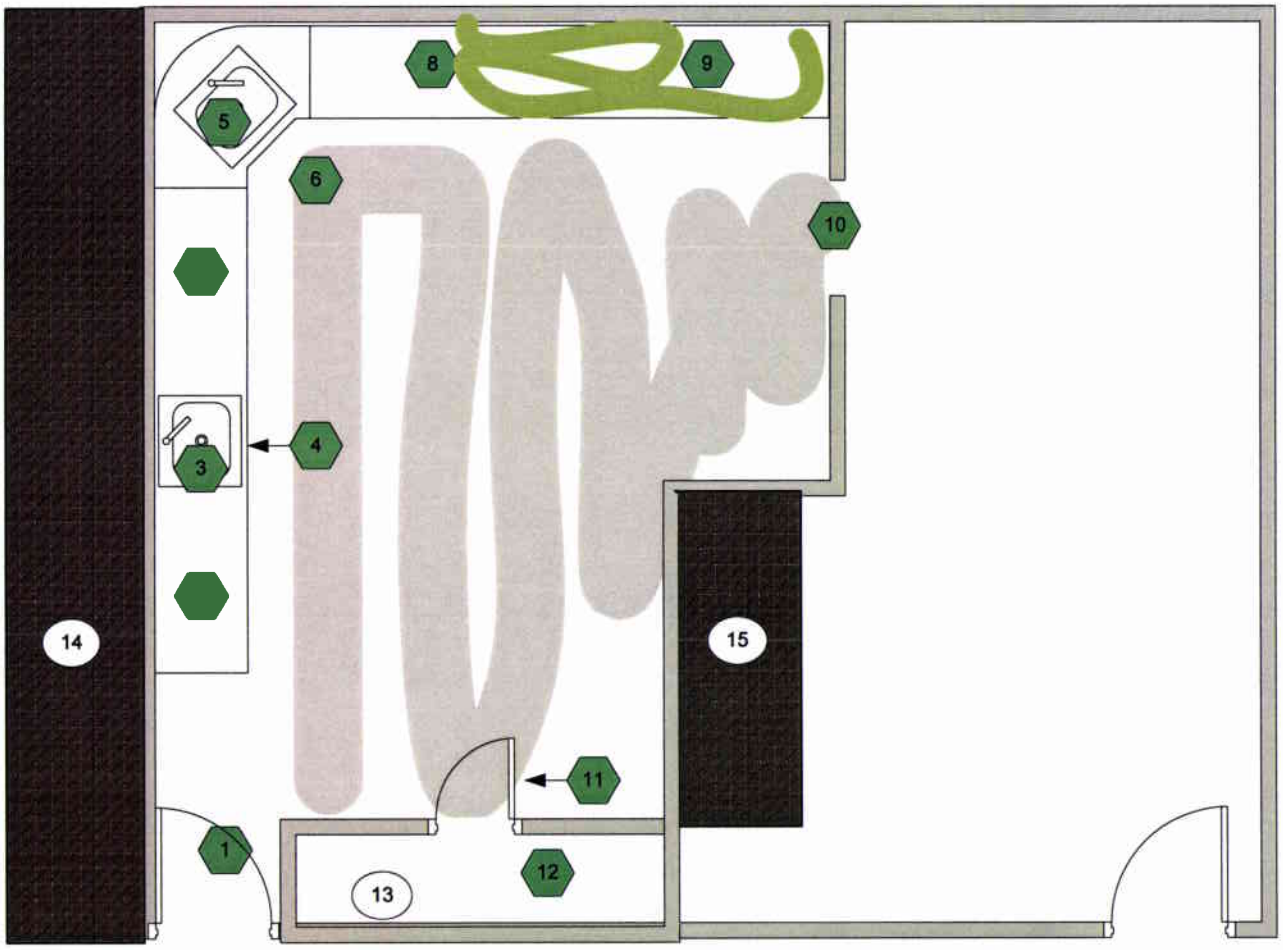
**Maximum:** 810
**Average:** 416
**STDEV:** 312

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 5**




**VA -Pittsburgh**
**Building 2**

**1A108 Laboratory**
**1A108A Closet**
**1A109 Laboratory**

**Biased Static Locations with smears**

**Non-biased smears**

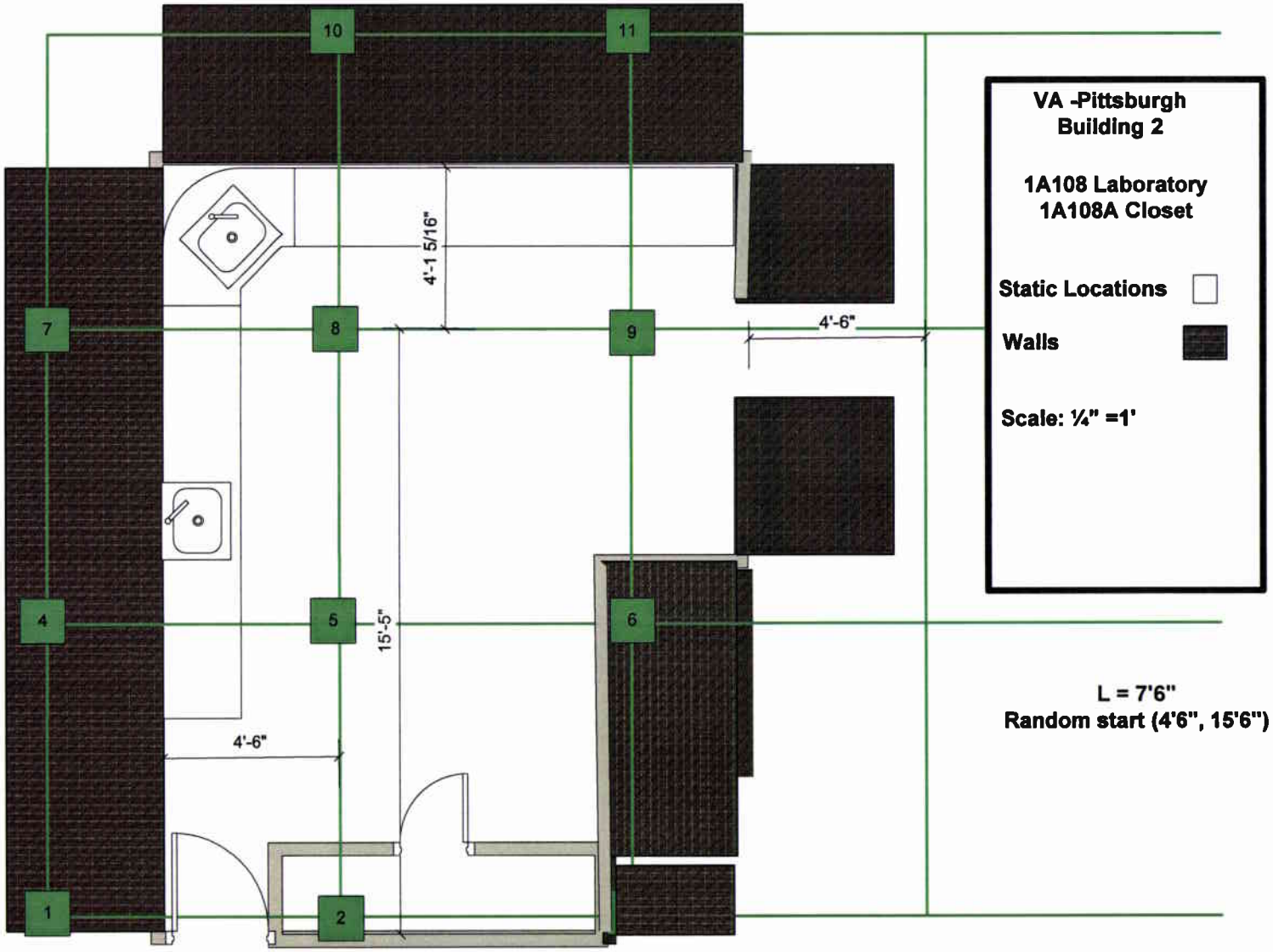
**C14 Scan path**

**H3 Scan path**

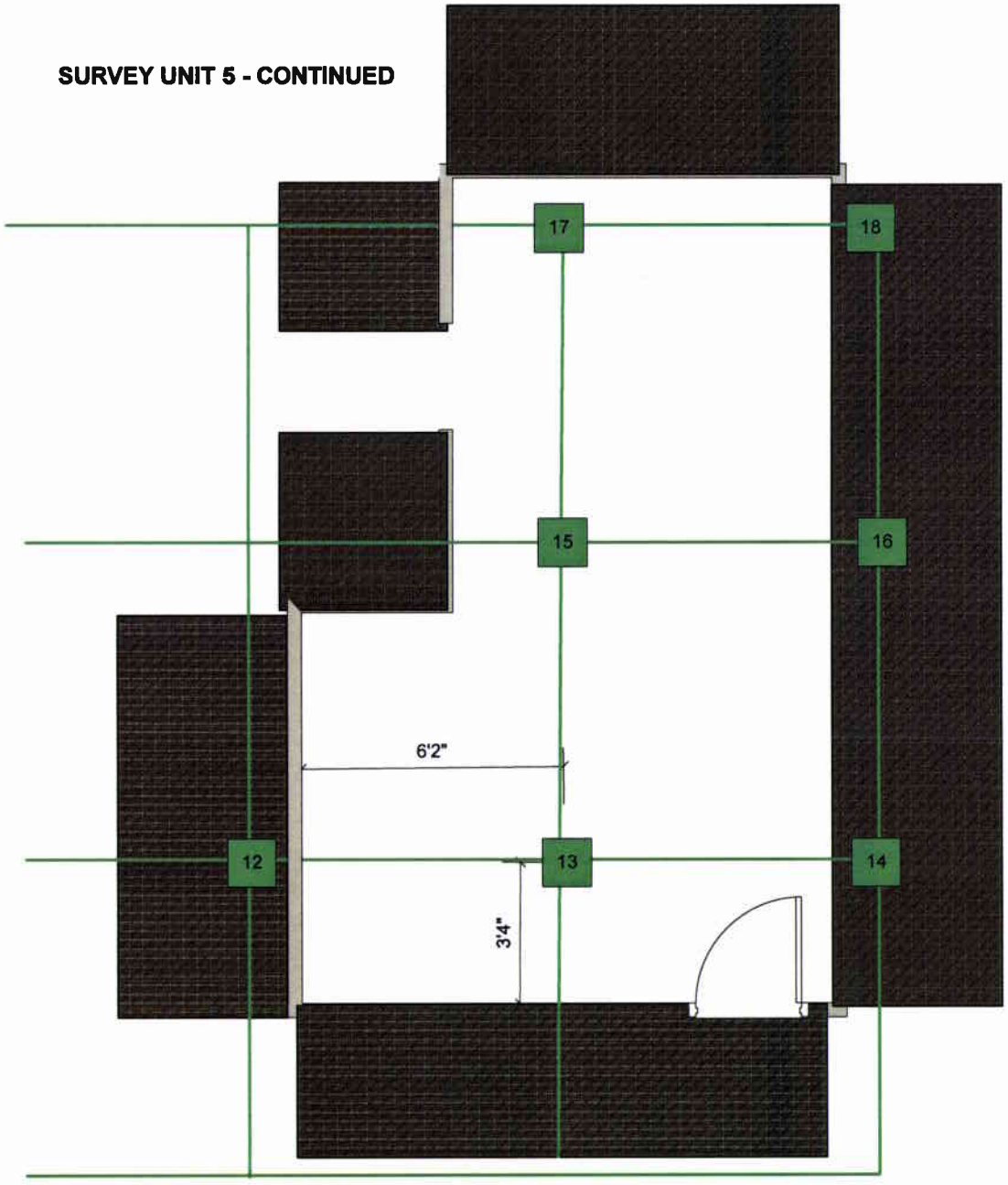
**Walls**

**Scale: ¼" =1'**

## SURVEY UNIT 5 - CONTINUED



**SURVEY UNIT 5 - CONTINUED**




**VA -Pittsburgh**
**Building 2**

**1A109 Laboratory**

**Static Locations** □

**Walls** ■

**Scale: ¼" =1'**

## *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 5
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 229 | -20 | 28 | -60 | 180 |
| 2 | 273 | 24 | 29 | 80 | 180 |
| 3 | 283 | 34 | 29 | 110 | 180 |
| 4 | 247 | -2 | 28 | -10 | 180 |
| 5 | 285 | 36 | 29 | 120 | 190 |
| 6 | 220 | -29 | 28 | -90 | 180 |
| 7 | 268 | 19 | 29 | 60 | 180 |
| 8 | 226 | -23 | 28 | -70 | 180 |
| 9 | 238 | -11 | 28 | -40 | 180 |
| 10 | 267 | 18 | 29 | 60 | 180 |
| 11 | 228 | -21 | 28 | -70 | 180 |
| 12 | 219 | -30 | 28 | -100 | 180 |
| 13 | 294 | 45 | 29 | 150 | 190 |
| 14 | 203 | -46 | 28 | -150 | 180 |
| 15 | 243 | -6 | 28 | -20 | 180 |
| 16 | 328 | 79 | 30 | 260 | 190 |
| 17 | 273 | 24 | 29 | 80 | 180 |
| 18 | 228 | -21 | 28 | -70 | 180 |

**Maximum:** 260
**Average:** 13
**STDEV:** 107

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

# *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 5
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 295 | 46 | 29 | 150 | 190 |
| 2 | 343 | 94 | 30 | 300 | 200 |
| 3 | 317 | 68 | 30 | 220 | 190 |
| 4 | 194 | -55 | 27 | -180 | 180 |
| 5 | 297 | 48 | 29 | 160 | 190 |
| 6 | 180 | -69 | 27 | -220 | 180 |
| 7 | 251 | 2 | 28 | 10 | 180 |
| 8 | 229 | -20 | 28 | -60 | 180 |
| 9 | 211 | -38 | 28 | -120 | 180 |
| 10 | 202 | -47 | 28 | -150 | 180 |
| 11 | 260 | 11 | 29 | 40 | 180 |
| 12 | 264 | 15 | 29 | 50 | 180 |

**Maximum:** 300
**Average:** 17
**STDEV:** 168

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 5
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 245 | 66 | 20 | 690 | 410 |
| 2 | 188 | 9 | 18 | 90 | 380 |
| 3 | 205 | 26 | 19 | 270 | 390 |
| 4 | 185 | 6 | 18 | 60 | 380 |
| 5 | 192 | 13 | 19 | 140 | 380 |
| 6 | 210 | 31 | 19 | 320 | 390 |
| 7 | 214 | 35 | 19 | 370 | 390 |
| 8 | 175 | -4 | 18 | -40 | 370 |
| 9 | 196 | 17 | 19 | 180 | 380 |
| 10 | 244 | 65 | 20 | 680 | 410 |
| 11 | 206 | 27 | 19 | 280 | 390 |
| 12 | 237 | 58 | 20 | 610 | 410 |
| 13 | 208 | 29 | 19 | 300 | 390 |
| 14 | 224 | 45 | 19 | 470 | 400 |
| 15 | 185 | 6 | 18 | 60 | 380 |
| 16 | 211 | 32 | 19 | 330 | 390 |
| 17 | 187 | 8 | 18 | 80 | 380 |
| 18 | 212 | 33 | 19 | 340 | 390 |

**Maximum:** 690
**Average:** 291
**STDEV:** 216

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 5
**Survey Date:** 4/20/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 197 | 18 | 19 | 190 | 380 |
| 2 | 226 | 47 | 19 | 490 | 400 |
| 3 | 205 | 26 | 19 | 270 | 390 |
| 4 | 175 | -4 | 18 | -40 | 370 |
| 5 | 180 | 1 | 18 | 10 | 370 |
| 6 | 180 | 1 | 18 | 10 | 370 |
| 7 | 199 | 20 | 19 | 210 | 380 |
| 8 | 176 | -3 | 18 | -30 | 370 |
| 9 | 198 | 19 | 19 | 200 | 380 |
| 10 | 201 | 22 | 19 | 230 | 390 |
| 11 | 194 | 15 | 19 | 160 | 380 |
| 12 | 193 | 14 | 19 | 150 | 380 |

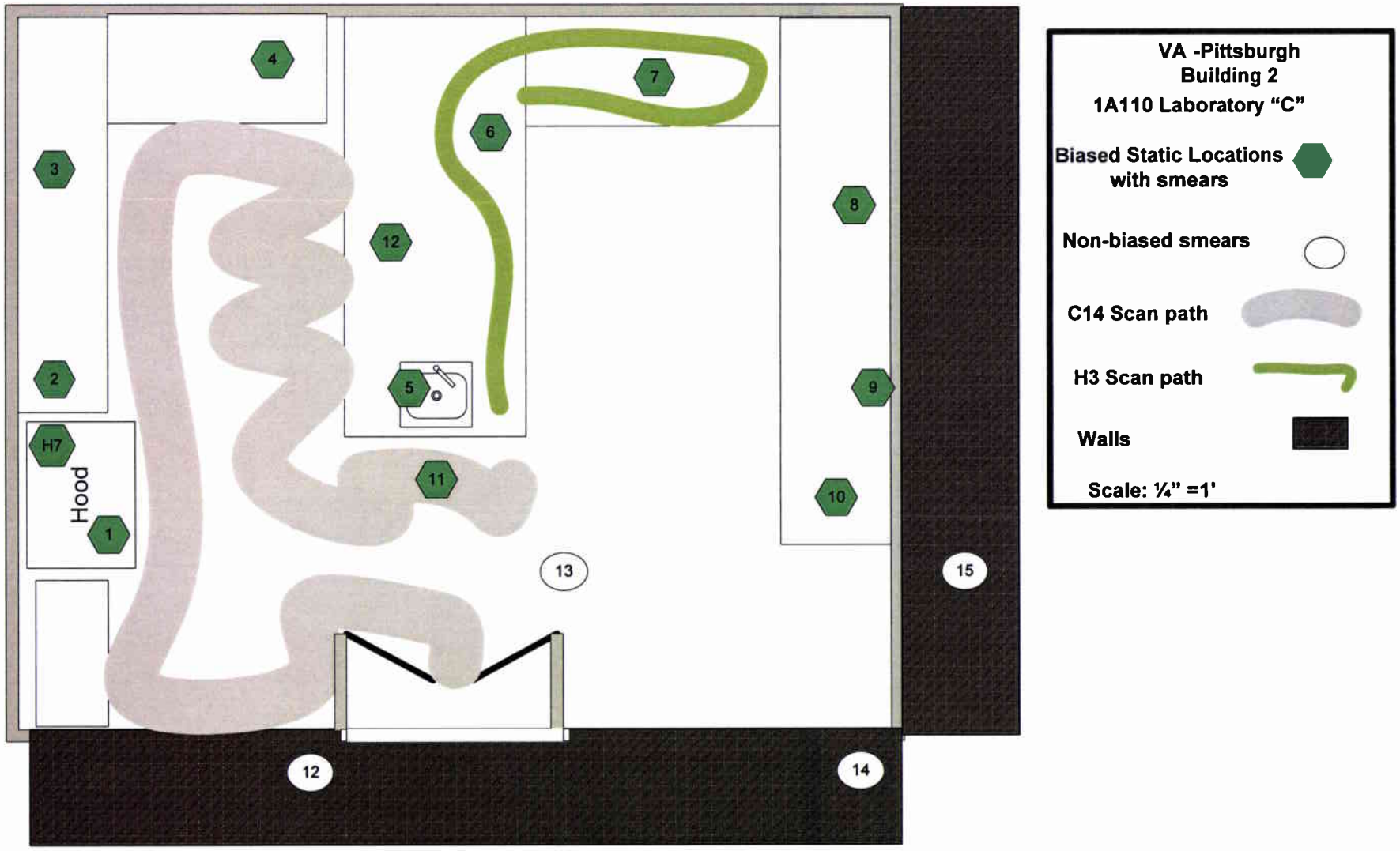
**Maximum:** 490
**Average:** 154
**STDEV:** 151

## *Instrument Data and Analysis Parameters*

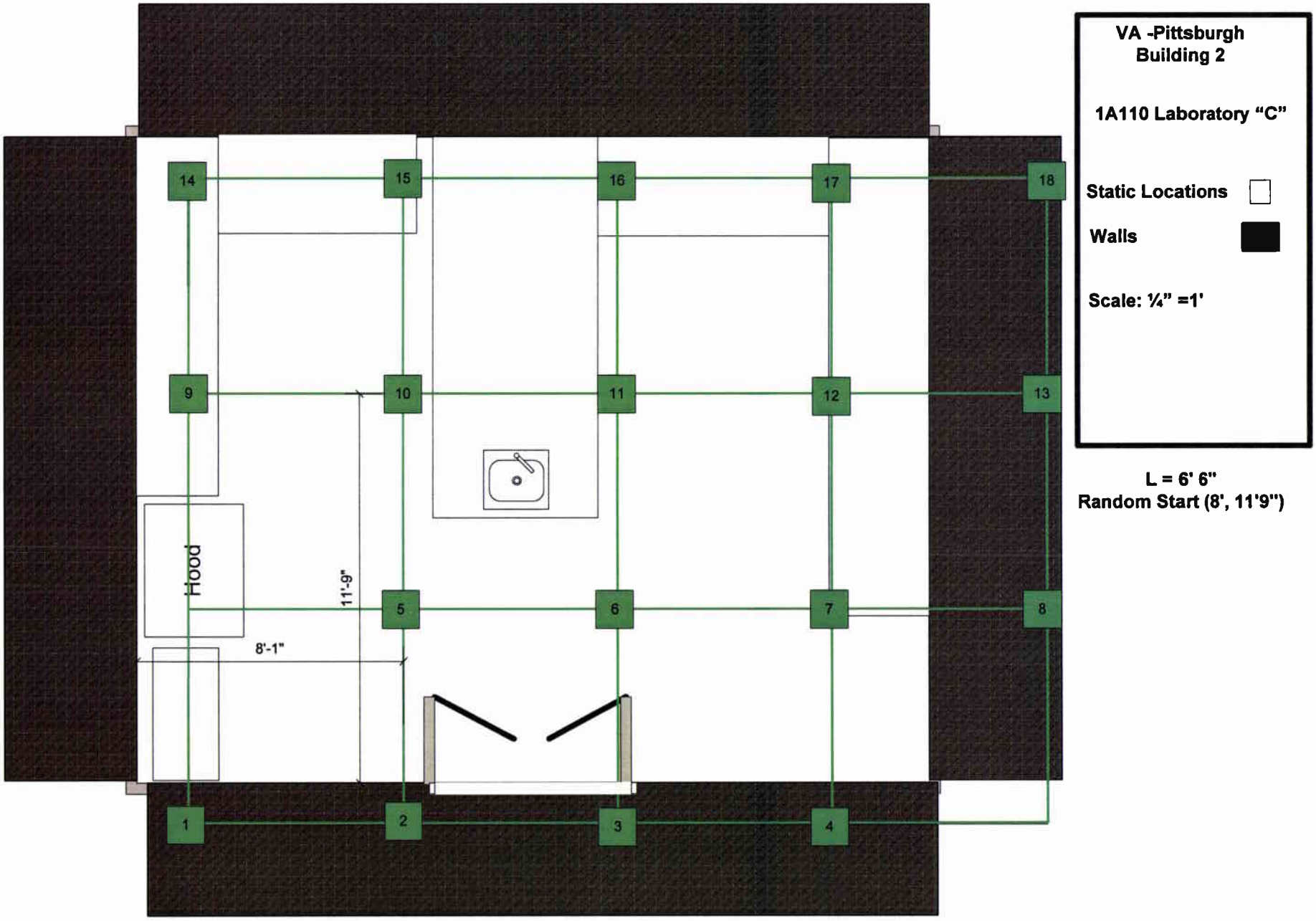
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 6**



## SURVEY UNIT 6 - CONTINUED



# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 6
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 236 | -13 | 28 | -40 | 180 |
| 2 | 235 | -14 | 28 | -50 | 180 |
| 3 | 279 | 30 | 29 | 100 | 180 |
| 4 | 274 | 25 | 29 | 80 | 180 |
| 5 | 255 | 6 | 28 | 20 | 180 |
| 6 | 181 | -68 | 27 | -220 | 180 |
| 7 | 207 | -42 | 28 | -140 | 180 |
| 8 | 288 | 39 | 29 | 130 | 190 |
| 9 | 206 | -43 | 28 | -140 | 180 |
| 10 | 177 | -72 | 27 | -230 | 180 |
| 11 | 200 | -49 | 28 | -160 | 180 |
| 12 | 214 | -35 | 28 | -110 | 180 |
| 13 | 279 | 30 | 29 | 100 | 180 |
| 14 | 268 | 19 | 29 | 60 | 180 |
| 15 | 235 | -14 | 28 | -50 | 180 |
| 16 | 234 | -15 | 28 | -50 | 180 |
| 17 | 205 | -44 | 28 | -140 | 180 |
| 18 | 301 | 52 | 29 | 170 | 190 |

**Maximum:** 170
**Average:** -37
**STDEV:** 123

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | cm² | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

## *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 6
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 255 | 6 | 28 | 20 | 180 |
| 2 | 193 | -56 | 27 | -180 | 180 |
| 3 | 219 | -30 | 28 | -100 | 180 |
| 4 | 297 | 48 | 29 | 160 | 190 |
| 5 | 300 | 51 | 29 | 170 | 190 |
| 6 | 246 | -3 | 28 | -10 | 180 |
| 7 | 223 | -26 | 28 | -80 | 180 |
| 8 | 325 | 76 | 30 | 250 | 190 |
| 9 | 245 | -4 | 28 | -10 | 180 |
| 10 | 218 | -31 | 28 | -100 | 180 |
| 11 | 246 | -3 | 28 | -10 | 180 |
| 12 | 269 | 20 | 29 | 60 | 180 |

**Maximum:** 250
**Average:** 14
**STDEV:** 127

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 6
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 172 | -7 | 18 | -70 | 370 |
| 2 | 179 | 0 | 18 | 0 | 370 |
| 3 | 193 | 14 | 19 | 150 | 380 |
| 4 | 216 | 37 | 19 | 390 | 390 |
| 5 | 203 | 24 | 19 | 250 | 390 |
| 6 | 188 | 9 | 18 | 90 | 380 |
| 7 | 222 | 43 | 19 | 450 | 400 |
| 8 | 241 | 62 | 20 | 650 | 410 |
| 9 | 176 | -3 | 18 | -30 | 370 |
| 10 | 177 | -2 | 18 | -20 | 370 |
| 11 | 158 | -21 | 18 | -220 | 360 |
| 12 | 203 | 24 | 19 | 250 | 390 |
| 13 | 221 | 42 | 19 | 440 | 400 |
| 14 | 217 | 38 | 19 | 400 | 390 |
| 15 | 217 | 38 | 19 | 400 | 390 |
| 16 | 194 | 15 | 19 | 160 | 380 |
| 17 | 212 | 33 | 19 | 340 | 390 |
| 18 | 262 | 83 | 20 | 870 | 420 |

**Maximum:** 870
**Average:** 250
**STDEV:** 274

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm² | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 6
**Survey Date:** 4/21/2010

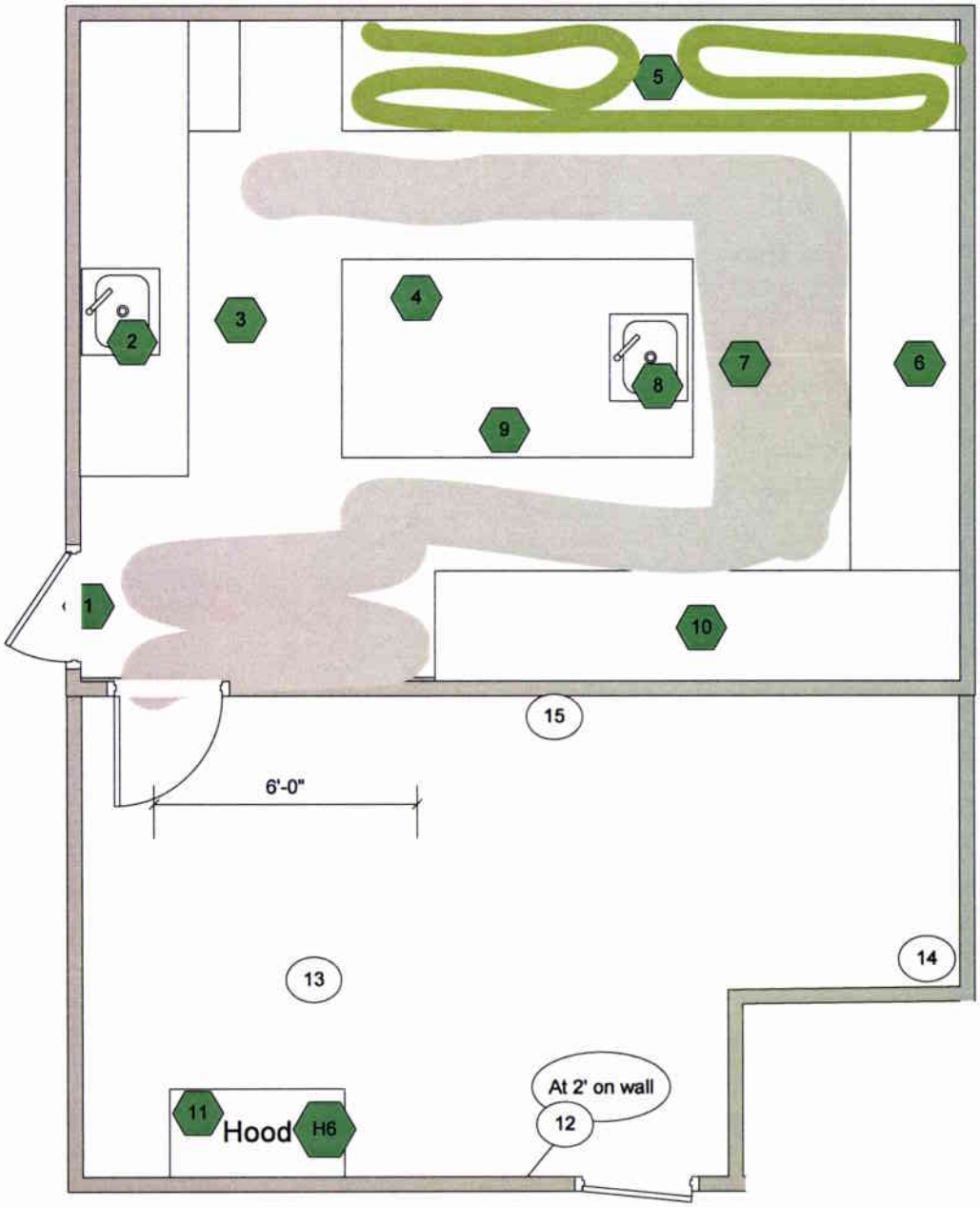
| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 158 | -21 | 18 | -220 | 360 |
| 2 | 193 | 14 | 19 | 150 | 380 |
| 3 | 213 | 34 | 19 | 360 | 390 |
| 4 | 172 | -7 | 18 | -70 | 370 |
| 5 | 196 | 17 | 19 | 180 | 380 |
| 6 | 207 | 28 | 19 | 290 | 390 |
| 7 | 177 | -2 | 18 | -20 | 370 |
| 8 | 212 | 33 | 19 | 340 | 390 |
| 9 | 193 | 14 | 19 | 150 | 380 |
| 10 | 219 | 40 | 19 | 420 | 400 |
| 11 | 181 | 2 | 18 | 20 | 370 |
| 12 | 170 | -9 | 18 | -90 | 370 |

**Maximum:** 420
**Average:** 126
**STDEV:** 203

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$




**SURVEY UNIT 7**

**VA -Pittsburgh**
**Building 2**
**1A128 Histo/Chem Laboratory**
**1A129 Conference**

**Biased Static Locations with smears**

**Non-biased smears**

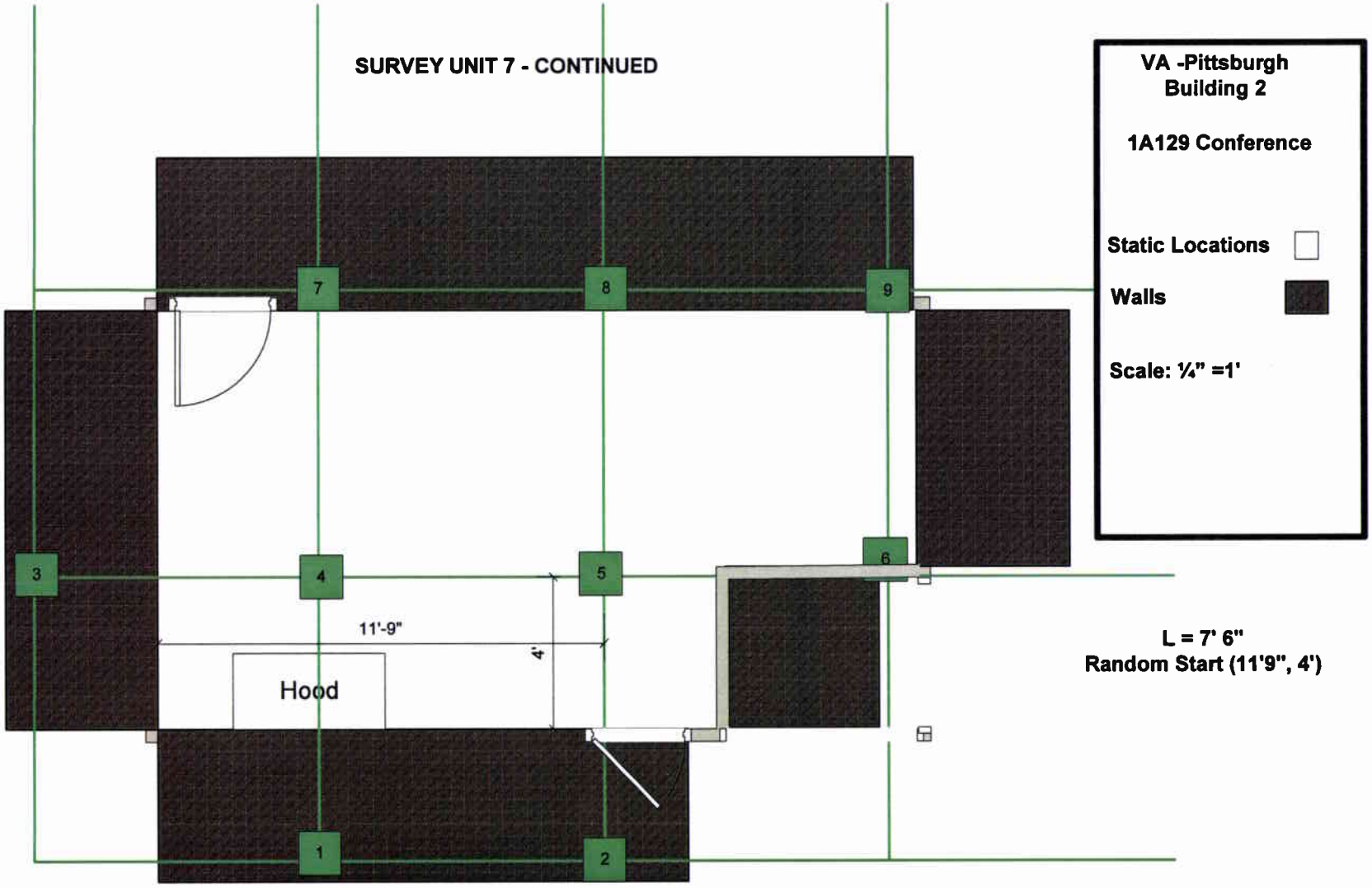
**C14 Scan path**

**H3 Scan path**

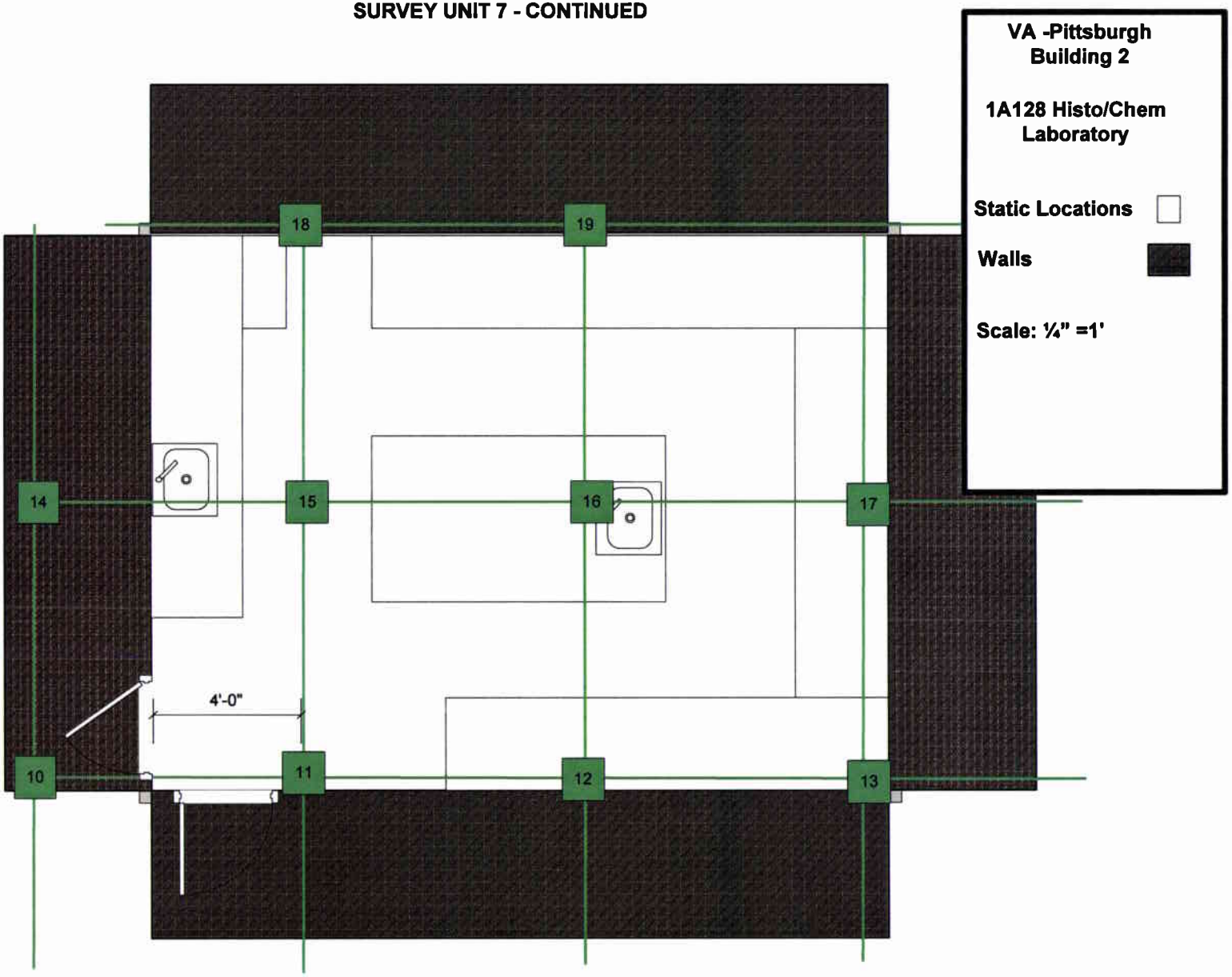
**Walls**

**Scale: ¼" =1'**

**SURVEY UNIT 7 - CONTINUED**



**SURVEY UNIT 7 - CONTINUED**



# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 7
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 293 | 44 | 29 | 140 | 190 |
| 2 | 299 | 50 | 29 | 160 | 190 |
| 3 | 254 | 5 | 28 | 20 | 180 |
| 4 | 283 | 34 | 29 | 110 | 180 |
| 5 | 269 | 20 | 29 | 60 | 180 |
| 6 | 379 | 130 | 31 | 420 | 210 |
| 7 | 237 | -12 | 28 | -40 | 180 |
| 8 | 231 | -18 | 28 | -60 | 180 |
| 9 | 256 | 7 | 29 | 20 | 180 |
| 10 | 278 | 29 | 29 | 90 | 180 |
| 11 | 300 | 51 | 29 | 170 | 190 |
| 12 | 251 | 2 | 28 | 10 | 180 |
| 13 | 273 | 24 | 29 | 80 | 180 |
| 14 | 242 | -7 | 28 | -20 | 180 |
| 15 | 260 | 11 | 29 | 40 | 180 |
| 16 | 264 | 15 | 29 | 50 | 180 |
| 17 | 294 | 45 | 29 | 150 | 190 |
| 18 | 281 | 32 | 29 | 100 | 180 |
| 19 | 271 | 22 | 29 | 70 | 180 |
| | | | **Maximum:** | 420 | |
| | | | **Average:** | 83 | |
| | | | **STDEV:** | 105 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

## *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 7
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 269 | 20 | 29 | 60 | 180 |
| 2 | 247 | -2 | 28 | -10 | 180 |
| 3 | 214 | -35 | 28 | -110 | 180 |
| 4 | 295 | 46 | 29 | 150 | 190 |
| 5 | 240 | -9 | 28 | -30 | 180 |
| 6 | 253 | 4 | 28 | 10 | 180 |
| 7 | 295 | 46 | 29 | 150 | 190 |
| 8 | 238 | -11 | 28 | -40 | 180 |
| 9 | 271 | 22 | 29 | 70 | 180 |
| 10 | 258 | 9 | 29 | 30 | 180 |
| 11 | 256 | 7 | 29 | 20 | 180 |

**Maximum:** 150
**Average:** 27
**STDEV:** 78

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 7
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 260 | 81 | 20 | 850 | 420 |
| 2 | 218 | 39 | 19 | 410 | 400 |
| 3 | 206 | 27 | 19 | 280 | 390 |
| 4 | 218 | 39 | 19 | 410 | 400 |
| 5 | 209 | 30 | 19 | 310 | 390 |
| 6 | 209 | 30 | 19 | 310 | 390 |
| 7 | 176 | -3 | 18 | -30 | 370 |
| 8 | 170 | -9 | 18 | -90 | 370 |
| 9 | 162 | -17 | 18 | -180 | 360 |
| 10 | 201 | 22 | 19 | 230 | 390 |
| 11 | 192 | 13 | 19 | 140 | 380 |
| 12 | 189 | 10 | 19 | 100 | 380 |
| 13 | 263 | 84 | 20 | 880 | 420 |
| 14 | 169 | -10 | 18 | -100 | 370 |
| 15 | 195 | 16 | 19 | 170 | 380 |
| 16 | 219 | 40 | 19 | 420 | 400 |
| 17 | 229 | 50 | 20 | 520 | 400 |
| 18 | 197 | 18 | 19 | 190 | 380 |
| 19 | 218 | 39 | 19 | 410 | 400 |
| | | | **Maximum:** | 880 | |
| | | | **Average:** | 275 | |
| | | | **STDEV:** | 287 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 7
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 218 | 39 | 19 | 410 | 400 |
| 2 | 181 | 2 | 18 | 20 | 370 |
| 3 | 190 | 11 | 19 | 110 | 380 |
| 4 | 196 | 17 | 19 | 180 | 380 |
| 5 | 208 | 29 | 19 | 300 | 390 |
| 6 | 168 | -11 | 18 | -110 | 370 |
| 7 | 204 | 25 | 19 | 260 | 390 |
| 8 | 180 | 1 | 18 | 10 | 370 |
| 9 | 155 | -24 | 18 | -250 | 360 |
| 10 | 207 | 28 | 19 | 290 | 390 |
| 11 | 217 | 38 | 19 | 400 | 390 |

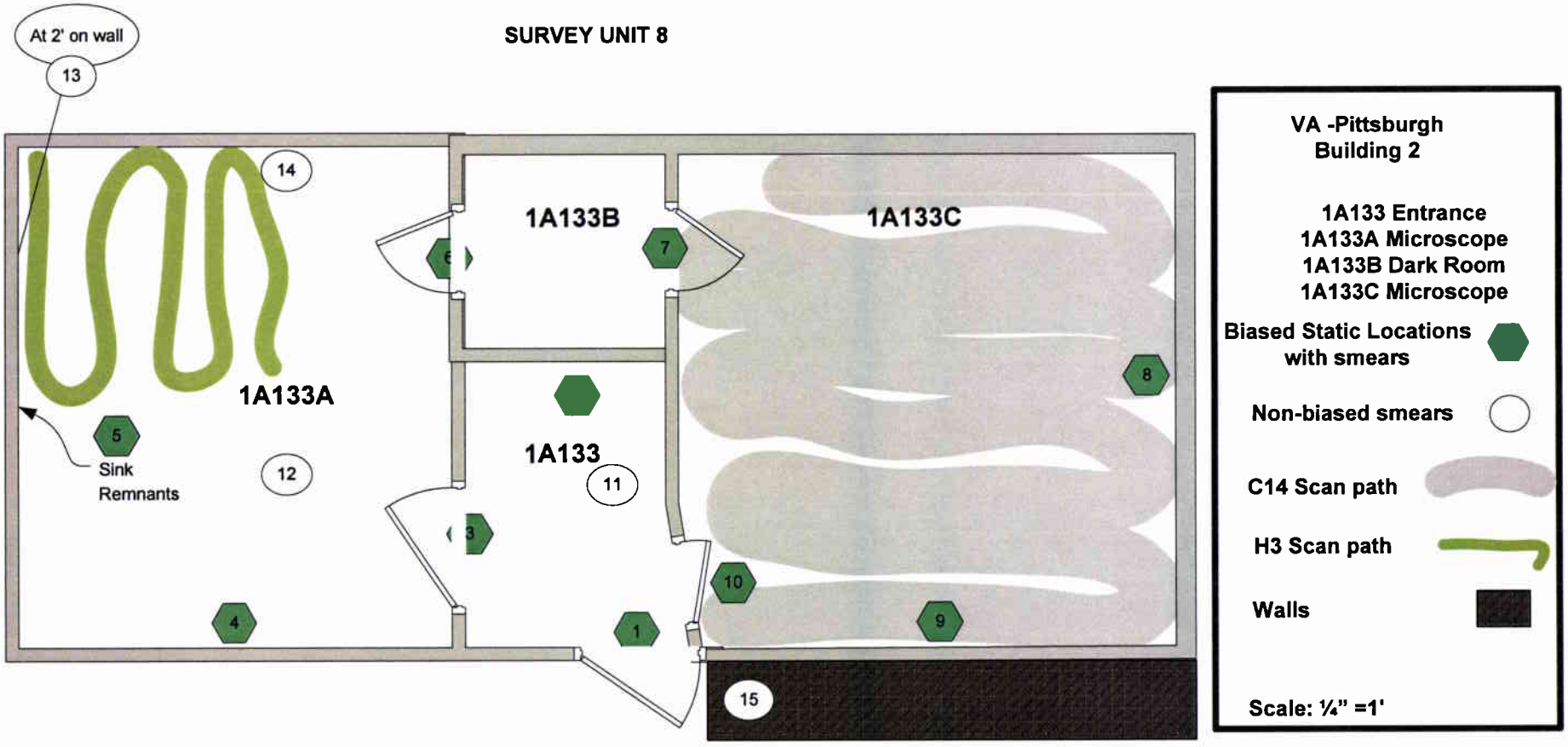
**Maximum:** 410
**Average:** 147
**STDEV:** 212

## *Instrument Data and Analysis Parameters*

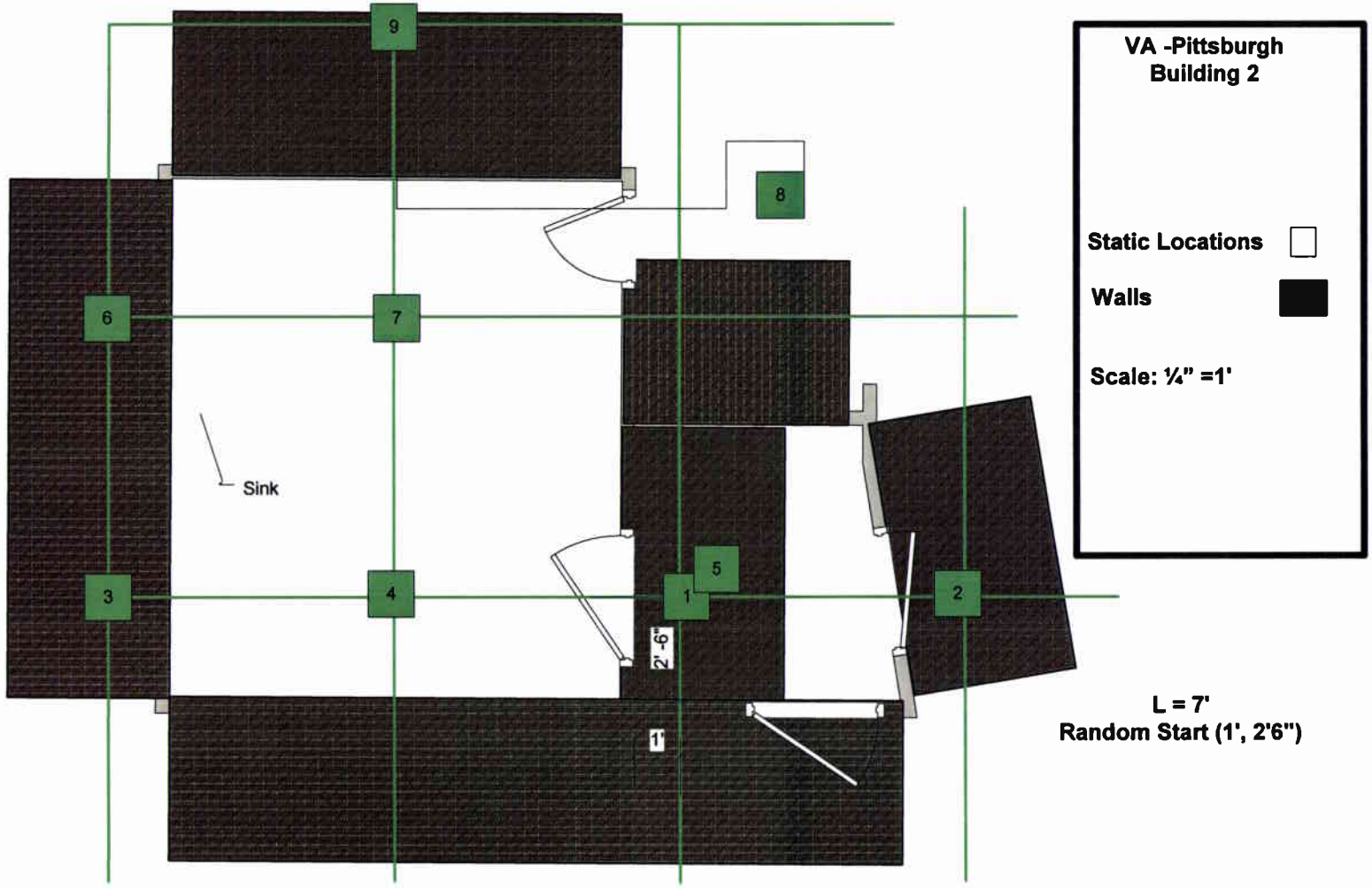
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

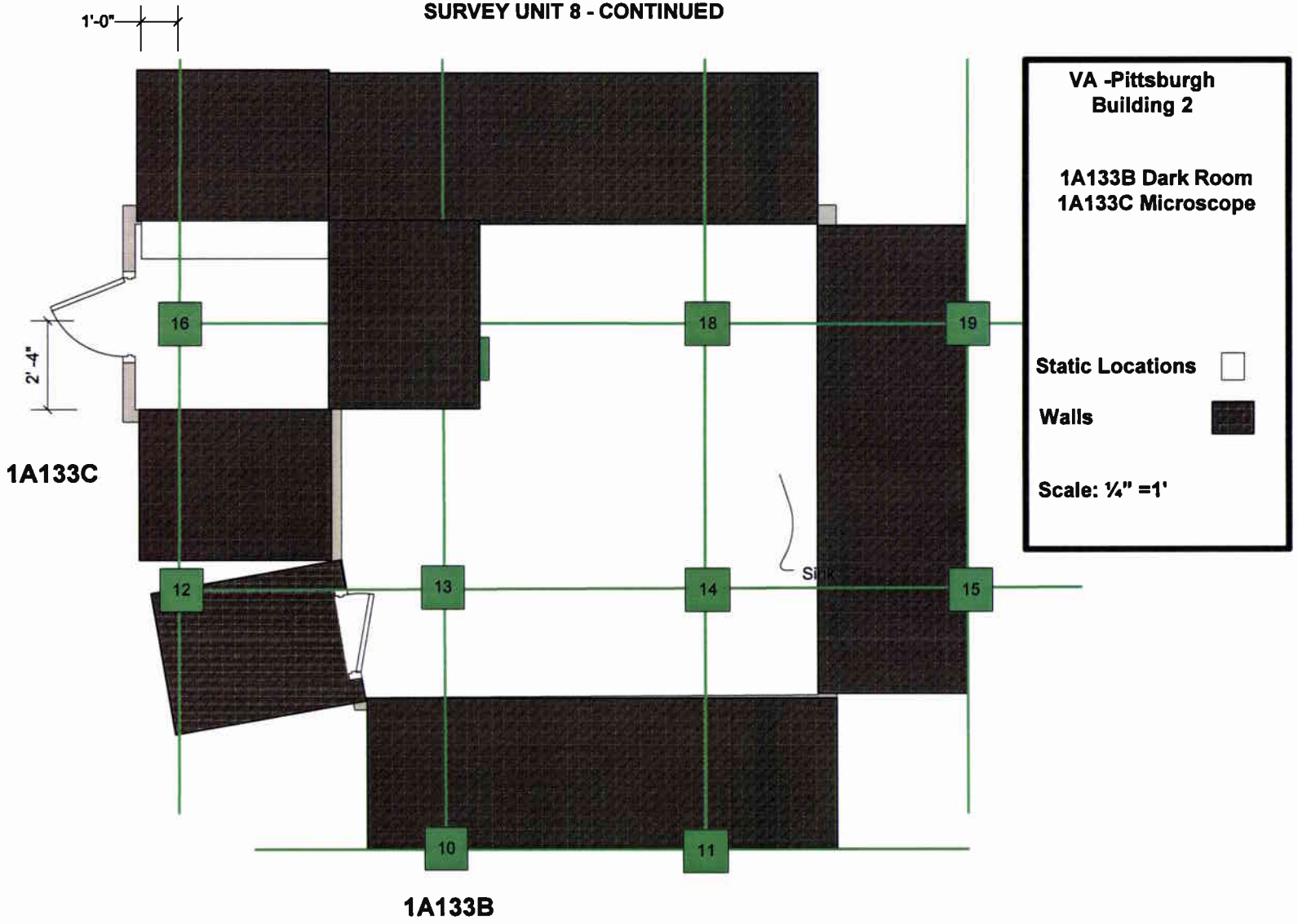
**SURVEY UNIT 8**



**SURVEY UNIT 8 - CONTINUED**



## SURVEY UNIT 8 - CONTINUED



## *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 8
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 210 | -39 | 28 | -130 | 180 |
| 2 | 236 | -13 | 28 | -40 | 180 |
| 3 | 271 | 22 | 29 | 70 | 180 |
| 4 | 210 | -39 | 28 | -130 | 180 |
| 5 | 232 | -17 | 28 | -60 | 180 |
| 6 | 266 | 17 | 29 | 60 | 180 |
| 7 | 209 | -40 | 28 | -130 | 180 |
| 8 | 269 | 20 | 29 | 60 | 180 |
| 9 | 226 | -23 | 28 | -70 | 180 |
| 10 | 210 | -39 | 28 | -130 | 180 |
| 11 | 205 | -44 | 28 | -140 | 180 |
| 12 | 215 | -34 | 28 | -110 | 180 |
| 13 | 306 | 57 | 29 | 180 | 190 |
| 14 | 219 | -30 | 28 | -100 | 180 |
| 15 | 228 | -21 | 28 | -70 | 180 |
| 16 | 269 | 20 | 29 | 60 | 180 |
| 17 | 211 | -38 | 28 | -120 | 180 |
| 18 | 240 | -9 | 28 | -30 | 180 |
| 19 | 183 | -66 | 27 | -210 | 180 |
| 20 | 199 | -50 | 27 | -160 | 180 |
| | | | **Maximum:** | 180 | |
| | | | **Average:** | -60 | |
| | | | **STDEV:** | 99 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

# *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 8
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 162 | -87 | 27 | -280 | 180 |
| 2 | 185 | -64 | 27 | -210 | 180 |
| 3 | 181 | -68 | 27 | -220 | 180 |
| 4 | 181 | -68 | 27 | -220 | 180 |
| 5 | 188 | -61 | 27 | -200 | 180 |
| 6 | 199 | -50 | 27 | -160 | 180 |
| 7 | 163 | -86 | 27 | -280 | 180 |
| 8 | 212 | -37 | 28 | -120 | 180 |
| 9 | 217 | -32 | 28 | -100 | 180 |
| 10 | 234 | -15 | 28 | -50 | 180 |

**Maximum:** -50
**Average:** -184
**STDEV:** 76

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 8
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 142 | -37 | 17 | -390 | 350 |
| 2 | 159 | -20 | 18 | -210 | 360 |
| 3 | 222 | 43 | 19 | 450 | 400 |
| 4 | 197 | 18 | 19 | 190 | 380 |
| 5 | 175 | -4 | 18 | -40 | 370 |
| 6 | 231 | 52 | 20 | 540 | 400 |
| 7 | 210 | 31 | 19 | 320 | 390 |
| 8 | 197 | 18 | 19 | 190 | 380 |
| 9 | 200 | 21 | 19 | 220 | 390 |
| 10 | 169 | -10 | 18 | -100 | 370 |
| 11 | 175 | -4 | 18 | -40 | 370 |
| 12 | 149 | -30 | 17 | -310 | 360 |
| 13 | 190 | 11 | 19 | 110 | 380 |
| 14 | 225 | 46 | 19 | 480 | 400 |
| 15 | 172 | -7 | 18 | -70 | 370 |
| 16 | 201 | 22 | 19 | 230 | 390 |
| 17 | 173 | -6 | 18 | -60 | 370 |
| 18 | 203 | 24 | 19 | 250 | 390 |
| 19 | 196 | 17 | 19 | 180 | 380 |
| 20 | 202 | 23 | 19 | 240 | 390 |
| | | | **Maximum:** | 540 | |
| | | | **Average:** | 109 | |
| | | | **STDEV:** | 256 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

# *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 8
**Survey Date:** 4/21/2010

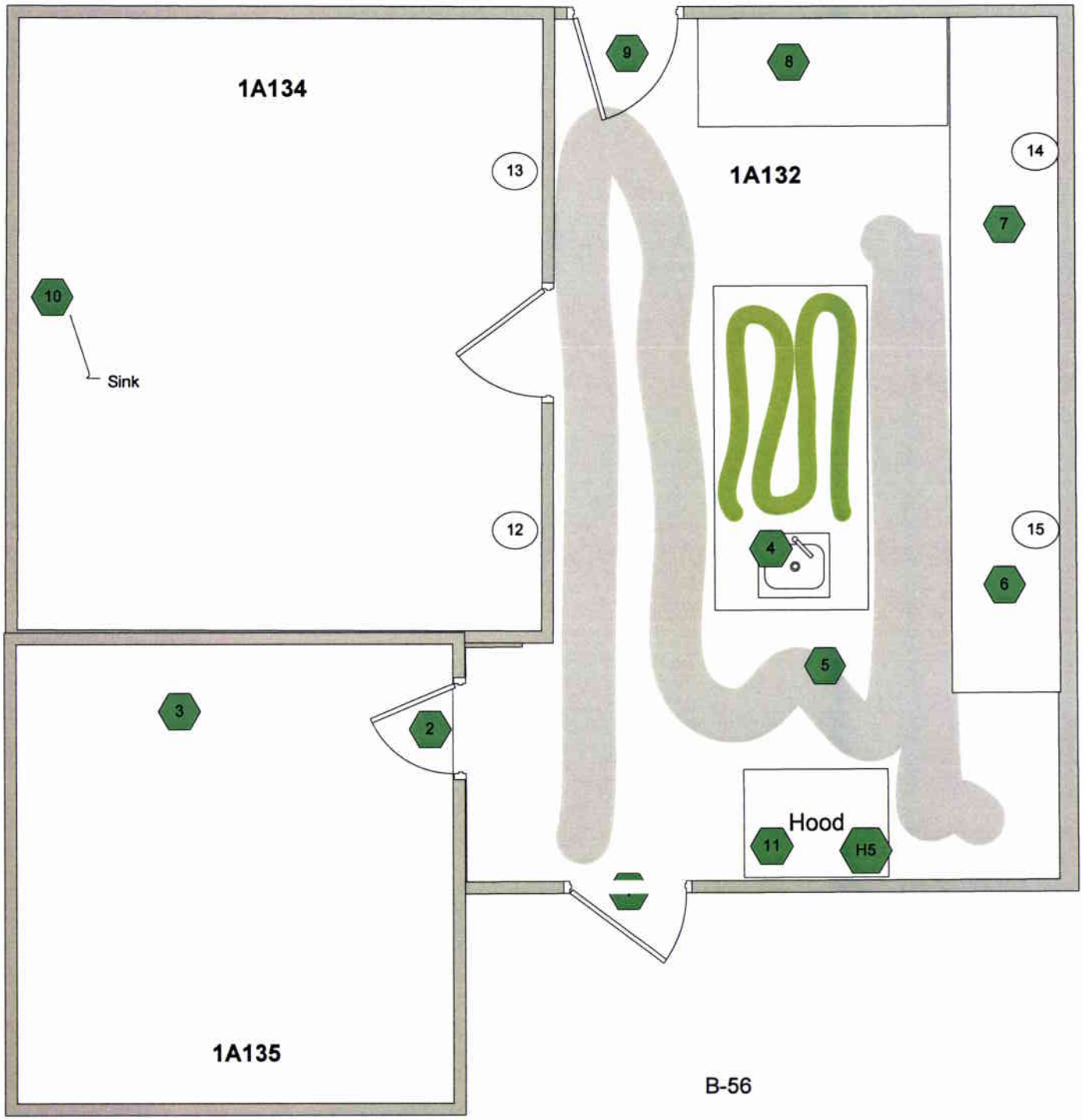
| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 189 | 10 | 19 | 100 | 380 |
| 2 | 179 | 0 | 18 | 0 | 370 |
| 3 | 158 | -21 | 18 | -220 | 360 |
| 4 | 233 | 54 | 20 | 560 | 400 |
| 5 | 192 | 13 | 19 | 140 | 380 |
| 6 | 182 | 3 | 18 | 30 | 380 |
| 7 | 173 | -6 | 18 | -60 | 370 |
| 8 | 200 | 21 | 19 | 220 | 390 |
| 9 | 187 | 8 | 18 | 80 | 380 |
| 10 | 200 | 21 | 19 | 220 | 390 |

**Maximum:** 560
**Average:** 107
**STDEV:** 207

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$




**SURVEY UNIT 9**

**VA -Pittsburgh**
**Building 2**
**1A132 Tissue Preparation Room**
**1A134 Cut Room**

**Biased Static Locations with smears**

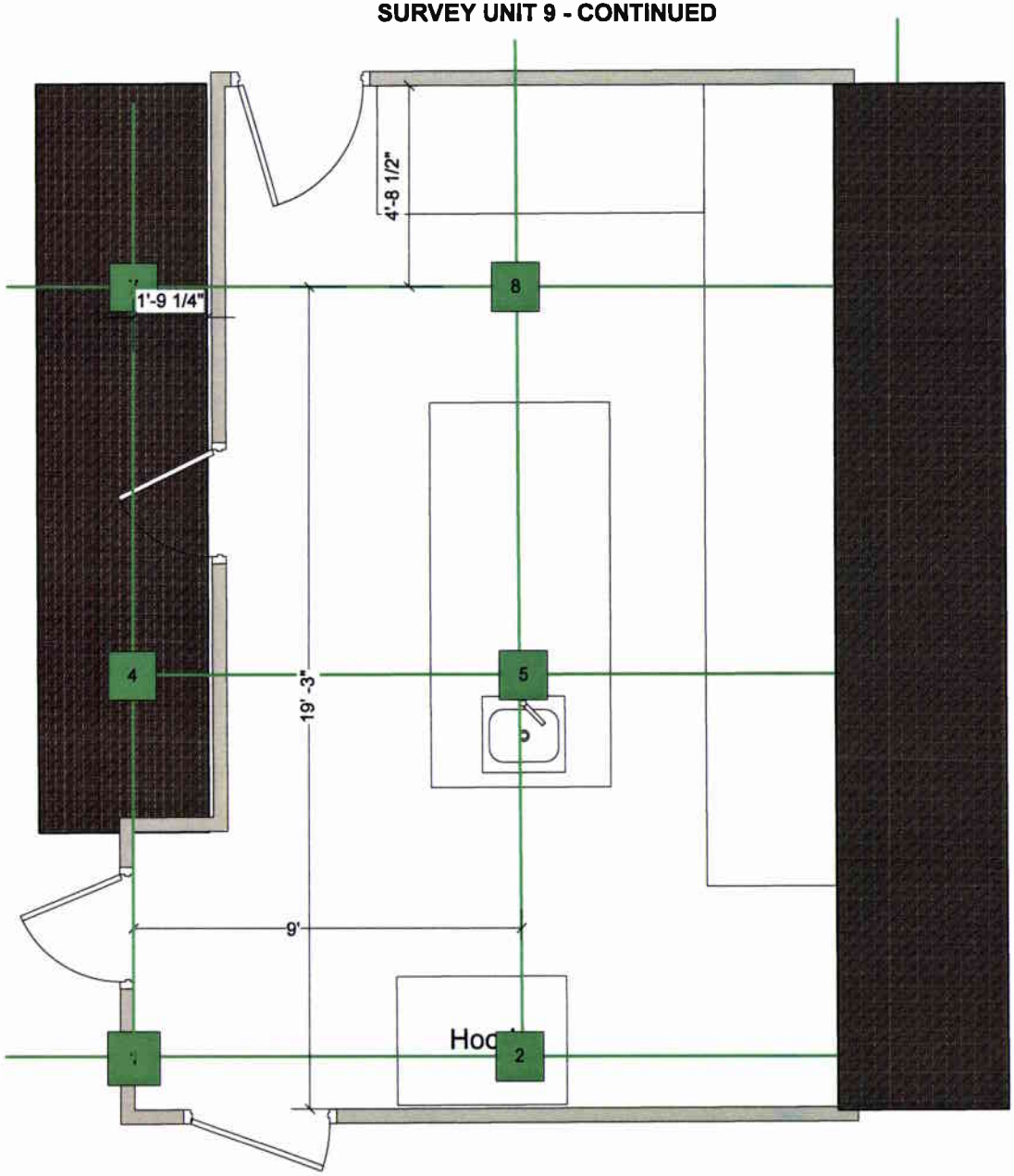
**Non-biased smears**

**C14 Scan path**

**H3 Scan path**

**Scale: ¼" =1'**

## SURVEY UNIT 9 - CONTINUED




**VA -Pittsburgh**
**Building 2**

**1A132 Tissue Preparation Room**

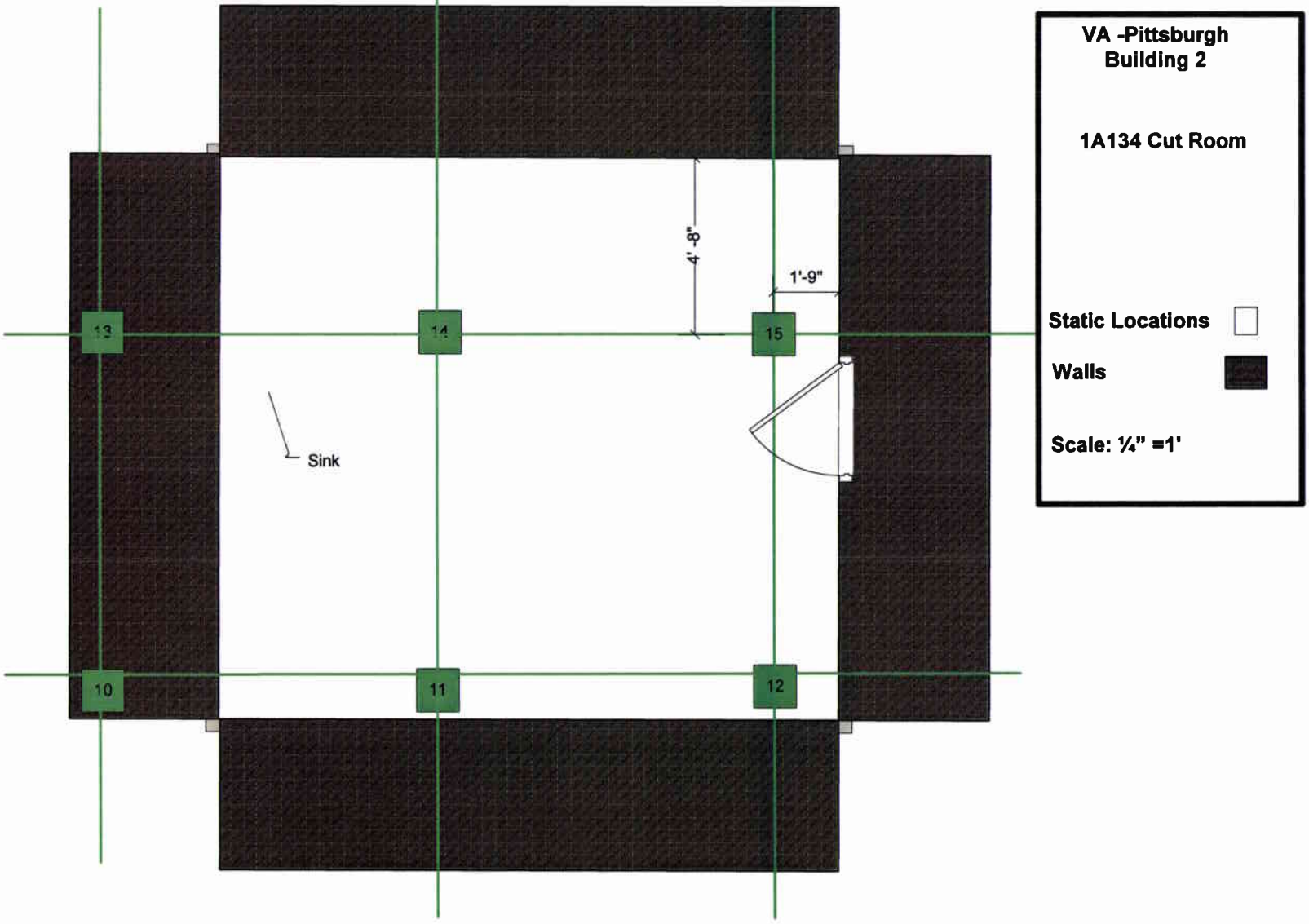
**Static Locations**

**Walls**

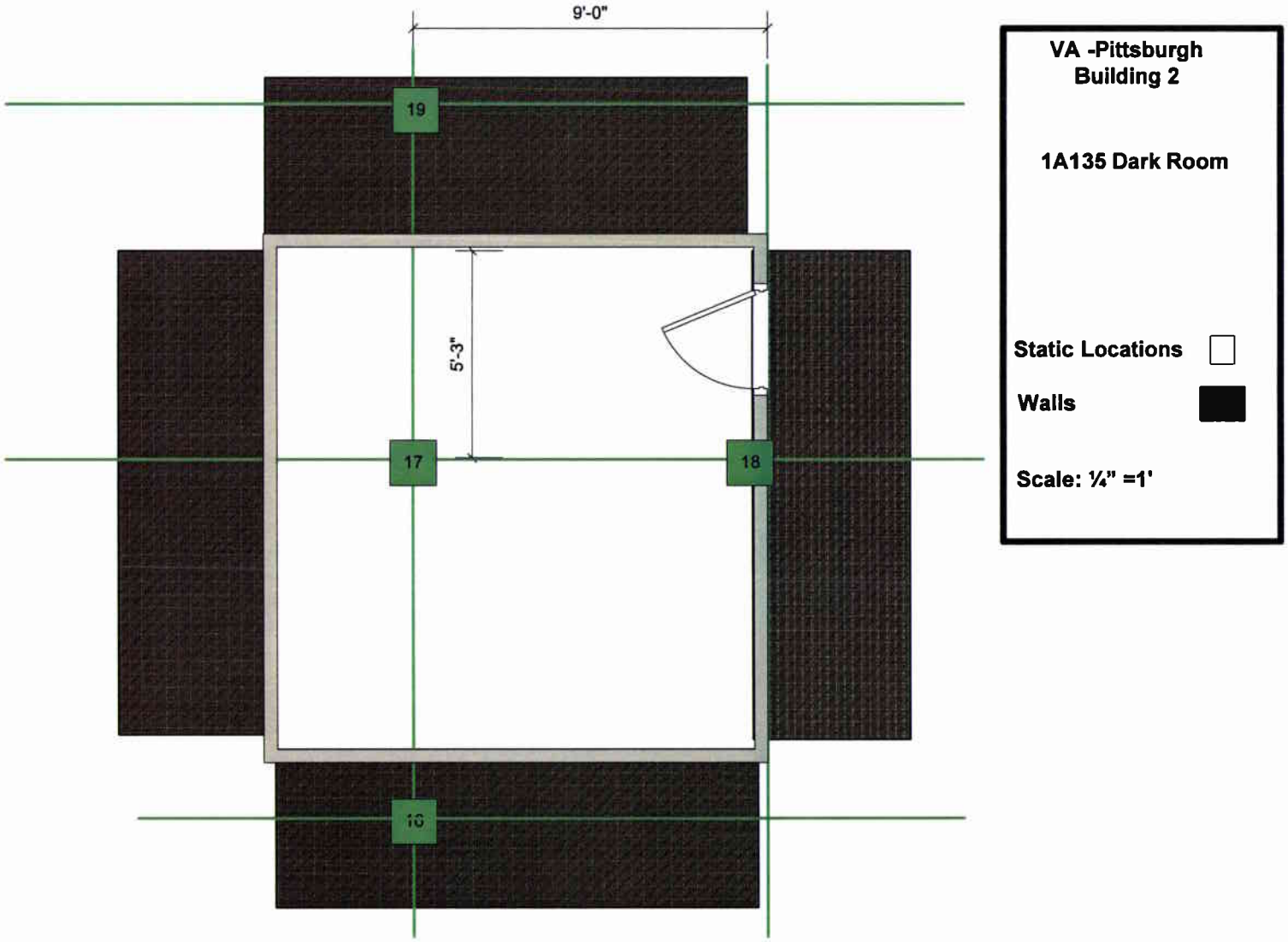
**Scale: ¼" =1'**

**L = 9'**
**Random Start (15', 19' 3")**

## SURVEY UNIT 9 - CONTINUED



**SURVEY UNIT 9 - CONTINUED**



## *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 9
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 243 | -6 | 28 | -20 | 180 |
| 2 | 187 | -62 | 27 | -200 | 180 |
| 3 | 283 | 34 | 29 | 110 | 180 |
| 4 | 212 | -37 | 28 | -120 | 180 |
| 5 | 216 | -33 | 28 | -110 | 180 |
| 6 | 209 | -40 | 28 | -130 | 180 |
| 7 | 221 | -28 | 28 | -90 | 180 |
| 8 | 229 | -20 | 28 | -60 | 180 |
| 9 | 128 | -121 | 26 | -390 | 180 |
| 10 | 265 | 16 | 29 | 50 | 180 |
| 11 | 223 | -26 | 28 | -80 | 180 |
| 12 | 197 | -52 | 27 | -170 | 180 |
| 13 | 255 | 6 | 28 | 20 | 180 |
| 14 | 197 | -52 | 27 | -170 | 180 |
| 15 | 245 | -4 | 28 | -10 | 180 |
| 16 | 205 | -44 | 28 | -140 | 180 |
| 17 | 244 | -5 | 28 | -20 | 180 |
| 18 | 222 | -27 | 28 | -90 | 180 |
| 19 | 256 | 7 | 29 | 20 | 180 |
| | | | **Maximum:** | 110 | |
| | | | **Average:** | -84 | |
| | | | **STDEV:** | 111 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

# *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 9
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 223 | -26 | 28 | -80 | 180 |
| 2 | 195 | -54 | 27 | -170 | 180 |
| 3 | 229 | -20 | 28 | -60 | 180 |
| 4 | 173 | -76 | 27 | -250 | 180 |
| 5 | 177 | -72 | 27 | -230 | 180 |
| 6 | 240 | -9 | 28 | -30 | 180 |
| 7 | 193 | -56 | 27 | -180 | 180 |
| 8 | 181 | -68 | 27 | -220 | 180 |
| 9 | 188 | -61 | 27 | -200 | 180 |
| 10 | 198 | -51 | 27 | -170 | 180 |
| 11 | 198 | -51 | 27 | -170 | 180 |

**Maximum:** -30
**Average:** -160
**STDEV:** 72

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 9
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 181 | 2 | 18 | 20 | 370 |
| 2 | 192 | 13 | 19 | 140 | 380 |
| 3 | 201 | 22 | 19 | 230 | 390 |
| 4 | 186 | 7 | 18 | 70 | 380 |
| 5 | 169 | -10 | 18 | -100 | 370 |
| 6 | 164 | -15 | 18 | -160 | 360 |
| 7 | 159 | -20 | 18 | -210 | 360 |
| 8 | 190 | 11 | 19 | 110 | 380 |
| 9 | 174 | -5 | 18 | -50 | 370 |
| 10 | 235 | 56 | 20 | 580 | 400 |
| 11 | 195 | 16 | 19 | 170 | 380 |
| 12 | 205 | 26 | 19 | 270 | 390 |
| 13 | 200 | 21 | 19 | 220 | 390 |
| 14 | 209 | 30 | 19 | 310 | 390 |
| 15 | 204 | 25 | 19 | 260 | 390 |
| 16 | 200 | 21 | 19 | 220 | 390 |
| 17 | 206 | 27 | 19 | 280 | 390 |
| 18 | 191 | 12 | 19 | 130 | 380 |
| 19 | 198 | 19 | 19 | 200 | 380 |
| | | | **Maximum:** | 580 | |
| | | | **Average:** | 142 | |
| | | | **STDEV:** | 186 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm² | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

# *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 9
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 207 | 28 | 19 | 290 | 390 |
| 2 | 136 | -43 | 17 | -450 | 350 |
| 3 | 175 | -4 | 18 | -40 | 370 |
| 4 | 207 | 28 | 19 | 290 | 390 |
| 5 | 200 | 21 | 19 | 220 | 390 |
| 6 | 201 | 22 | 19 | 230 | 390 |
| 7 | 197 | 18 | 19 | 190 | 380 |
| 8 | 176 | -3 | 18 | -30 | 370 |
| 9 | 190 | 11 | 19 | 110 | 380 |
| 10 | 186 | 7 | 18 | 70 | 380 |
| 11 | 162 | -17 | 18 | -180 | 360 |

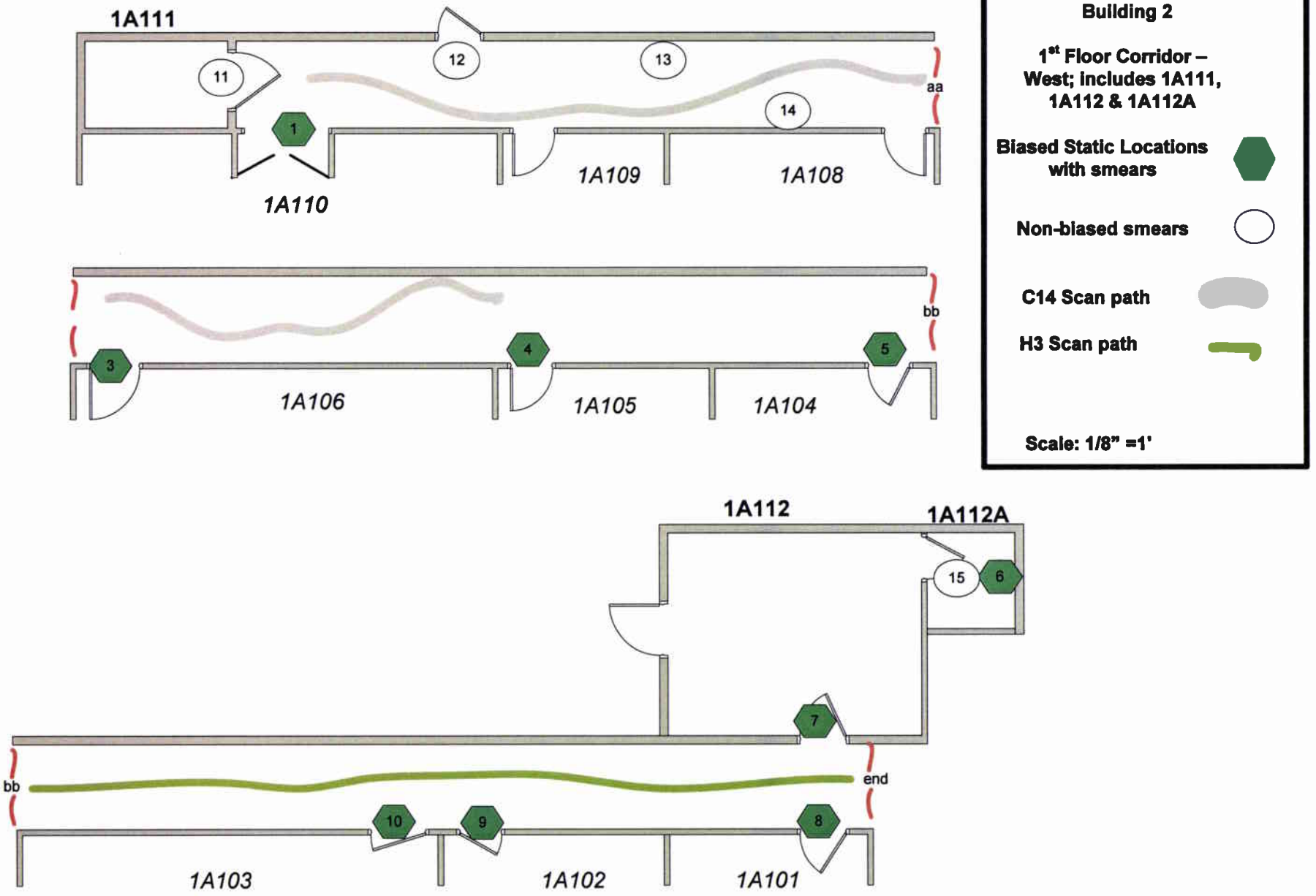
**Maximum:** 290
**Average:** 64
**STDEV:** 227

## *Instrument Data and Analysis Parameters*

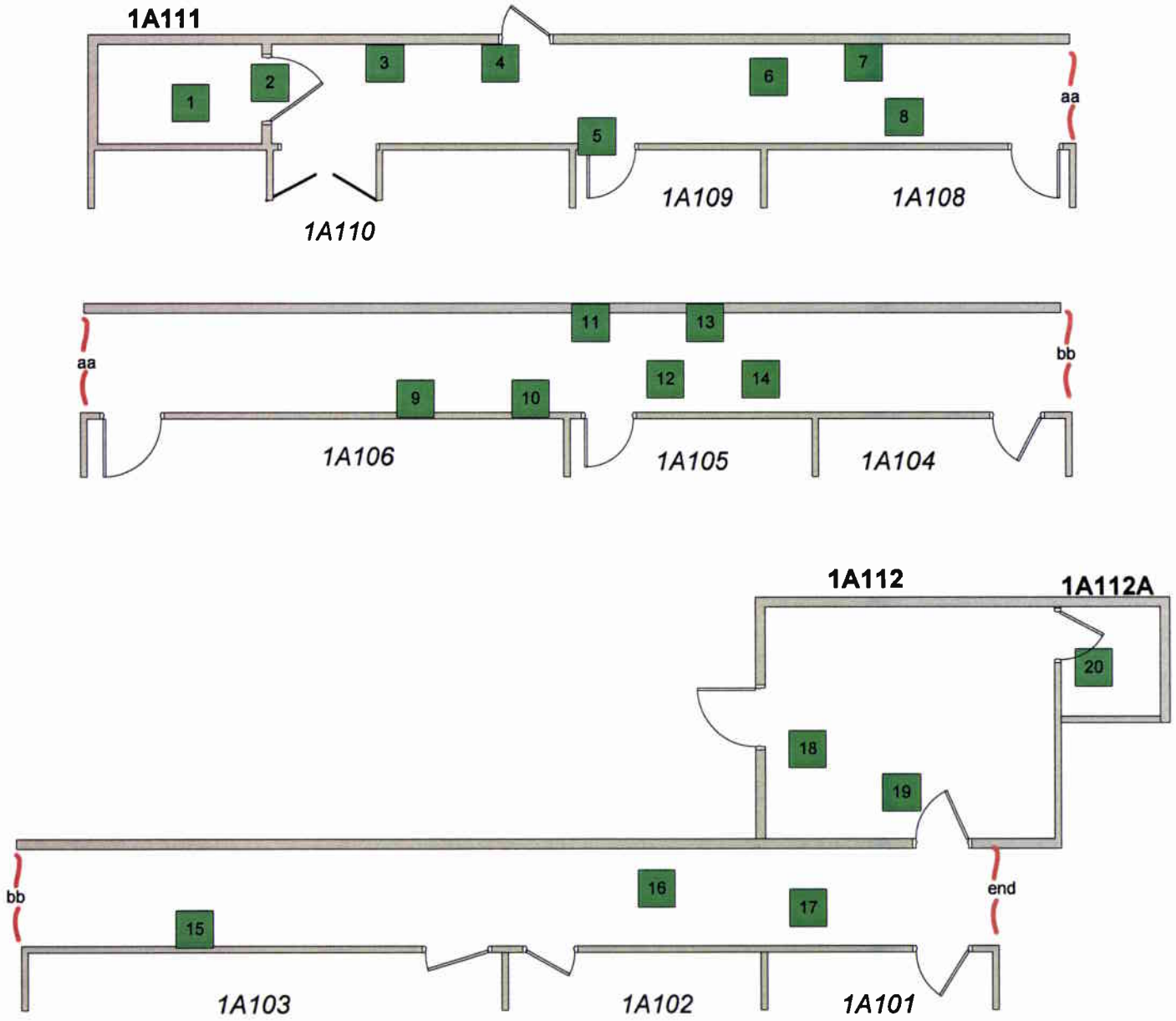
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm² | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

**SURVEY UNIT 10**



## SURVEY UNIT 10 - CONTINUED




**VA -Pittsburgh Building 2**

**1st Floor Corridor – West; includes 1A111, 1A112 & 1A112A**

**Static Locations** ☐

**Scale: 1/8" =1'**

Random Locations (ft)

| N | X | Y |
|---|---|---|
| 1 | 3 | 2 |
| 2 | 2 | 8 |
| 3 | 1 | 15 |
| 4 | 2 | 22 |
| 5 | 4 | 26 |
| 6 | 2 | 35 |
| 7 | 1 | 40 |
| 8 | 4 | 42 |
| 9 | 4 | 67 |
| 10 | 4 | 74 |
| 11 | 0 | 77 |
| 12 | 3 | 81 |
| 13 | 0 | 83 |
| 14 | 3 | 86 |
| 15 | 4 | 108 |
| 16 | 2 | 133 |
| 17 | 3 | 142 |
| Room 112 | | |
| 18 | 2 | 5 |
| 19 | 7 | 3 |
| Room 112A | | |
| 20 | 1 | 3 |

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 10
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 207 | -42 | 28 | -140 | 180 |
| 2 | 233 | -16 | 28 | -50 | 180 |
| 3 | 195 | -54 | 27 | -170 | 180 |
| 4 | 187 | -62 | 27 | -200 | 180 |
| 5 | 189 | -60 | 27 | -190 | 180 |
| 6 | 216 | -33 | 28 | -110 | 180 |
| 7 | 209 | -40 | 28 | -130 | 180 |
| 8 | 229 | -20 | 28 | -60 | 180 |
| 9 | 175 | -74 | 27 | -240 | 180 |
| 10 | 232 | -17 | 28 | -60 | 180 |
| 11 | 209 | -40 | 28 | -130 | 180 |
| 12 | 262 | 13 | 29 | 40 | 180 |
| 13 | 188 | -61 | 27 | -200 | 180 |
| 14 | 189 | -60 | 27 | -190 | 180 |
| 15 | 260 | 11 | 29 | 40 | 180 |
| 16 | 181 | -68 | 27 | -220 | 180 |
| 17 | 277 | 28 | 29 | 90 | 180 |
| 18 | 236 | -13 | 28 | -40 | 180 |
| 19 | 245 | -4 | 28 | -10 | 180 |
| 20 | 276 | 27 | 29 | 90 | 180 |
| | | | **Maximum:** | 90 | |
| | | | **Average:** | -94 | |
| | | | **STDEV:** | 104 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

| | | |
|---|---|---|
| Total Efficiency: | 0.245 | cpm/dpm |
| Total Efficiency Uncertainty: | 0.020 | cpm/dpm |
| MDC: | 223 | dpm/100 cm$^2$ |

## *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 10
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 288 | 39 | 29 | 130 | 190 |
| 2 | 215 | -34 | 28 | -110 | 180 |
| 3 | 230 | -19 | 28 | -60 | 180 |
| 4 | 204 | -45 | 28 | -150 | 180 |
| 5 | 222 | -27 | 28 | -90 | 180 |
| 6 | 188 | -61 | 27 | -200 | 180 |
| 7 | 169 | -80 | 27 | -260 | 180 |
| 8 | 209 | -40 | 28 | -130 | 180 |
| 9 | 255 | 6 | 28 | 20 | 180 |
| 10 | 289 | 40 | 29 | 130 | 190 |

**Maximum:** 130
**Average:** -72
**STDEV:** 130

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 10
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 223 | 44 | 19 | 460 | 400 |
| 2 | 197 | 18 | 19 | 190 | 380 |
| 3 | 229 | 50 | 20 | 520 | 400 |
| 4 | 228 | 49 | 20 | 510 | 400 |
| 5 | 215 | 36 | 19 | 380 | 390 |
| 6 | 229 | 50 | 20 | 520 | 400 |
| 7 | 215 | 36 | 19 | 380 | 390 |
| 8 | 244 | 65 | 20 | 680 | 410 |
| 9 | 209 | 30 | 19 | 310 | 390 |
| 10 | 216 | 37 | 19 | 390 | 390 |
| 11 | 211 | 32 | 19 | 330 | 390 |
| 12 | 215 | 36 | 19 | 380 | 390 |
| 13 | 231 | 52 | 20 | 540 | 400 |
| 14 | 215 | 36 | 19 | 380 | 390 |
| 15 | 237 | 58 | 20 | 610 | 410 |
| 16 | 224 | 45 | 19 | 470 | 400 |
| 17 | 237 | 58 | 20 | 610 | 410 |
| 18 | 228 | 49 | 20 | 510 | 400 |
| 19 | 233 | 54 | 20 | 560 | 400 |
| 20 | 230 | 51 | 20 | 530 | 400 |
| | | | **Maximum:** | 680 | |
| | | | **Average:** | 463 | |
| | | | **STDEV:** | 119 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

| | | |
|---|---|---|
| Total Efficiency: | 0.076 | cpm/dpm |
| Total Efficiency Uncertainty: | 0.002 | cpm/dpm |
| MDC: | 524 | dpm/100 $cm^2$ |

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 10
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 215 | 36 | 19 | 380 | 390 |
| 2 | 209 | 30 | 19 | 310 | 390 |
| 3 | 215 | 36 | 19 | 380 | 390 |
| 4 | 229 | 50 | 20 | 520 | 400 |
| 5 | 228 | 49 | 20 | 510 | 400 |
| 6 | 227 | 48 | 20 | 500 | 400 |
| 7 | 217 | 38 | 19 | 400 | 390 |
| 8 | 194 | 15 | 19 | 160 | 380 |
| 9 | 247 | 68 | 20 | 710 | 410 |
| 10 | 235 | 56 | 20 | 580 | 400 |

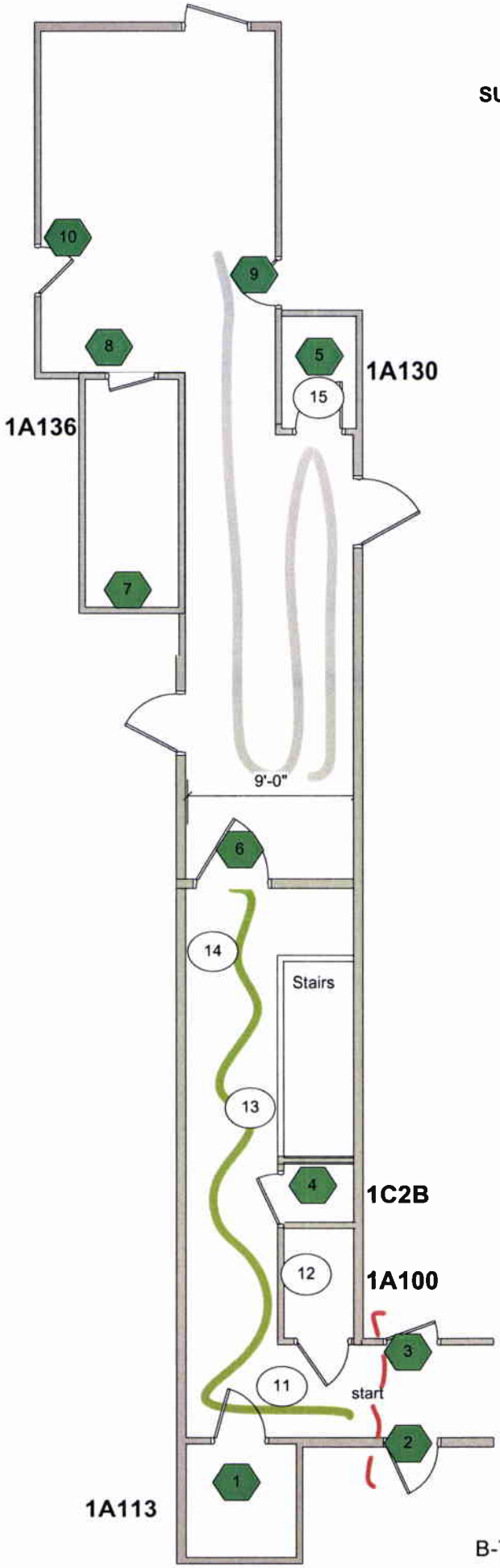
**Maximum:** 710
**Average:** 445
**STDEV:** 153

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 11**




**VA -Pittsburgh**
**Building 2**
**1st Floor Corridor – East; Includes 1A113, 1A100, 1A136, 1A130, 1C2B**

**Biased Static Locations with smears**

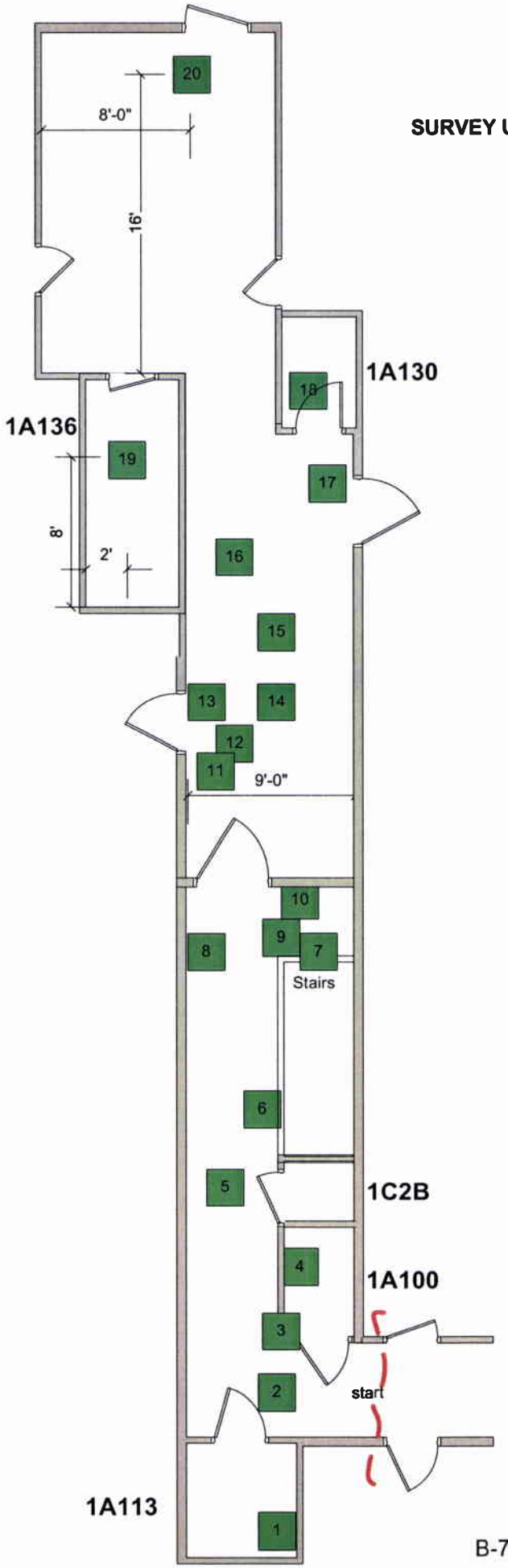
**Non-biased smears**

**C14 Scan path**

**H3 Scan path**

**Scale: 1/8" =1'**

## SURVEY UNIT 11- CONTINUED




**VA -Pittsburgh**
**Building 2**

**1st Floor Corridor – East; Includes 1A113, 1A100, 1A136, 1A130, 1C2B**

**Static Locations** ☐

**Scale: 1/8" =1'**

Random Locations (ft)

| N | X | Y |
|---|---|---|
| 1 | 4 | 1 |
| 2 | 4 | 9 |
| 3 | 4 | 12 |
| 4 | 5 | 16 |
| 5 | 3 | 20 |
| 6 | 4 | 24 |
| 7 | 8 | 32 |
| 8 | 0 | 32 |
| 9 | 5 | 33 |
| 10 | 6 | 35 |
| 11 | 1 | 43 |
| 12 | 2 | 44 |
| 13 | 1 | 46 |
| 14 | 5 | 46 |
| 15 | 5 | 50 |
| 16 | 2 | 54 |
| 17 | 8 | 59 |
| 18 | 6 | 63 |
| 19 | 2 | 8 |
| 20 | 8 | 16 |

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 11
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 281 | 32 | 29 | 100 | 180 |
| 2 | 288 | 39 | 29 | 130 | 190 |
| 3 | 273 | 24 | 29 | 80 | 180 |
| 4 | 301 | 52 | 29 | 170 | 190 |
| 5 | 211 | -38 | 28 | -120 | 180 |
| 6 | 234 | -15 | 28 | -50 | 180 |
| 7 | 279 | 30 | 29 | 100 | 180 |
| 8 | 222 | -27 | 28 | -90 | 180 |
| 9 | 226 | -23 | 28 | -70 | 180 |
| 10 | 236 | -13 | 28 | -40 | 180 |
| 11 | 223 | -26 | 28 | -80 | 180 |
| 12 | 237 | -12 | 28 | -40 | 180 |
| 13 | 266 | 17 | 29 | 60 | 180 |
| 14 | 278 | 29 | 29 | 90 | 180 |
| 15 | 249 | 0 | 28 | 0 | 180 |
| 16 | 257 | 8 | 29 | 30 | 180 |
| 17 | 235 | -14 | 28 | -50 | 180 |
| 18 | 226 | -23 | 28 | -70 | 180 |
| 19 | 235 | -14 | 28 | -50 | 180 |
| 20 | 217 | -32 | 28 | -100 | 180 |
| | | | **Maximum:** | 170 | |
| | | | **Average:** | 0 | |
| | | | **STDEV:** | 87 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

# *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 11
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 202 | -47 | 28 | -150 | 180 |
| 2 | 228 | -21 | 28 | -70 | 180 |
| 3 | 234 | -15 | 28 | -50 | 180 |
| 4 | 220 | -29 | 28 | -90 | 180 |
| 5 | 261 | 12 | 29 | 40 | 180 |
| 6 | 215 | -34 | 28 | -110 | 180 |
| 7 | 221 | -28 | 28 | -90 | 180 |
| 8 | 256 | 7 | 29 | 20 | 180 |
| 9 | 259 | 10 | 29 | 30 | 180 |
| 10 | 298 | 49 | 29 | 160 | 190 |

**Maximum:** 160
**Average:** -31
**STDEV:** 93

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 11
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 228 | 49 | 20 | 510 | 400 |
| 2 | 239 | 60 | 20 | 630 | 410 |
| 3 | 211 | 32 | 19 | 330 | 390 |
| 4 | 241 | 62 | 20 | 650 | 410 |
| 5 | 221 | 42 | 19 | 440 | 400 |
| 6 | 188 | 9 | 18 | 90 | 380 |
| 7 | 268 | 89 | 21 | 930 | 420 |
| 8 | 199 | 20 | 19 | 210 | 380 |
| 9 | 197 | 18 | 19 | 190 | 380 |
| 10 | 251 | 72 | 20 | 750 | 410 |
| 11 | 206 | 27 | 19 | 280 | 390 |
| 12 | 218 | 39 | 19 | 410 | 400 |
| 13 | 190 | 11 | 19 | 110 | 380 |
| 14 | 179 | 0 | 18 | 0 | 370 |
| 15 | 218 | 39 | 19 | 410 | 400 |
| 16 | 181 | 2 | 18 | 20 | 370 |
| 17 | 199 | 20 | 19 | 210 | 380 |
| 18 | 213 | 34 | 19 | 360 | 390 |
| 19 | 198 | 19 | 19 | 200 | 380 |
| 20 | 208 | 29 | 19 | 300 | 390 |
| | | | **Maximum:** | 930 | |
| | | | **Average:** | 352 | |
| | | | **STDEV:** | 247 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 11
**Survey Date:** 4/21/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 201 | 22 | 19 | 230 | 390 |
| 2 | 185 | 6 | 18 | 60 | 380 |
| 3 | 199 | 20 | 19 | 210 | 380 |
| 4 | 210 | 31 | 19 | 320 | 390 |
| 5 | 161 | -18 | 18 | -190 | 360 |
| 6 | 177 | -2 | 18 | -20 | 370 |
| 7 | 204 | 25 | 19 | 260 | 390 |
| 8 | 199 | 20 | 19 | 210 | 380 |
| 9 | 182 | 3 | 18 | 30 | 380 |
| 10 | 187 | 8 | 18 | 80 | 380 |

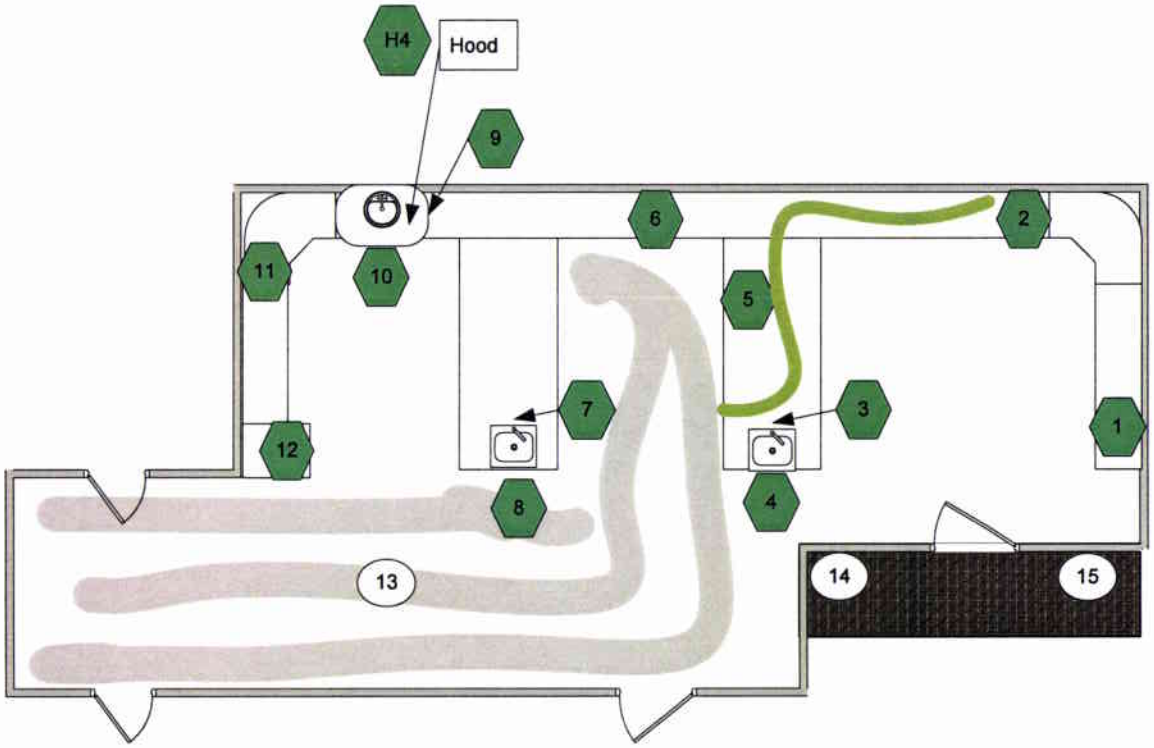
**Maximum:** 320
**Average:** 119
**STDEV:** 155

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 12**




**VA -Pittsburgh**
**Building 2**

**2A112 Laboratory**

**Biased Static Locations with smears**

**Non-biased smears**

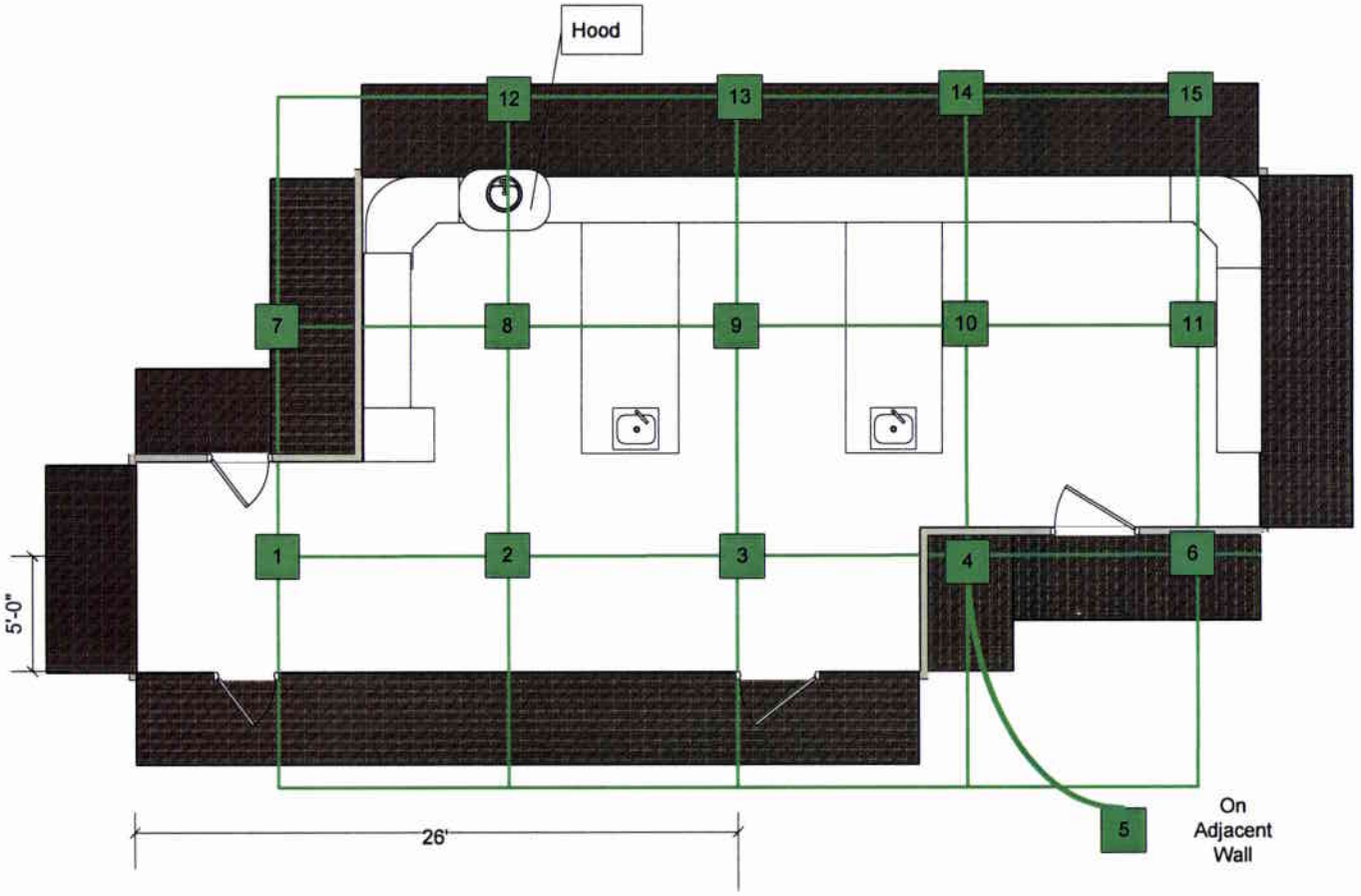
**C14 Scan path**

**H3 Scan path**

**Walls**

**Scale: 1/8" =1'**

## SURVEY UNIT 12 - CONTINUED




L = 10'
Random Start: (26', 5')

VA -Pittsburgh
Building 2

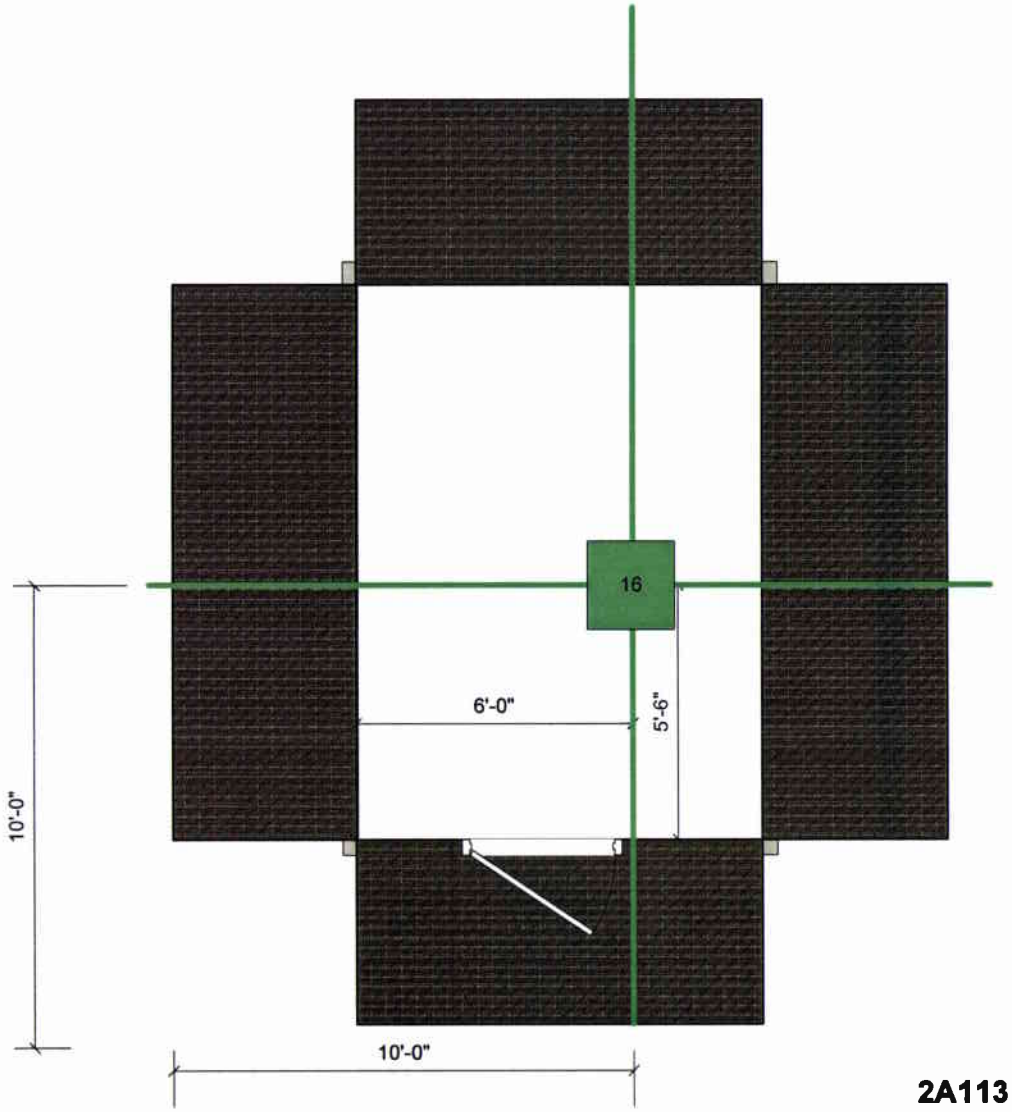
2A112 Laboratory

Static Locations

Walls

Scale: 1/8" =1'

## SURVEY UNIT 12 - CONTINUED




**2A113**

**L = 10'**

**VA -Pittsburgh**
**Building 2**

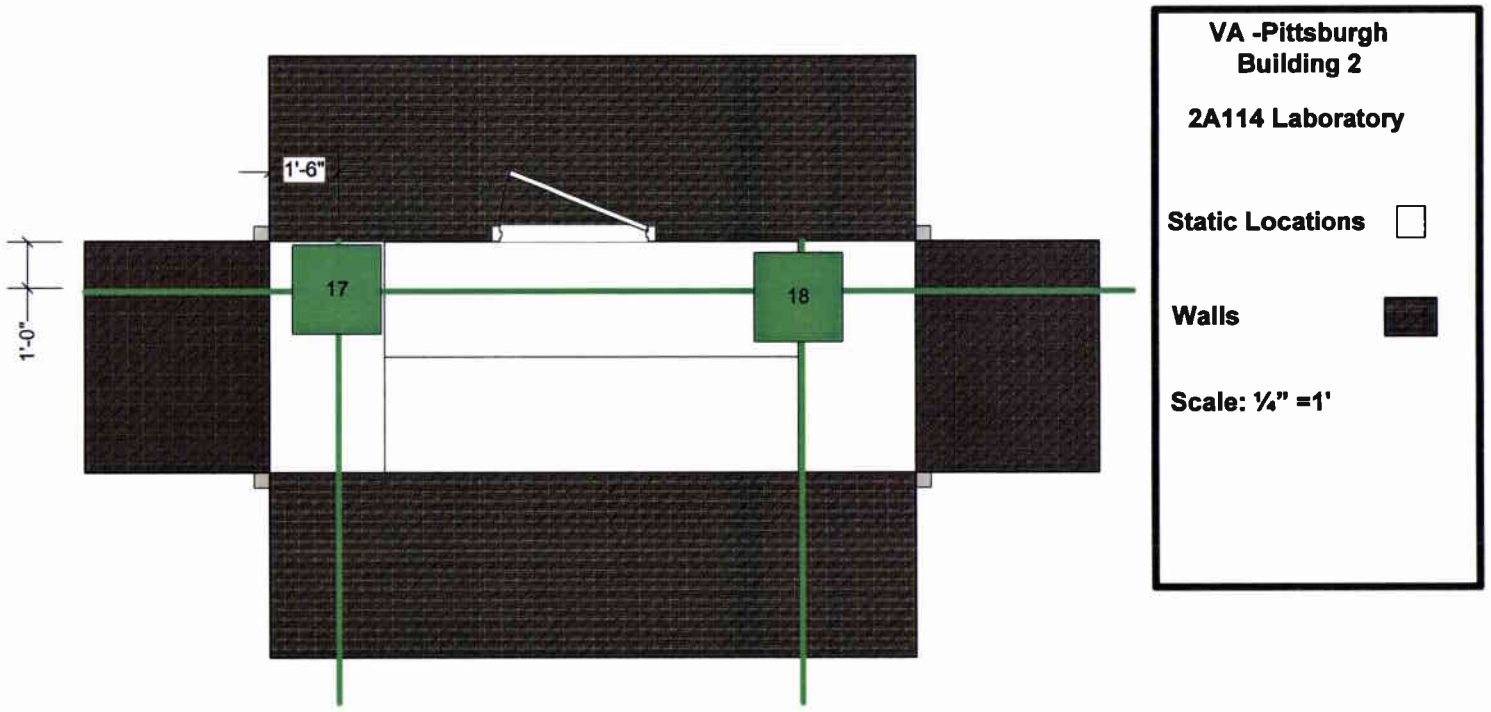
**2A113 Laboratory**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

## SURVEY UNIT 12 - CONTINUED




L = 10'

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 12
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 302 | 53 | 29 | 170 | 190 |
| 2 | 322 | 73 | 30 | 240 | 190 |
| 3 | 288 | 39 | 29 | 130 | 190 |
| 4 | 212 | -37 | 28 | -120 | 180 |
| 5 | 208 | -41 | 28 | -130 | 180 |
| 6 | 243 | -6 | 28 | -20 | 180 |
| 7 | 211 | -38 | 28 | -120 | 180 |
| 8 | 309 | 60 | 29 | 190 | 190 |
| 9 | 309 | 60 | 29 | 190 | 190 |
| 10 | 264 | 15 | 29 | 50 | 180 |
| 11 | 317 | 68 | 30 | 220 | 190 |
| 12 | 193 | -56 | 27 | -180 | 180 |
| 13 | 204 | -45 | 28 | -150 | 180 |
| 14 | 183 | -66 | 27 | -210 | 180 |
| 15 | 253 | 4 | 28 | 10 | 180 |
| 16 | 292 | 43 | 29 | 140 | 190 |
| 17 | 328 | 79 | 30 | 260 | 190 |
| 18 | 302 | 53 | 29 | 170 | 190 |

**Maximum:** 260
**Average:** 47
**STDEV:** 162

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm²

# *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 12
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 283 | 34 | 29 | 110 | 180 |
| 2 | 301 | 52 | 29 | 170 | 190 |
| 3 | 209 | -40 | 28 | -130 | 180 |
| 4 | 242 | -7 | 28 | -20 | 180 |
| 5 | 274 | 25 | 29 | 80 | 180 |
| 6 | 290 | 41 | 29 | 130 | 190 |
| 7 | 268 | 19 | 29 | 60 | 180 |
| 8 | 257 | 8 | 29 | 30 | 180 |
| 9 | 290 | 41 | 29 | 130 | 190 |
| 10 | 311 | 62 | 29 | 200 | 190 |
| 11 | 281 | 32 | 29 | 100 | 180 |
| 12 | 250 | 1 | 28 | 0 | 180 |

**Maximum:** 200
**Average:** 72
**STDEV:** 91

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 12
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 199 | 20 | 19 | 210 | 380 |
| 2 | 206 | 27 | 19 | 280 | 390 |
| 3 | 172 | -7 | 18 | -70 | 370 |
| 4 | 154 | -25 | 18 | -260 | 360 |
| 5 | 144 | -35 | 17 | -370 | 350 |
| 6 | 161 | -18 | 18 | -190 | 360 |
| 7 | 133 | -46 | 17 | -480 | 350 |
| 8 | 179 | 0 | 18 | 0 | 370 |
| 9 | 178 | -1 | 18 | -10 | 370 |
| 10 | 194 | 15 | 19 | 160 | 380 |
| 11 | 214 | 35 | 19 | 370 | 390 |
| 12 | 152 | -27 | 17 | -280 | 360 |
| 13 | 160 | -19 | 18 | -200 | 360 |
| 14 | 170 | -9 | 18 | -90 | 370 |
| 15 | 192 | 13 | 19 | 140 | 380 |
| 16 | 201 | 22 | 19 | 230 | 390 |
| 17 | 174 | -5 | 18 | -50 | 370 |
| 18 | 188 | 9 | 18 | 90 | 380 |

**Maximum:** 370
**Average:** -53
**STDEV:** 249

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm² | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm²

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 12
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 186 | 7 | 18 | 70 | 380 |
| 2 | 180 | 1 | 18 | 10 | 370 |
| 3 | 168 | -11 | 18 | -110 | 370 |
| 4 | 154 | -25 | 18 | -260 | 360 |
| 5 | 173 | -6 | 18 | -60 | 370 |
| 6 | 177 | -2 | 18 | -20 | 370 |
| 7 | 145 | -34 | 17 | -360 | 350 |
| 8 | 164 | -15 | 18 | -160 | 360 |
| 9 | 197 | 18 | 19 | 190 | 380 |
| 10 | 190 | 11 | 19 | 110 | 380 |
| 11 | 170 | -9 | 18 | -90 | 370 |
| 12 | 181 | 2 | 18 | 20 | 370 |

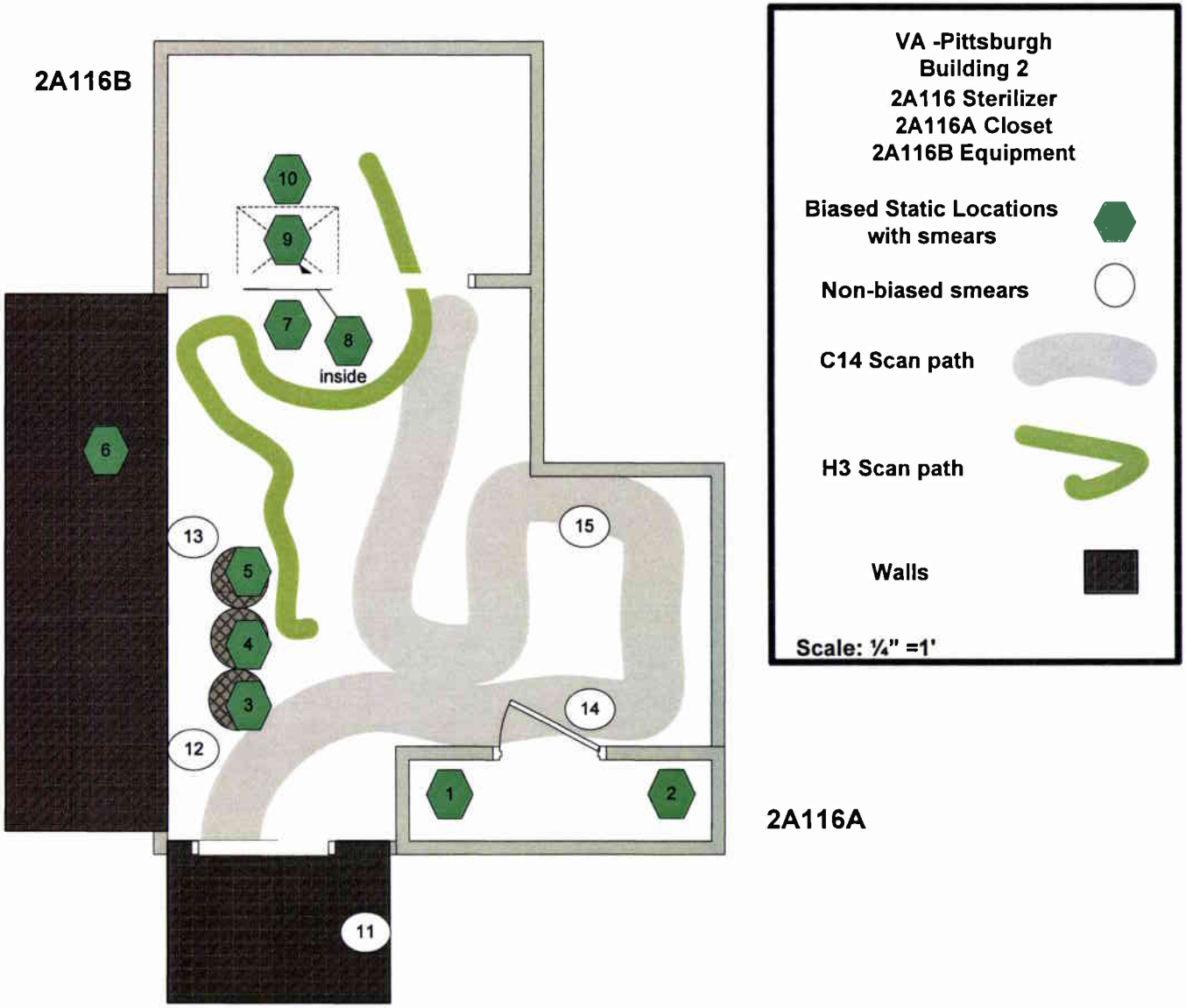
**Maximum:** 190
**Average:** -55
**STDEV:** 155

## *Instrument Data and Analysis Parameters*

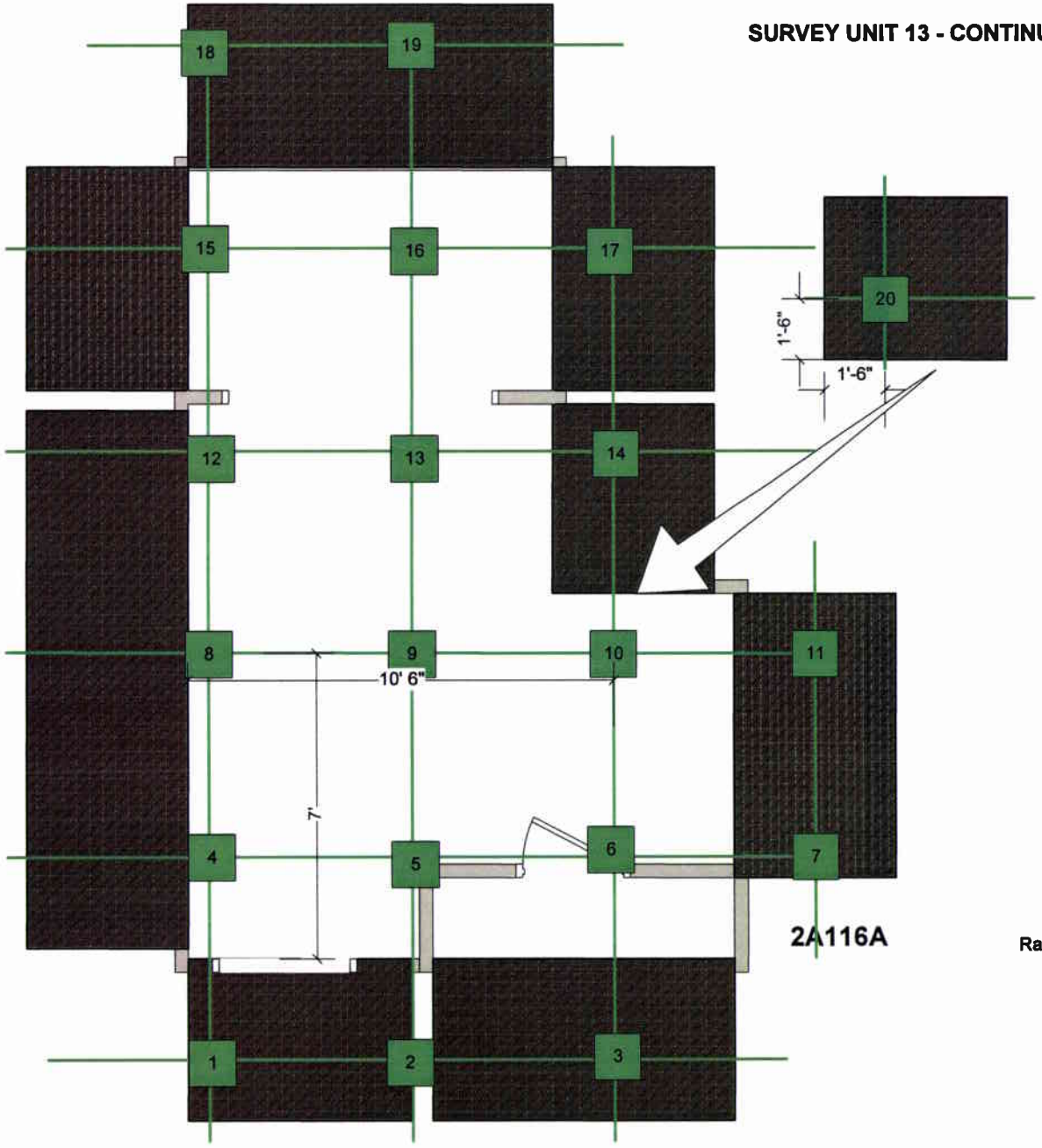
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

## SURVEY UNIT 13



**SURVEY UNIT 13 - CONTINUED**




**VA -Pittsburgh**
**Building 2**

**2A116 Sterilizer**
**2A116A Closet**
**2A116B Equipment**

**Static Locations** ☐

**Walls** ■

**Scale: ¼" =1'**

L = 5'
Random Start: (10'6", 7')

# *Summary of $^{3}$H Static Measurements*

**Survey Unit:** 13
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 220 | -29 | 28 | -90 | 180 |
| 2 | 263 | 14 | 29 | 50 | 180 |
| 3 | 284 | 35 | 29 | 110 | 190 |
| 4 | 234 | -15 | 28 | -50 | 180 |
| 5 | 284 | 35 | 29 | 110 | 190 |
| 6 | 257 | 8 | 29 | 30 | 180 |
| 7 | 251 | 2 | 28 | 10 | 180 |
| 8 | 310 | 61 | 29 | 200 | 190 |
| 9 | 269 | 20 | 29 | 60 | 180 |
| 10 | 286 | 37 | 29 | 120 | 190 |
| 11 | 273 | 24 | 29 | 80 | 180 |
| 12 | 286 | 37 | 29 | 120 | 190 |
| 13 | 228 | -21 | 28 | -70 | 180 |
| 14 | 341 | 92 | 30 | 300 | 200 |
| 15 | 308 | 59 | 29 | 190 | 190 |
| 16 | 296 | 47 | 29 | 150 | 190 |
| 17 | 257 | 8 | 29 | 30 | 180 |
| 18 | 280 | 31 | 29 | 100 | 180 |
| 19 | 270 | 21 | 29 | 70 | 180 |
| 20 | 294 | 45 | 29 | 150 | 190 |
| | | | **Maximum:** | 300 | |
| | | | **Average:** | 84 | |
| | | | **STDEV:** | 94 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 13
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 248 | -1 | 28 | 0 | 180 |
| 2 | 260 | 11 | 29 | 40 | 180 |
| 3 | 275 | 26 | 29 | 80 | 180 |
| 4 | 218 | -31 | 28 | -100 | 180 |
| 5 | 287 | 38 | 29 | 120 | 190 |
| 6 | 178 | -71 | 27 | -230 | 180 |
| 7 | 244 | -5 | 28 | -20 | 180 |
| 8 | 219 | -30 | 28 | -100 | 180 |
| 9 | 289 | 40 | 29 | 130 | 190 |
| 10 | 227 | -22 | 28 | -70 | 180 |

**Maximum:** 130
**Average:** -15
**STDEV:** 113

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 13
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 200 | 21 | 19 | 220 | 390 |
| 2 | 189 | 10 | 19 | 100 | 380 |
| 3 | 203 | 24 | 19 | 250 | 390 |
| 4 | 207 | 28 | 19 | 290 | 390 |
| 5 | 192 | 13 | 19 | 140 | 380 |
| 6 | 187 | 8 | 18 | 80 | 380 |
| 7 | 184 | 5 | 18 | 50 | 380 |
| 8 | 201 | 22 | 19 | 230 | 390 |
| 9 | 210 | 31 | 19 | 320 | 390 |
| 10 | 172 | -7 | 18 | -70 | 370 |
| 11 | 208 | 29 | 19 | 300 | 390 |
| 12 | 185 | 6 | 18 | 60 | 380 |
| 13 | 182 | 3 | 18 | 30 | 380 |
| 14 | 176 | -3 | 18 | -30 | 370 |
| 15 | 211 | 32 | 19 | 330 | 390 |
| 16 | 201 | 22 | 19 | 230 | 390 |
| 17 | 195 | 16 | 19 | 170 | 380 |
| 18 | 218 | 39 | 19 | 410 | 400 |
| 19 | 209 | 30 | 19 | 310 | 390 |
| 20 | 206 | 27 | 19 | 280 | 390 |
| | | | **Maximum:** | 410 | |
| | | | **Average:** | 185 | |
| | | | **STDEV:** | 133 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

| | | |
|---|---|---|
| Total Efficiency: | 0.076 | cpm/dpm |
| Total Efficiency Uncertainty: | 0.002 | cpm/dpm |
| MDC: | 524 | dpm/100 cm$^2$ |

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 13
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 202 | 23 | 19 | 240 | 390 |
| 2 | 179 | 0 | 18 | 0 | 370 |
| 3 | 179 | 0 | 18 | 0 | 370 |
| 4 | 199 | 20 | 19 | 210 | 380 |
| 5 | 203 | 24 | 19 | 250 | 390 |
| 6 | 194 | 15 | 19 | 160 | 380 |
| 7 | 201 | 22 | 19 | 230 | 390 |
| 8 | 174 | -5 | 18 | -50 | 370 |
| 9 | 201 | 22 | 19 | 230 | 390 |
| 10 | 202 | 23 | 19 | 240 | 390 |

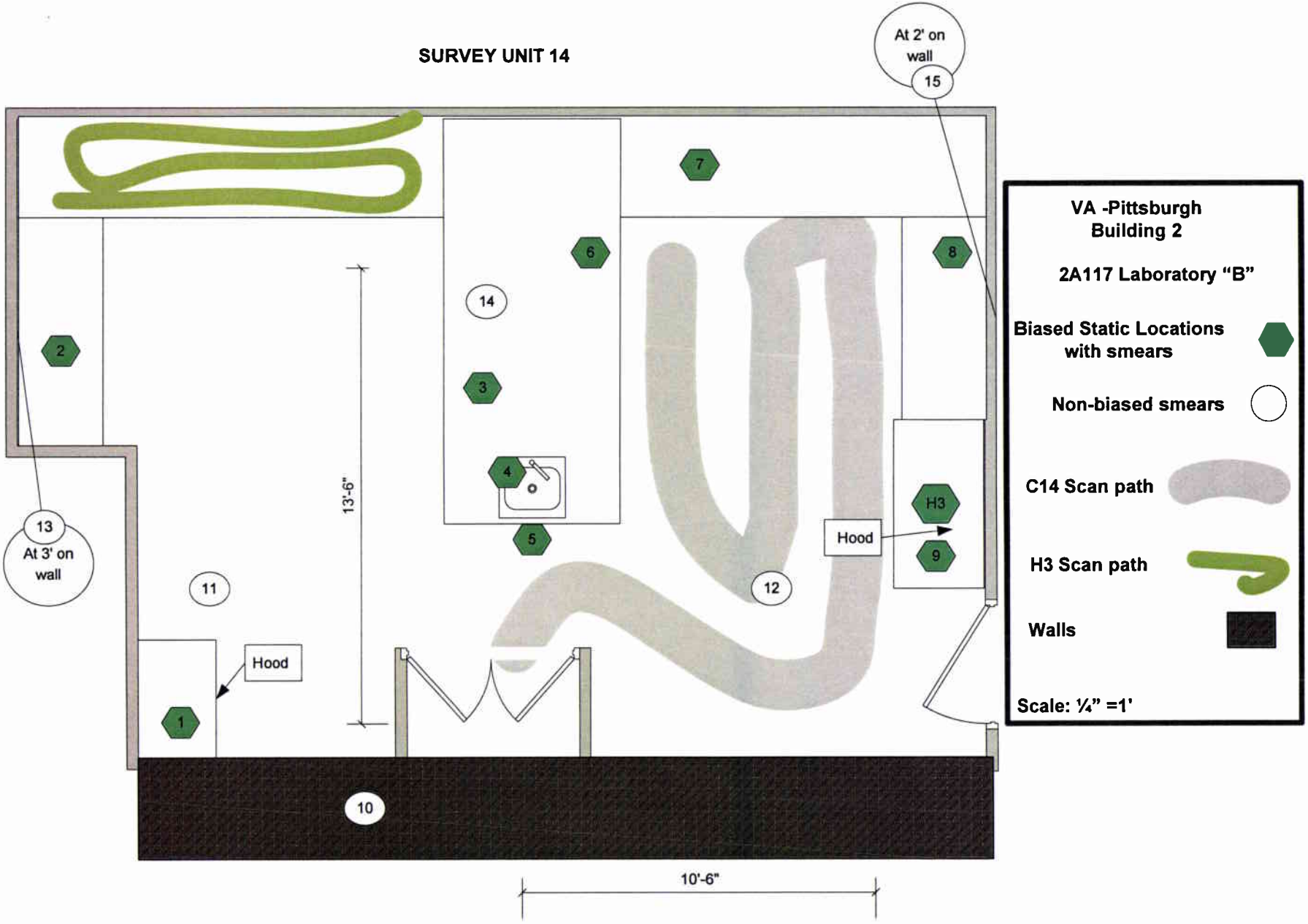
**Maximum:** 250
**Average:** 151
**STDEV:** 119

## *Instrument Data and Analysis Parameters*

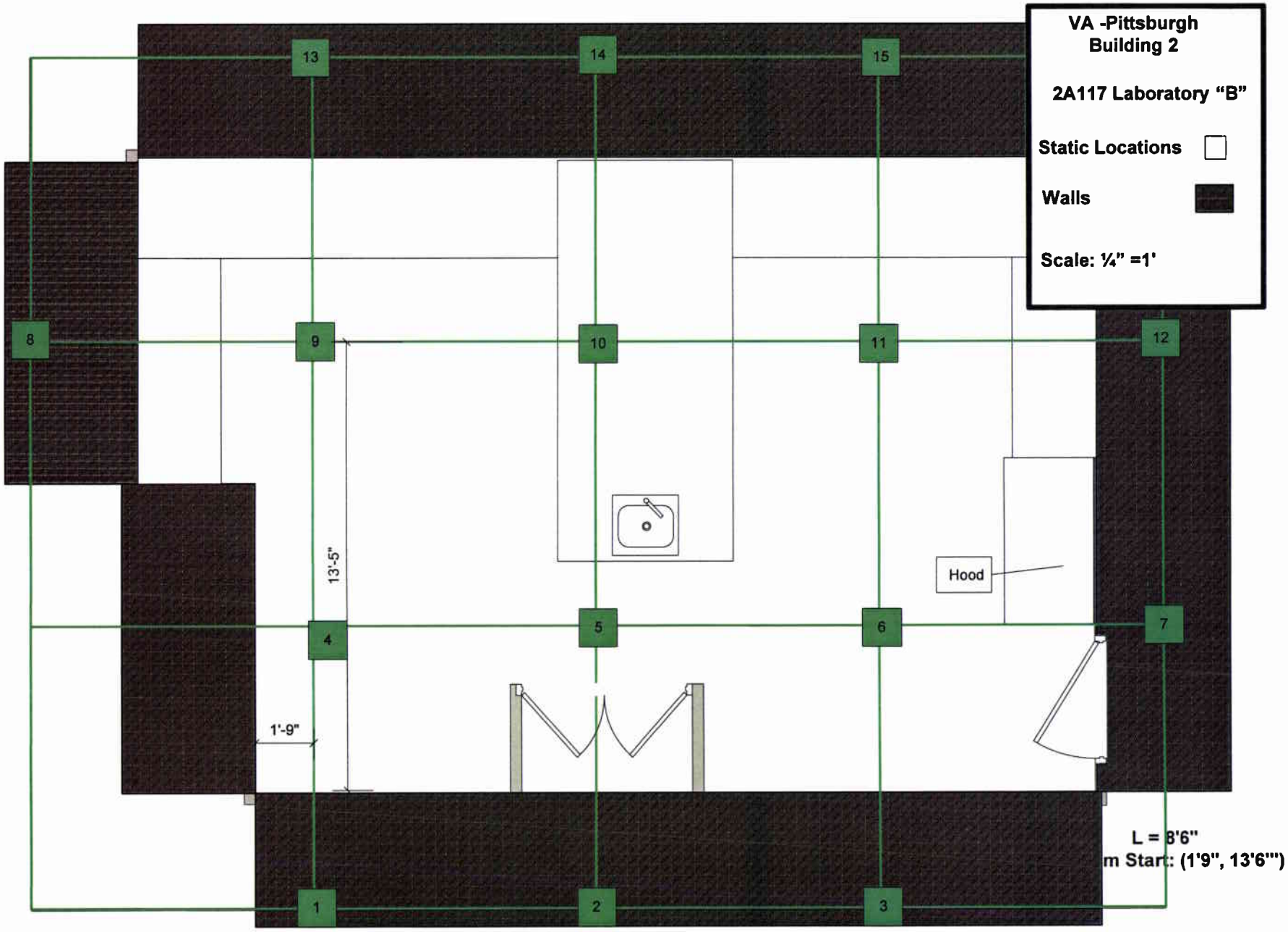
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

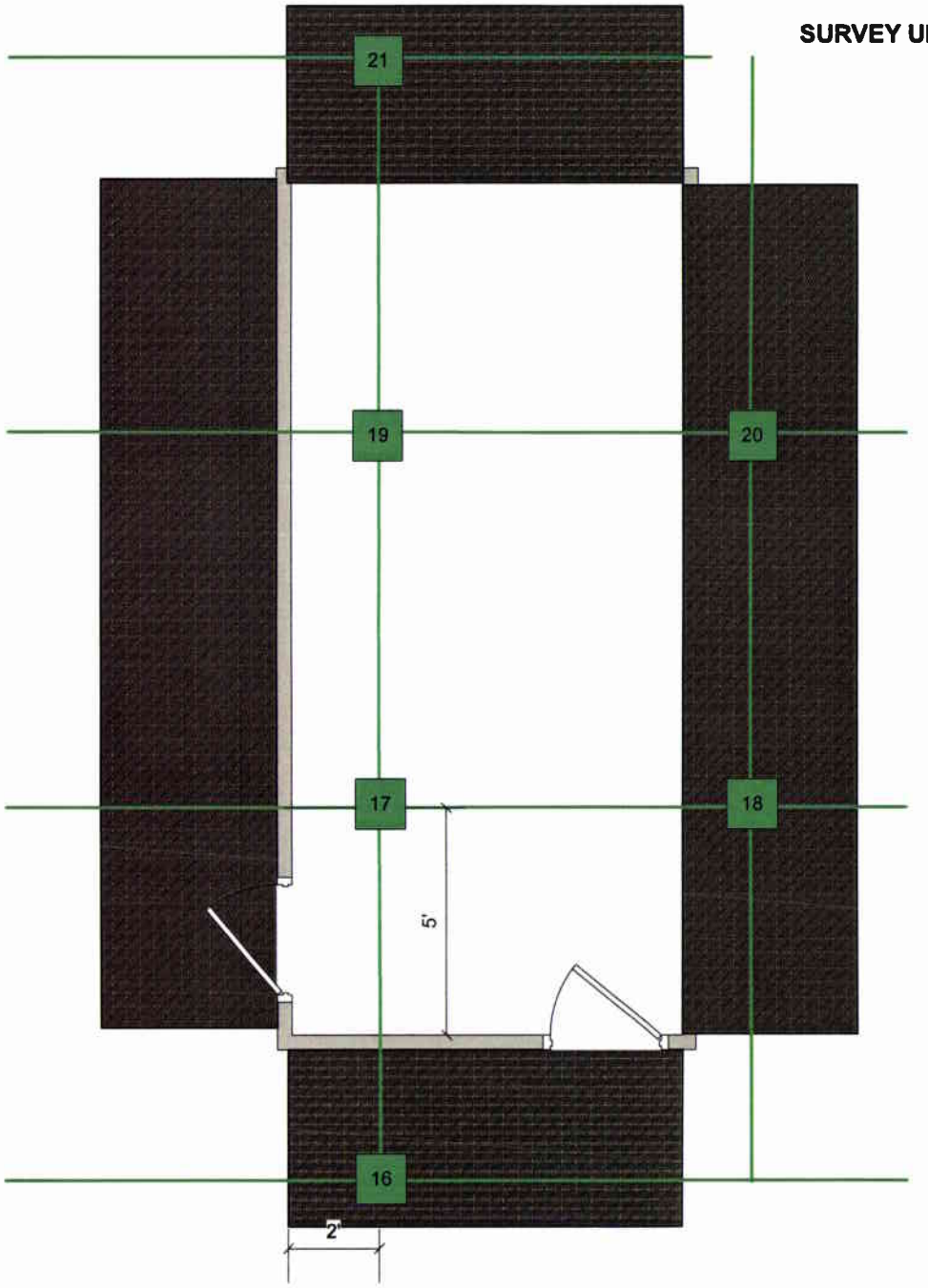
**SURVEY UNIT 14**



## SURVEY UNIT 14 - CONTINUED



**SURVEY UNIT 14 - CONTINUED**




**VA -Pittsburgh**
**Building 2**

**2A118 Office**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

**L = 8'6"**

# *Summary of $^{3}$H Static Measurements*

**Survey Unit:** 14
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 301 | 52 | 29 | 170 | 190 |
| 2 | 241 | -8 | 28 | -30 | 180 |
| 3 | 251 | 2 | 28 | 10 | 180 |
| 4 | 245 | -4 | 28 | -10 | 180 |
| 5 | 261 | 12 | 29 | 40 | 180 |
| 6 | 262 | 13 | 29 | 40 | 180 |
| 7 | 273 | 24 | 29 | 80 | 180 |
| 8 | 271 | 22 | 29 | 70 | 180 |
| 9 | 273 | 24 | 29 | 80 | 180 |
| 10 | 212 | -37 | 28 | -120 | 180 |
| 11 | 242 | -7 | 28 | -20 | 180 |
| 12 | 241 | -8 | 28 | -30 | 180 |
| 13 | 183 | -66 | 27 | -210 | 180 |
| 14 | 205 | -44 | 28 | -140 | 180 |
| 15 | 184 | -65 | 27 | -210 | 180 |
| 16 | 278 | 29 | 29 | 90 | 180 |
| 17 | 184 | -65 | 27 | -210 | 180 |
| 18 | 276 | 27 | 29 | 90 | 180 |
| 19 | 216 | -33 | 28 | -110 | 180 |
| 20 | 252 | 3 | 28 | 10 | 180 |
| | | | **Maximum:** | 170 | |
| | | | **Average:** | -21 | |
| | | | **STDEV:** | 112 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 253237 | Background: | 249 | cpm |
| Detector: | 44-110 | 268330 | Background σ: | 23.6 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 14
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 241 | -8 | 28 | -30 | 180 |
| 2 | 192 | -57 | 27 | -180 | 180 |
| 3 | 171 | -78 | 27 | -250 | 180 |
| 4 | 221 | -28 | 28 | -90 | 180 |
| 5 | 224 | -25 | 28 | -80 | 180 |
| 6 | 238 | -11 | 28 | -40 | 180 |
| 7 | 279 | 30 | 29 | 100 | 180 |
| 8 | 238 | -11 | 28 | -40 | 180 |
| 9 | 244 | -5 | 28 | -20 | 180 |
| 10 | 295 | 46 | 29 | 150 | 190 |

**Maximum:** 150
**Average:** -48
**STDEV:** 117

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 14
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 202 | 23 | 19 | 240 | 390 |
| 2 | 167 | -12 | 18 | -130 | 370 |
| 3 | 202 | 23 | 19 | 240 | 390 |
| 4 | 187 | 8 | 18 | 80 | 380 |
| 5 | 165 | -14 | 18 | -150 | 370 |
| 6 | 165 | -14 | 18 | -150 | 370 |
| 7 | 193 | 14 | 19 | 150 | 380 |
| 8 | 147 | -32 | 17 | -330 | 360 |
| 9 | 156 | -23 | 18 | -240 | 360 |
| 10 | 173 | -6 | 18 | -60 | 370 |
| 11 | 146 | -33 | 17 | -340 | 350 |
| 12 | 157 | -22 | 18 | -230 | 360 |
| 13 | 165 | -14 | 18 | -150 | 370 |
| 14 | 143 | -36 | 17 | -380 | 350 |
| 15 | 151 | -28 | 17 | -290 | 360 |
| 16 | 179 | 0 | 18 | 0 | 370 |
| 17 | 165 | -14 | 18 | -150 | 370 |
| 18 | 198 | 19 | 19 | 200 | 380 |
| 19 | 165 | -14 | 18 | -150 | 370 |
| 20 | 181 | 2 | 18 | 20 | 370 |
| | | | **Maximum:** | 240 | |
| | | | **Average:** | -91 | |
| | | | **STDEV:** | 194 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

| | | |
|---|---|---|
| Total Efficiency: | 0.076 | cpm/dpm |
| Total Efficiency Uncertainty: | 0.002 | cpm/dpm |
| MDC: | 524 | dpm/100 cm$^2$ |

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 14
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 207 | 28 | 19 | 290 | 390 |
| 2 | 166 | -13 | 18 | -140 | 370 |
| 3 | 168 | -11 | 18 | -110 | 370 |
| 4 | 189 | 10 | 19 | 100 | 380 |
| 5 | 160 | -19 | 18 | -200 | 360 |
| 6 | 165 | -14 | 18 | -150 | 370 |
| 7 | 181 | 2 | 18 | 20 | 370 |
| 8 | 184 | 5 | 18 | 50 | 380 |
| 9 | 184 | 5 | 18 | 50 | 380 |
| 10 | 206 | 27 | 19 | 280 | 390 |

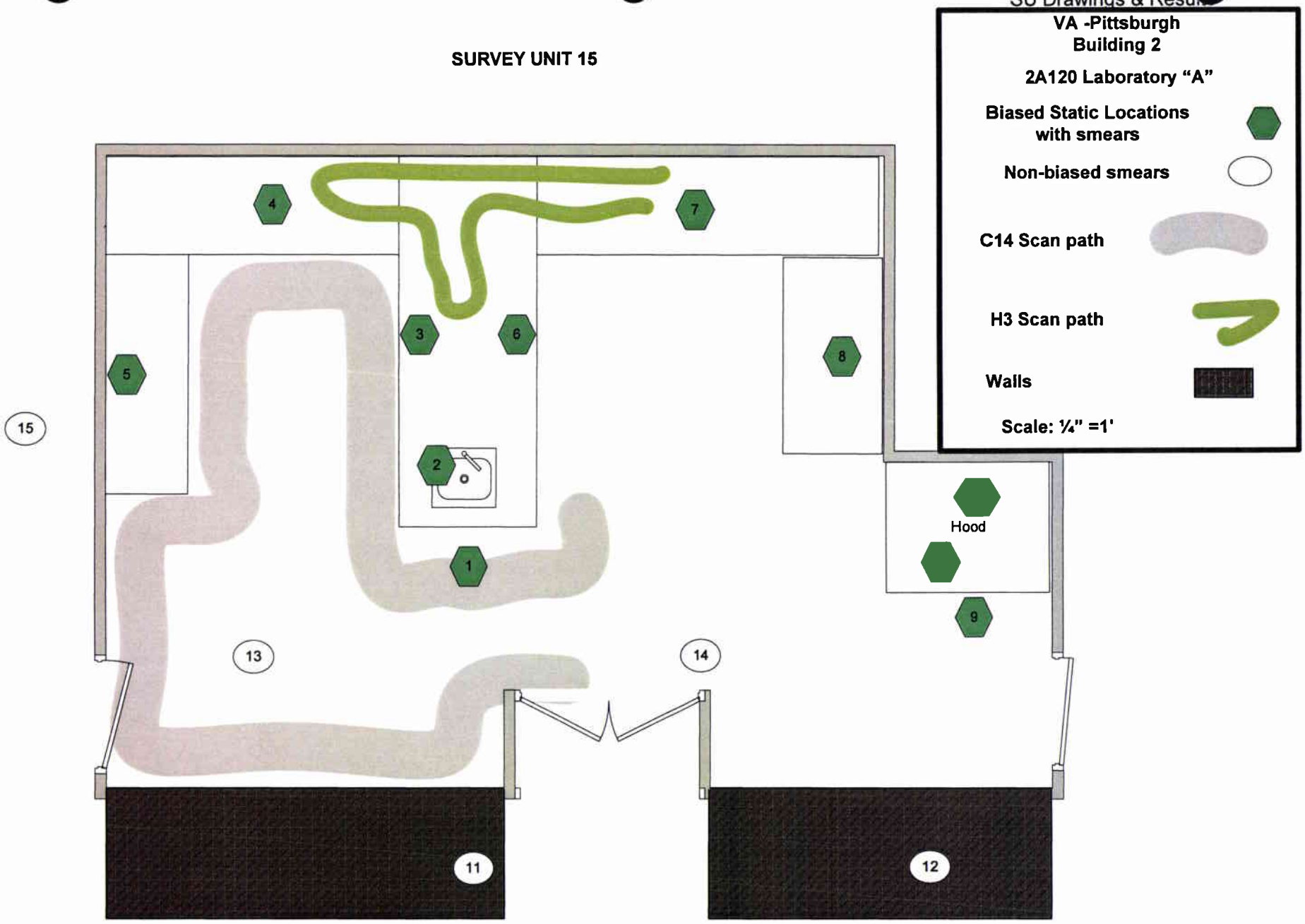
**Maximum:** 290
**Average:** 19
**STDEV:** 173

## *Instrument Data and Analysis Parameters*

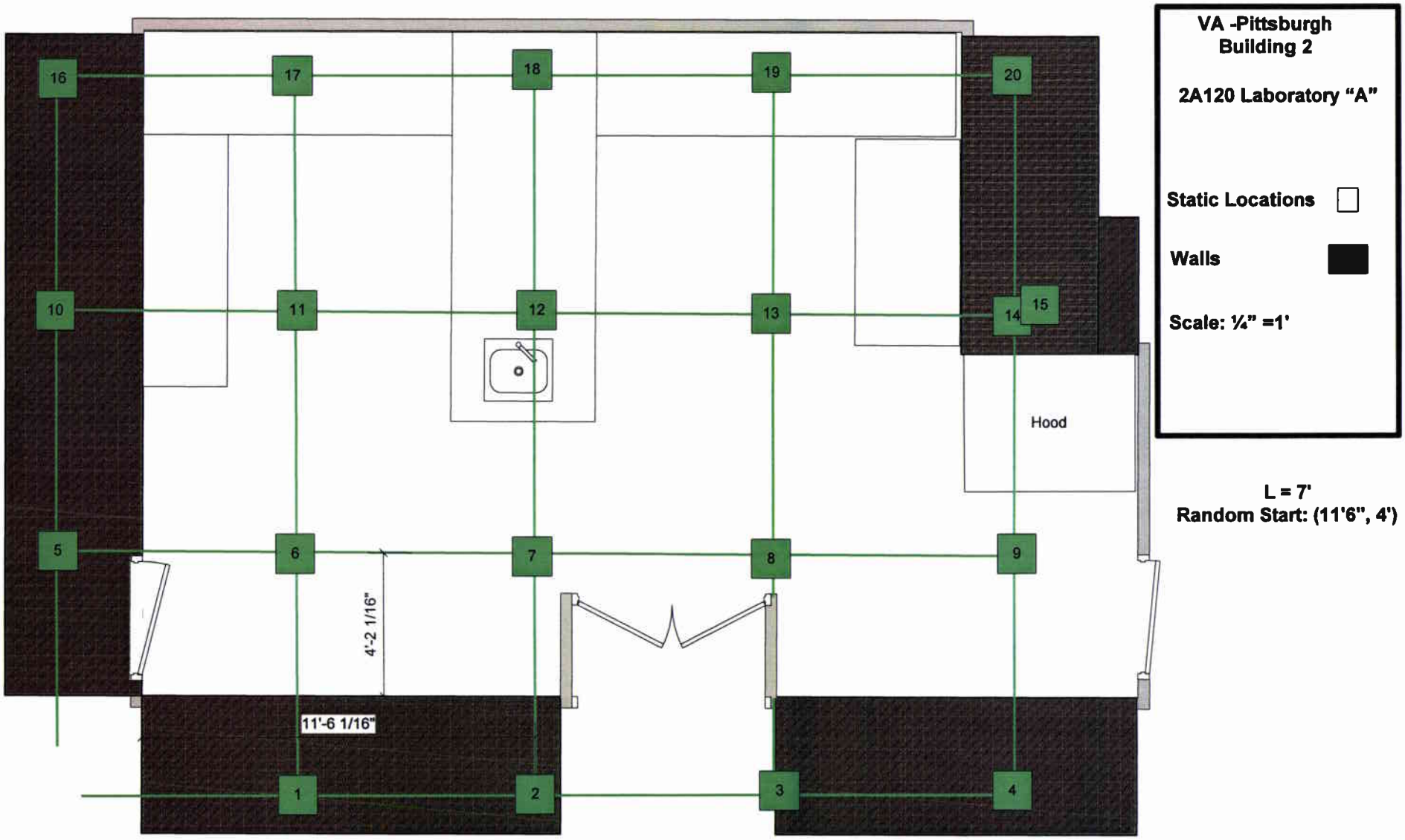
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 15**



**SURVEY UNIT 15 - CONTINUED**



## *Summary of $^{3}$H Static Measurements*

**Survey Unit:** 15
**Survey Date:** 4/15/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 269 | 20 | 29 | 60 | 180 |
| 2 | 244 | -5 | 28 | -20 | 180 |
| 3 | 246 | -3 | 28 | -10 | 180 |
| 4 | 274 | 25 | 29 | 80 | 180 |
| 5 | 236 | -13 | 28 | -40 | 180 |
| 6 | 241 | -8 | 28 | -30 | 180 |
| 7 | 275 | 26 | 29 | 80 | 180 |
| 8 | 219 | -30 | 28 | -100 | 180 |
| 9 | 229 | -20 | 28 | -60 | 180 |
| 10 | 233 | -16 | 28 | -50 | 180 |
| 11 | 244 | -5 | 28 | -20 | 180 |
| 12 | 214 | -35 | 28 | -110 | 180 |
| 13 | 252 | 3 | 28 | 10 | 180 |
| 14 | 219 | -30 | 28 | -100 | 180 |
| 15 | 243 | -6 | 28 | -20 | 180 |
| 16 | 232 | -17 | 28 | -60 | 180 |
| 17 | 266 | 17 | 29 | 60 | 180 |
| 18 | 236 | -13 | 28 | -40 | 180 |
| 19 | 213 | -36 | 28 | -120 | 180 |
| 20 | 217 | -32 | 28 | -100 | 180 |
| | | | **Maximum:** | 80 | |
| | | | **Average:** | -30 | |
| | | | **STDEV:** | 63 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 15
**Survey Date:** 4/15/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 243 | -6 | 28 | -20 | 180 |
| 2 | 236 | -13 | 28 | -40 | 180 |
| 3 | 215 | -34 | 28 | -110 | 180 |
| 4 | 223 | -26 | 28 | -80 | 180 |
| 5 | 202 | -47 | 28 | -150 | 180 |
| 6 | 235 | -14 | 28 | -50 | 180 |
| 7 | 224 | -25 | 28 | -80 | 180 |
| 8 | 320 | 71 | 30 | 230 | 190 |
| 9 | 225 | -24 | 28 | -80 | 180 |
| 10 | 205 | -44 | 28 | -140 | 180 |

**Maximum:** 230
**Average:** -52
**STDEV:** 107

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 15
**Survey Date:** 4/15/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 178 | -1 | 18 | -10 | 370 |
| 2 | 189 | 10 | 19 | 100 | 380 |
| 3 | 224 | 45 | 19 | 470 | 400 |
| 4 | 181 | 2 | 18 | 20 | 370 |
| 5 | 166 | -13 | 18 | -140 | 370 |
| 6 | 159 | -20 | 18 | -210 | 360 |
| 7 | 153 | -26 | 18 | -270 | 360 |
| 8 | 182 | 3 | 18 | 30 | 380 |
| 9 | 175 | -4 | 18 | -40 | 370 |
| 10 | 189 | 10 | 19 | 100 | 380 |
| 11 | 158 | -21 | 18 | -220 | 360 |
| 12 | 132 | -47 | 17 | -490 | 350 |
| 13 | 162 | -17 | 18 | -180 | 360 |
| 14 | 170 | -9 | 18 | -90 | 370 |
| 15 | 172 | -7 | 18 | -70 | 370 |
| 16 | 146 | -33 | 17 | -340 | 350 |
| 17 | 162 | -17 | 18 | -180 | 360 |
| 18 | 147 | -32 | 17 | -330 | 360 |
| 19 | 153 | -26 | 18 | -270 | 360 |
| 20 | 174 | -5 | 18 | -50 | 370 |
| | | | **Maximum:** | 470 | |
| | | | **Average:** | -109 | |
| | | | **STDEV:** | 207 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | $cm^2$ | Sample Analysis Time: | 1 | min |

| | |
|---|---|
| Total Efficiency: | 0.076 cpm/dpm |
| Total Efficiency Uncertainty: | 0.002 cpm/dpm |
| MDC: | 524 dpm/100 $cm^2$ |

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 15
**Survey Date:** 4/15/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 160 | -19 | 18 | -200 | 360 |
| 2 | 159 | -20 | 18 | -210 | 360 |
| 3 | 167 | -12 | 18 | -130 | 370 |
| 4 | 173 | -6 | 18 | -60 | 370 |
| 5 | 197 | 18 | 19 | 190 | 380 |
| 6 | 160 | -19 | 18 | -200 | 360 |
| 7 | 193 | 14 | 19 | 150 | 380 |
| 8 | 197 | 18 | 19 | 190 | 380 |
| 9 | 189 | 10 | 19 | 100 | 380 |
| 10 | 179 | 0 | 18 | 0 | 370 |

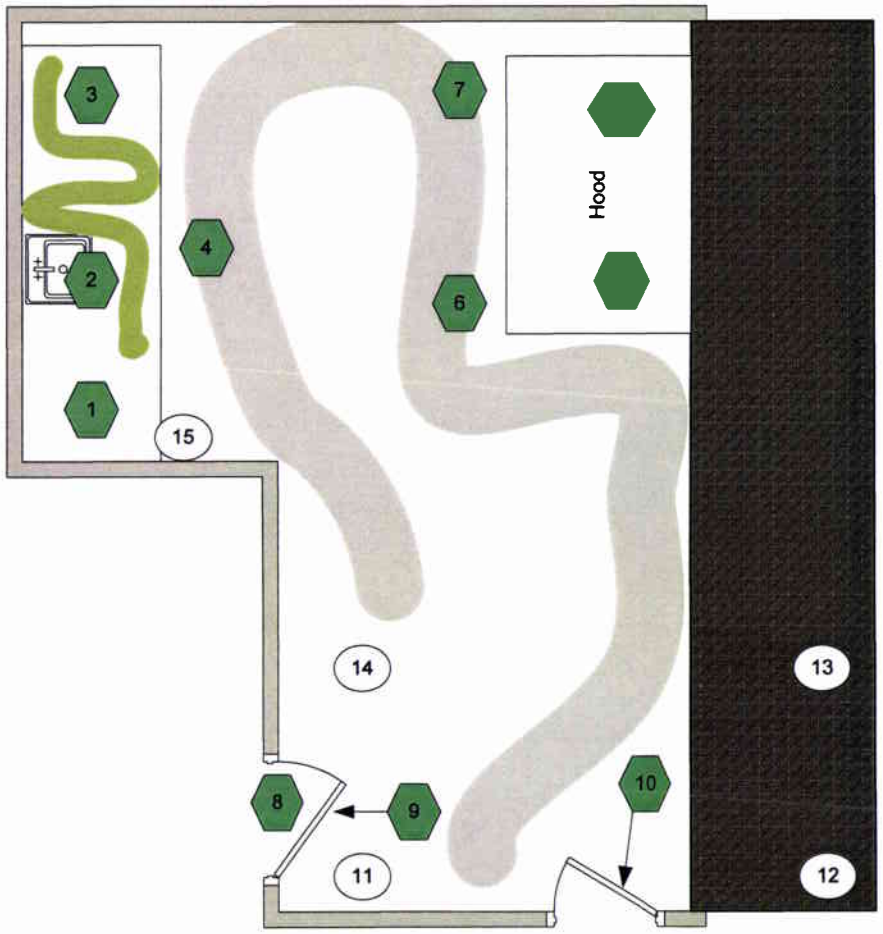
**Maximum:** 190
**Average:** -17
**STDEV:** 165

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

**SURVEY UNIT 16**




**VA -Pittsburgh**
**Building 2**

**2A121 Laboratory**

**Biased Static Locations with smears**

**Non-biased smears**

**C14 Scan path**

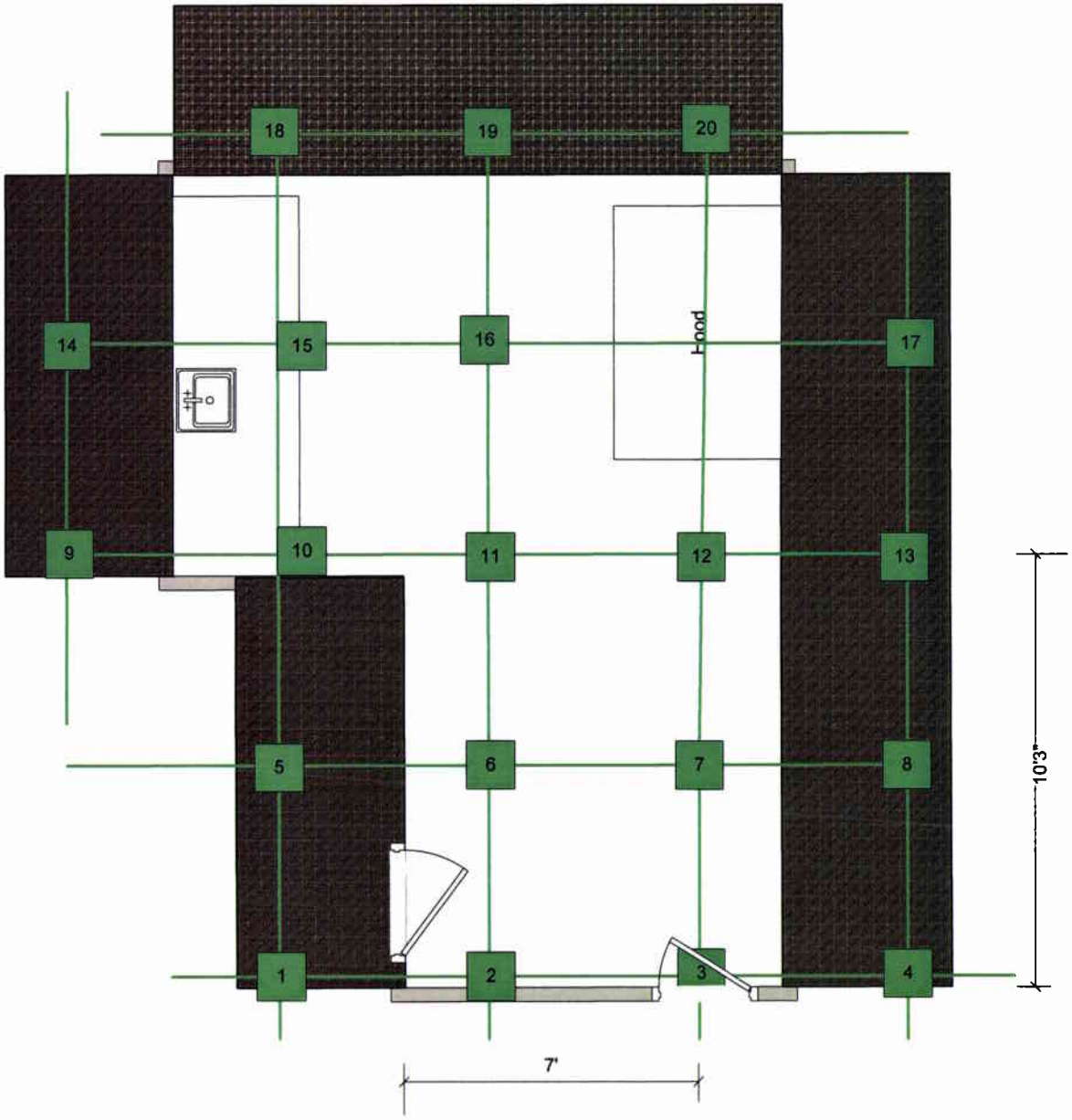
**H3 Scan path**

**Walls**

**Scale: ¼" =1'**

**L = 5'**
**Random Start: (7', 10'3")**

**SURVEY UNIT 16 - CONTINUED**




**VA -Pittsburgh**
**Building 2**

**2A121 Laboratory**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

**L = 5'**
**Random Start: (7', 10'3")**

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 16
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 479 | 230 | 32 | 750 | 240 | Ceramic |
| 2 | 286 | 37 | 29 | 120 | 190 | |
| 3 | 290 | 41 | 29 | 130 | 190 | |
| 4 | 550 | 301 | 33 | 980 | 260 | Ceramic |
| 5 | 498 | 249 | 32 | 810 | 240 | Ceramic |
| 6 | 317 | 68 | 30 | 220 | 190 | |
| 7 | 320 | 71 | 30 | 230 | 190 | |
| 8 | 567 | 318 | 34 | 1030 | 270 | Ceramic |
| 9 | 482 | 233 | 32 | 750 | 240 | Ceramic |
| 10 | 260 | 11 | 29 | 40 | 180 | |
| 11 | 309 | 60 | 29 | 190 | 190 | |
| 12 | 276 | 27 | 29 | 90 | 180 | |
| 13 | 555 | 306 | 33 | 990 | 260 | Ceramic |
| 14 | 499 | 250 | 32 | 810 | 240 | Ceramic |
| 15 | 251 | 2 | 28 | 10 | 180 | |
| 16 | 334 | 85 | 30 | 280 | 190 | |
| 17 | 221 | -28 | 28 | -90 | 180 | I/S Hood |
| 18 | 501 | 252 | 33 | 820 | 240 | Ceramic |
| 19 | 540 | 291 | 33 | 940 | 260 | Ceramic |
| 20 | 606 | 357 | 34 | 1160 | 280 | Ceramic |
| | | | **Maximum:** | 1160 | | |
| | | | **Average:** | 513 | | |
| | | | **STDEV:** | 419 | | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 $cm^2$

# *Summary of $^{3}H$ Static Measurements (Biased)*

**Survey Unit:** 16
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 341 | 92 | 30 | 300 | 200 |
| 2 | 310 | 61 | 29 | 200 | 190 |
| 3 | 286 | 37 | 29 | 120 | 190 |
| 4 | 260 | 11 | 29 | 40 | 180 |
| 5 | 272 | 23 | 29 | 70 | 180 |
| 6 | 258 | 9 | 29 | 30 | 180 |
| 7 | 267 | 18 | 29 | 60 | 180 |
| 8 | 279 | 30 | 29 | 100 | 180 |
| 9 | 319 | 70 | 30 | 230 | 190 |
| 10 | 304 | 55 | 29 | 180 | 190 |

**Maximum:** 300
**Average:** 133
**STDEV:** 91

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

## *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 16
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 384 | 205 | 23 | 2140 | 490 | Ceramic |
| 2 | 221 | 42 | 19 | 440 | 400 | |
| 3 | 217 | 38 | 19 | 400 | 390 | |
| 4 | 395 | 216 | 23 | 2260 | 490 | Ceramic |
| 5 | 342 | 163 | 22 | 1700 | 460 | Ceramic |
| 6 | 202 | 23 | 19 | 240 | 390 | |
| 7 | 212 | 33 | 19 | 340 | 390 | |
| 8 | 384 | 205 | 23 | 2140 | 490 | Ceramic |
| 9 | 333 | 154 | 22 | 1610 | 460 | Ceramic |
| 10 | 183 | 4 | 18 | 40 | 380 | |
| 11 | 212 | 33 | 19 | 340 | 390 | |
| 12 | 216 | 37 | 19 | 390 | 390 | |
| 13 | 314 | 135 | 22 | 1410 | 450 | Ceramic |
| 14 | 326 | 147 | 22 | 1540 | 460 | Ceramic |
| 15 | 218 | 39 | 19 | 410 | 400 | |
| 16 | 206 | 27 | 19 | 280 | 390 | |
| 17 | 183 | 4 | 18 | 40 | 380 | I/S Hood |
| 18 | 391 | 212 | 23 | 2210 | 490 | Ceramic |
| 19 | 385 | 206 | 23 | 2150 | 490 | Ceramic |
| 20 | 400 | 221 | 24 | 2310 | 500 | Ceramic |
| | | | **Maximum:** | 2310 | | |
| | | | **Average:** | 1120 | | |
| | | | **STDEV:** | 886 | | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

## *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 16
**Survey Date:** 4/16/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 221 | 42 | 19 | 440 | 400 |
| 2 | 188 | 9 | 18 | 90 | 380 |
| 3 | 189 | 10 | 19 | 100 | 380 |
| 4 | 150 | -29 | 17 | -300 | 360 |
| 5 | 184 | 5 | 18 | 50 | 380 |
| 6 | 221 | 42 | 19 | 440 | 400 |
| 7 | 212 | 33 | 19 | 340 | 390 |
| 8 | 206 | 27 | 19 | 280 | 390 |
| 9 | 216 | 37 | 19 | 390 | 390 |
| 10 | 208 | 29 | 19 | 300 | 390 |

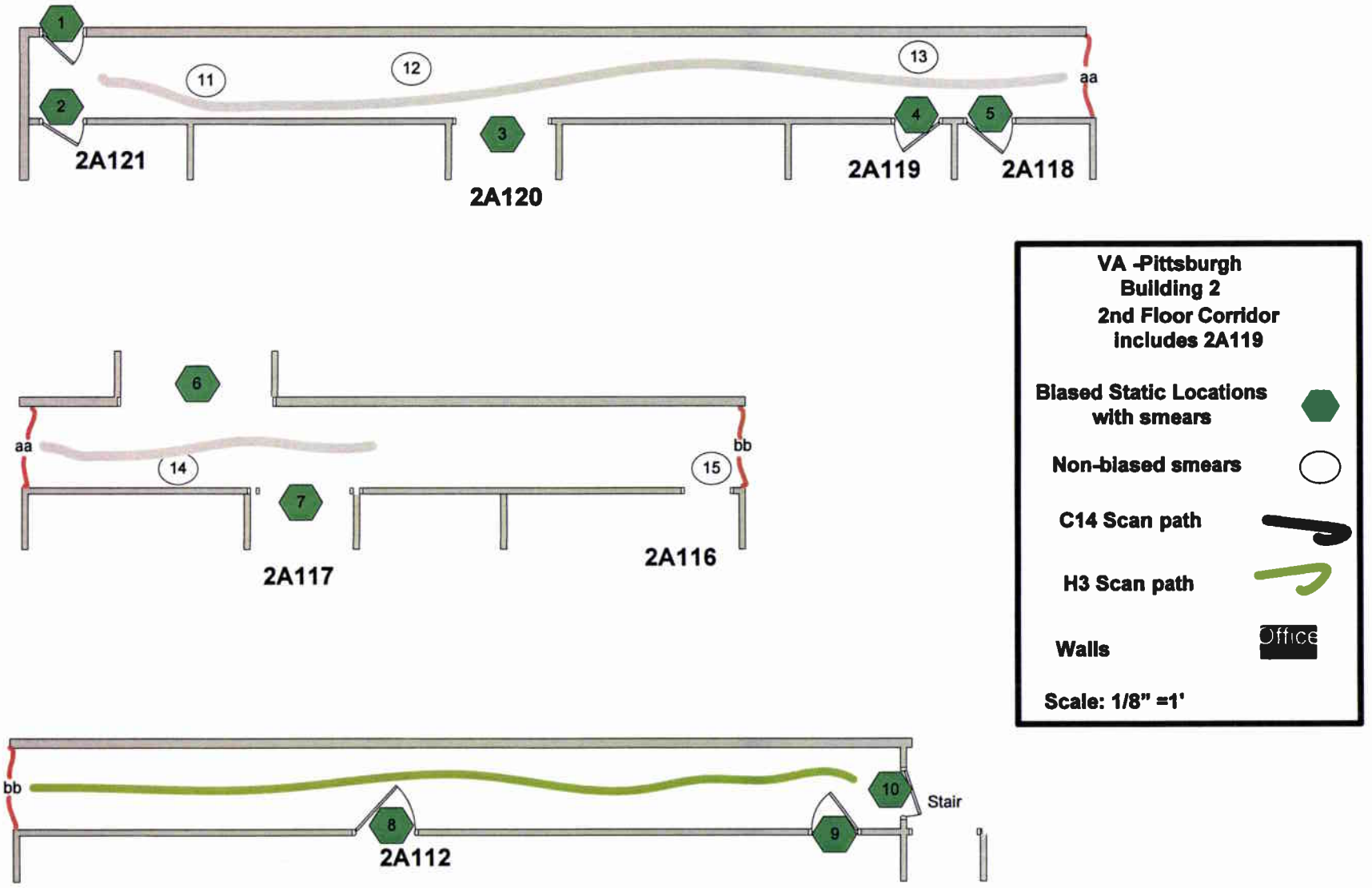
**Maximum:** 440
**Average:** 213
**STDEV:** 231

## *Instrument Data and Analysis Parameters*

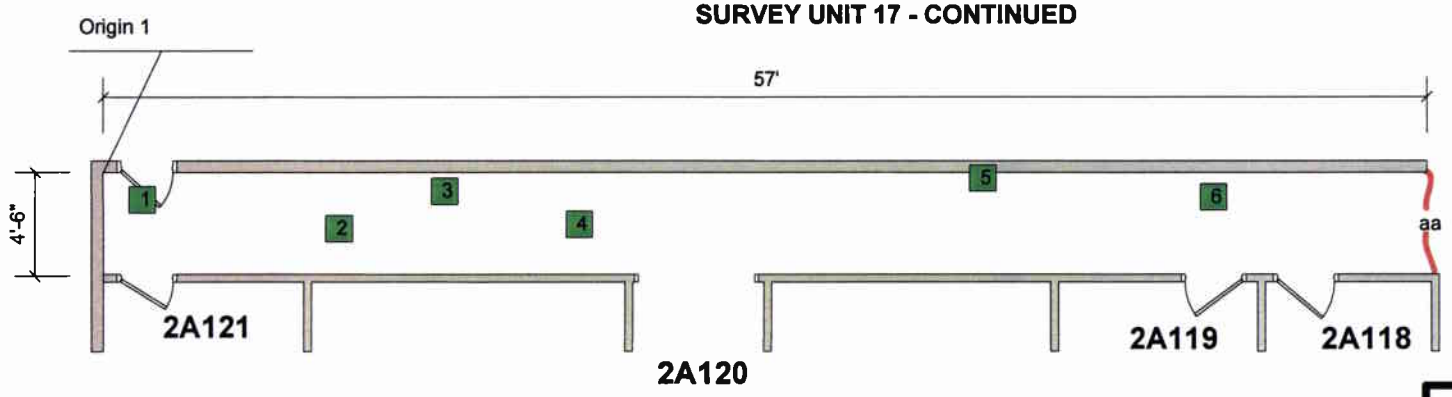
| | Model | Serial No | | | |
|---|---|---|---|---|---|
| | | | Reference Material: | Source Jig | |
| Instrument: | 2360 | 141321 | Background: | 179 | cpm |
| Detector: | 43-68 | 148456 | Background σ: | 12.4 | cpm |
| Probe Area: | 126 | cm$^2$ | Sample Analysis Time: | 1 | min |

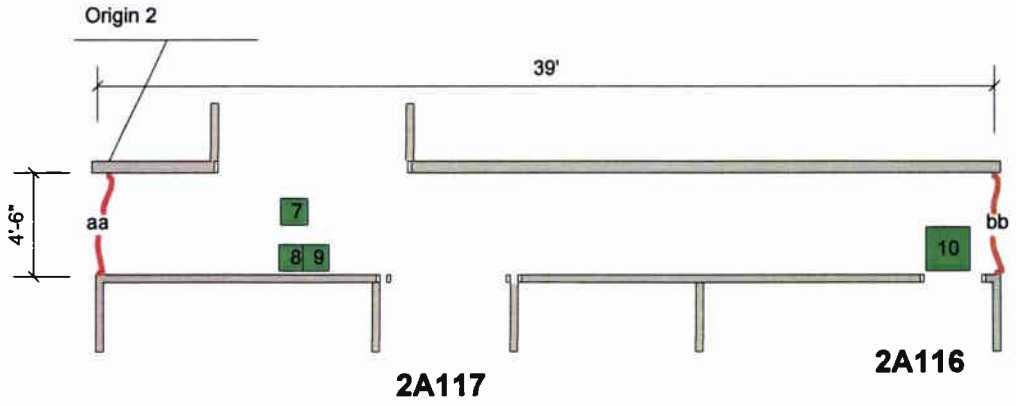
Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 cm$^2$

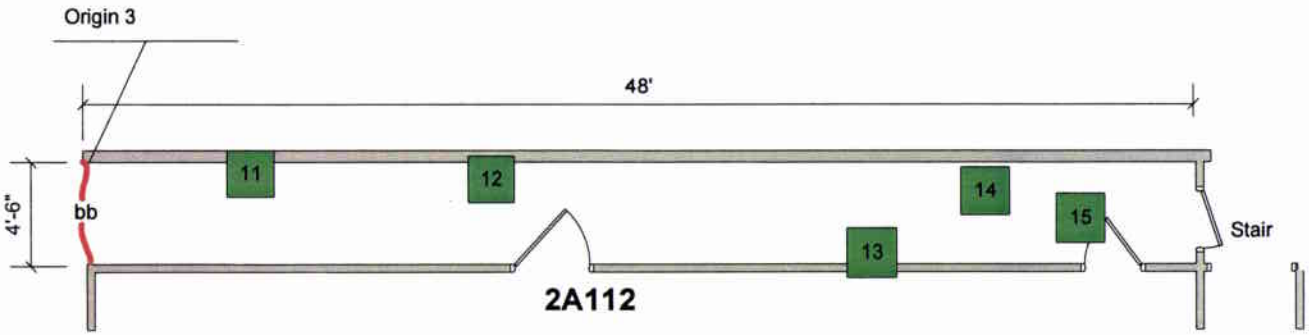
## SURVEY UNIT 17



## SURVEY UNIT 17 - CONTINUED




**VA -Pittsburgh**
**Building 2**

**2nd Floor Corridor includes 2A119**

**Static Locations** ☐

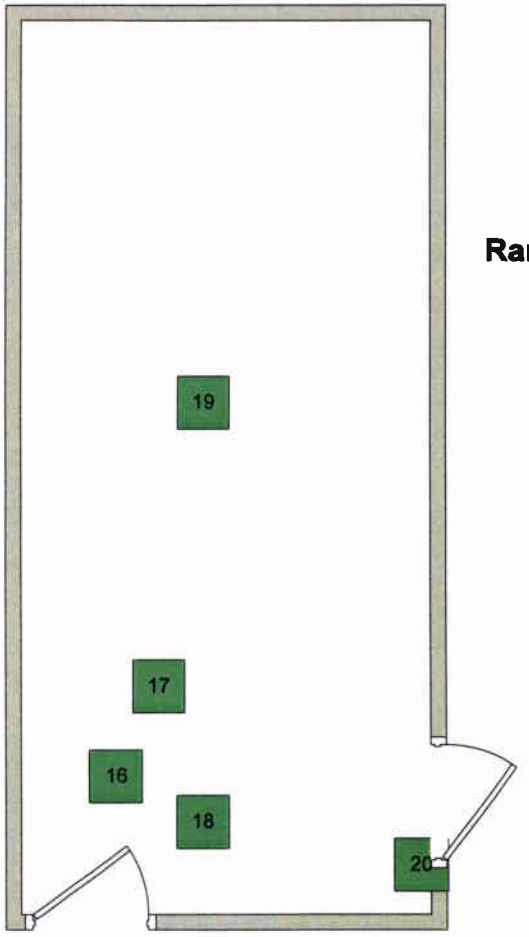
**Walls** ▬

**Scale: 1/8" =1'**

Random Coordinates (ft)

| | N | X | Y |
|---|---|---|---|
| Origin 1 | 1 | 1 | 2 |
| | 2 | 3 | 10 |
| | 3 | 1 | 16 |
| | 4 | 3 | 22 |
| | 5 | 0 | 38 |
| | 6 | 1 | 48 |
| Origin 2 | 7 | 2 | 8 |
| | 8 | 4 | 8 |
| | 9 | 4 | 9 |
| | 10 | 4 | 37 |
| Origin 3 | 11 | 0 | 7 |
| | 12 | 0 | 18 |
| | 13 | 4 | 34 |
| | 14 | 2 | 39 |
| | 15 | 3 | 43 |

SURVEY UNIT 17 - CONTINUED




**Random Coordinates (ft)**

| N | X | Y |
|---|---|---|
| 16 | 2 | 3 |
| 17 | 3 | 5 |
| 18 | 4 | 2 |
| 19 | 4 | 11 |
| 20 | 9 | 1 |

**VA -Pittsburgh**
**Building 2**

**2A119 Office**

**Static Locations**

**Walls**

**Scale: ¼" =1'**

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 17
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 244 | -5 | 28 | -20 | 180 |
| 2 | 272 | 23 | 29 | 70 | 180 |
| 3 | 273 | 24 | 29 | 80 | 180 |
| 4 | 275 | 26 | 29 | 80 | 180 |
| 5 | 253 | 4 | 28 | 10 | 180 |
| 6 | 236 | -13 | 28 | -40 | 180 |
| 7 | 236 | -13 | 28 | -40 | 180 |
| 8 | 184 | -65 | 27 | -210 | 180 |
| 9 | 202 | -47 | 28 | -150 | 180 |
| 10 | 252 | 3 | 28 | 10 | 180 |
| 11 | 239 | -10 | 28 | -30 | 180 |
| 12 | 241 | -8 | 28 | -30 | 180 |
| 13 | 233 | -16 | 28 | -50 | 180 |
| 14 | 216 | -33 | 28 | -110 | 180 |
| 15 | 164 | -85 | 27 | -280 | 180 |
| 16 | 181 | -68 | 27 | -220 | 180 |
| 17 | 133 | -116 | 26 | -380 | 180 |
| 18 | 134 | -115 | 26 | -370 | 180 |
| 19 | 139 | -110 | 26 | -360 | 180 |
| 20 | 198 | -51 | 27 | -170 | 180 |
| | | | **Maximum:** | 80 | |
| | | | **Average:** | -111 | |
| | | | **STDEV:** | 150 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

| | | |
|---|---|---|
| Total Efficiency: | 0.245 | cpm/dpm |
| Total Efficiency Uncertainty: | 0.020 | cpm/dpm |
| MDC: | 223 | dpm/100 $cm^2$ |

## *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 17
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) |
|---|---|---|---|---|---|
| 1 | 218 | -31 | 28 | -100 | 180 |
| 2 | 199 | -50 | 27 | -160 | 180 |
| 3 | 209 | -40 | 28 | -130 | 180 |
| 4 | 204 | -45 | 28 | -150 | 180 |
| 5 | 239 | -10 | 28 | -30 | 180 |
| 6 | 229 | -20 | 28 | -60 | 180 |
| 7 | 204 | -45 | 28 | -150 | 180 |
| 8 | 236 | -13 | 28 | -40 | 180 |
| 9 | 234 | -15 | 28 | -50 | 180 |
| 10 | 219 | -30 | 28 | -100 | 180 |

**Maximum:** -30
**Average:** -97
**STDEV:** 49

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 17
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 227 | 48 | 20 | 500 | 400 |
| 2 | 202 | 23 | 19 | 240 | 390 |
| 3 | 193 | 14 | 19 | 150 | 380 |
| 4 | 206 | 27 | 19 | 280 | 390 |
| 5 | 185 | 6 | 18 | 60 | 380 |
| 6 | 148 | -31 | 17 | -320 | 360 |
| 7 | 165 | -14 | 18 | -150 | 370 |
| 8 | 170 | -9 | 18 | -90 | 370 |
| 9 | 148 | -31 | 17 | -320 | 360 |
| 10 | 187 | 8 | 18 | 80 | 380 |
| 11 | 186 | 7 | 18 | 70 | 380 |
| 12 | 169 | -10 | 18 | -100 | 370 |
| 13 | 158 | -21 | 18 | -220 | 360 |
| 14 | 177 | -2 | 18 | -20 | 370 |
| 15 | 183 | 4 | 18 | 40 | 380 |
| 16 | 159 | -20 | 18 | -210 | 360 |
| 17 | 159 | -20 | 18 | -210 | 360 |
| 18 | 186 | 7 | 18 | 70 | 380 |
| 19 | 162 | -17 | 18 | -180 | 360 |
| 20 | 157 | -22 | 18 | -230 | 360 |
| | | | **Maximum:** | 500 | |
| | | | **Average:** | -28 | |
| | | | **STDEV:** | 215 | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

# *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 17
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) |
|---|---|---|---|---|---|
| 1 | 193 | 14 | 19 | 150 | 380 |
| 2 | 173 | -6 | 18 | -60 | 370 |
| 3 | 163 | -16 | 18 | -170 | 360 |
| 4 | 194 | 15 | 19 | 160 | 380 |
| 5 | 177 | -2 | 18 | -20 | 370 |
| 6 | 177 | -2 | 18 | -20 | 370 |
| 7 | 171 | -8 | 18 | -80 | 370 |
| 8 | 163 | -16 | 18 | -170 | 360 |
| 9 | 196 | 17 | 19 | 180 | 380 |
| 10 | 202 | 23 | 19 | 240 | 390 |

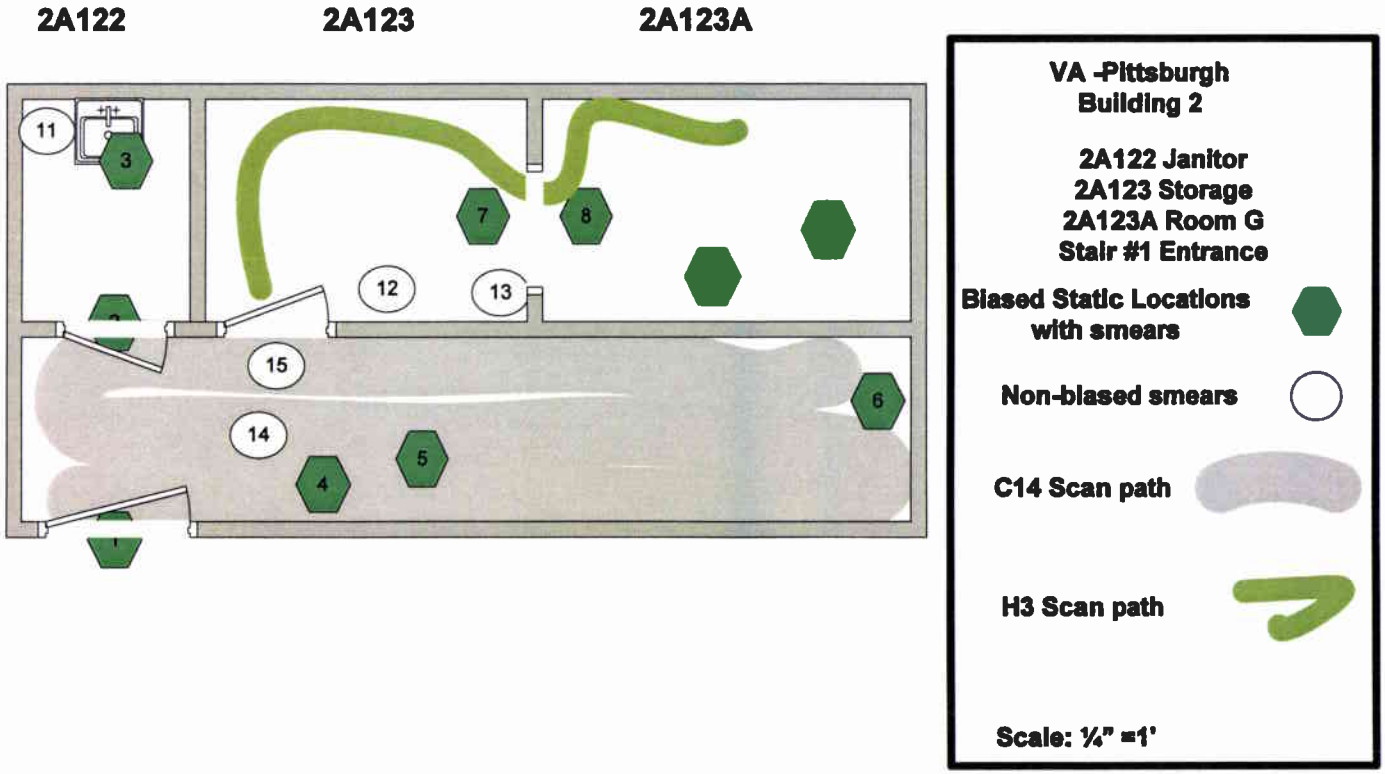
**Maximum:** 240
**Average:** 21
**STDEV:** 150

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

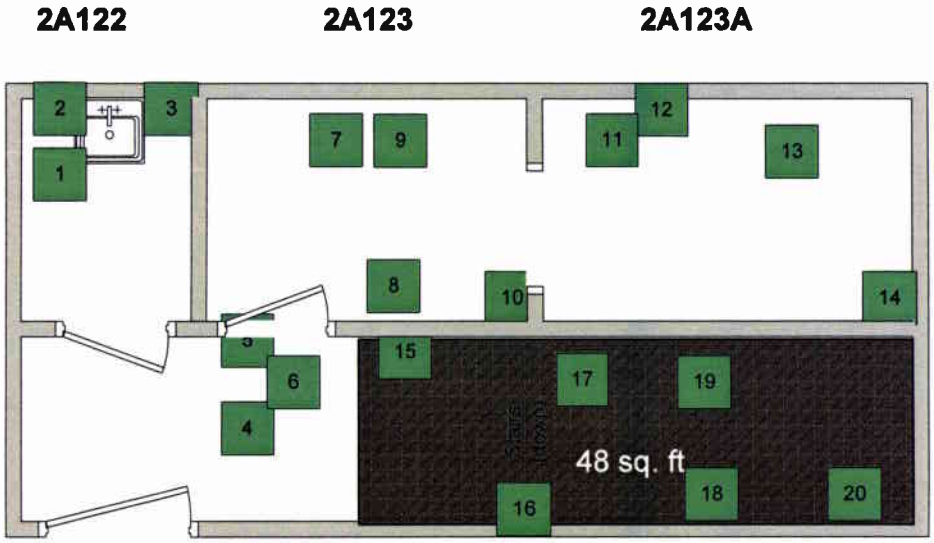
**SURVEY UNIT 18**



## SURVEY UNIT 18 - CONTINUED

**Random Coordinates (ft)**

| N | X | Y |
|---|---|---|
| 1 | 1 | 7 |
| 2 | 1 | 9 |
| 3 | 4 | 9 |
| 4 | 5 | 2 |
| 5 | 5 | 4 |
| 6 | 6 | 3 |
| 7 | 7 | 8 |
| 8 | 8 | 5 |
| 9 | 8 | 8 |
| 10 | 11 | 5 |
| 11 | 13 | 8 |
| 12 | 14 | 9 |
| 13 | 17 | 8 |
| 14 | 19 | 5 |
| 15 | 9 | 4 |
| 16 | 11 | 0 |
| 17 | 12 | 3 |
| 18 | 15 | 1 |
| 19 | 15 | 3 |
| 20 | 18 | 1 |




VA -Pittsburgh
Building 2

2A122 Janitor
2A123 Storage
2A123A Room G
Stair #1 Entrance

Static Locations

Walls

Scale: ¼" =1'

# *Summary of $^{3}H$ Static Measurements*

**Survey Unit:** 18
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 599 | 350 | 34 | 1130 | 280 | Ceramic |
| 2 | 460 | 211 | 32 | 680 | 230 | Ceramic |
| 3 | 599 | 350 | 34 | 1130 | 280 | Ceramic |
| 4 | 156 | -93 | 27 | -300 | 180 | |
| 5 | 138 | -111 | 26 | -360 | 180 | |
| 6 | 206 | -43 | 28 | -140 | 180 | |
| 7 | 177 | -72 | 27 | -230 | 180 | |
| 8 | 200 | -49 | 28 | -160 | 180 | |
| 9 | 212 | -37 | 28 | -120 | 180 | |
| 10 | 234 | -15 | 28 | -50 | 180 | |
| 11 | 242 | -7 | 28 | -20 | 180 | |
| 12 | 290 | 41 | 29 | 130 | 190 | |
| 13 | 264 | 15 | 29 | 50 | 180 | |
| 14 | 324 | 75 | 30 | 240 | 190 | |
| 15 | 274 | 25 | 29 | 80 | 180 | |
| 16 | 336 | 87 | 30 | 280 | 200 | |
| 17 | 354 | 105 | 30 | 340 | 200 | |
| 18 | 264 | 15 | 29 | 50 | 180 | |
| 19 | 174 | -75 | 27 | -240 | 180 | |
| 20 | 243 | -6 | 28 | -20 | 180 | |
| | | | **Maximum:** | 1130 | | |
| | | | **Average:** | 124 | | |
| | | | **STDEV:** | 422 | | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

| | | |
|---|---|---|
| Total Efficiency: | 0.245 | cpm/dpm |
| Total Efficiency Uncertainty: | 0.020 | cpm/dpm |
| MDC: | 223 | dpm/100 $cm^2$ |

# *Summary of $^{3}$H Static Measurements (Biased)*

**Survey Unit:** 18
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm$^2$) | Uncertainty (2σ) (dpm/100 cm$^2$) | |
|---|---|---|---|---|---|---|
| 1 | 235 | -14 | 28 | -50 | 180 | |
| 2 | 543 | 294 | 33 | 950 | 260 | Ceramic |
| 3 | 549 | 300 | 33 | 970 | 260 | Ceramic |
| 4 | 215 | -34 | 28 | -110 | 180 | |
| 5 | 190 | -59 | 27 | -190 | 180 | |
| 6 | 151 | -98 | 27 | -320 | 180 | |
| 7 | 118 | -131 | 26 | -420 | 180 | |
| 8 | 181 | -68 | 27 | -220 | 180 | |
| 9 | 215 | -34 | 28 | -110 | 180 | |
| 10 | 197 | -52 | 27 | -170 | 180 | |

**Maximum:** 970
**Average:** 33
**STDEV:** 500

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 253237 | Reference Material: | Source Jig | |
| Detector: | 44-110 | 268330 | Background: | 249 | cpm |
| Probe Area: | 126 | cm$^2$ | Background σ: | 23.6 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
MDC: 223 dpm/100 cm$^2$

# *Summary of $^{14}C$ Static Measurements*

**Survey Unit:** 18
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 447 | 268 | 25 | 2800 | 520 | Ceramic |
| 2 | 452 | 273 | 25 | 2850 | 520 | Ceramic |
| 3 | 417 | 238 | 24 | 2490 | 510 | Ceramic |
| 4 | 182 | 3 | 18 | 30 | 380 | |
| 5 | 214 | 35 | 19 | 370 | 390 | |
| 6 | 180 | 1 | 18 | 10 | 370 | |
| 7 | 194 | 15 | 19 | 160 | 380 | |
| 8 | 182 | 3 | 18 | 30 | 380 | |
| 9 | 212 | 33 | 19 | 340 | 390 | |
| 10 | 193 | 14 | 19 | 150 | 380 | |
| 11 | 229 | 50 | 20 | 520 | 400 | |
| 12 | 214 | 35 | 19 | 370 | 390 | |
| 13 | 228 | 49 | 20 | 510 | 400 | |
| 14 | 243 | 64 | 20 | 670 | 410 | |
| 15 | 223 | 44 | 19 | 460 | 400 | |
| 16 | 234 | 55 | 20 | 570 | 400 | |
| 17 | 235 | 56 | 20 | 580 | 400 | |
| 18 | 178 | -1 | 18 | -10 | 370 | |
| 19 | 212 | 33 | 19 | 340 | 390 | |
| 20 | 208 | 29 | 19 | 300 | 390 | |
| | | | **Maximum:** | 2850 | | |
| | | | **Average:** | 677 | | |
| | | | **STDEV:** | 903 | | |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

# *Summary of $^{14}C$ Static Measurements (Biased)*

**Survey Unit:** 18
**Survey Date:** 4/19/2010

| Location | Gross (counts) | NCPM | NCPM Uncertainty (1σ) | Activity (dpm/100 cm²) | Uncertainty (2σ) (dpm/100 cm²) | |
|---|---|---|---|---|---|---|
| 1 | 161 | -18 | 18 | -190 | 360 | |
| 2 | 418 | 239 | 24 | 2500 | 510 | Ceramic |
| 3 | 435 | 256 | 24 | 2670 | 520 | Ceramic |
| 4 | 163 | -16 | 18 | -170 | 360 | |
| 5 | 164 | -15 | 18 | -160 | 360 | |
| 6 | 190 | 11 | 19 | 110 | 380 | |
| 7 | 199 | 20 | 19 | 210 | 380 | |
| 8 | 247 | 68 | 20 | 710 | 410 | |
| 9 | 197 | 18 | 19 | 190 | 380 | |
| 10 | 202 | 23 | 19 | 240 | 390 | |

**Maximum:** 2670
**Average:** 611
**STDEV:** 1074

## *Instrument Data and Analysis Parameters*

| | Model | Serial No | | | |
|---|---|---|---|---|---|
| Instrument: | 2360 | 141321 | Reference Material: | Source Jig | |
| Detector: | 43-68 | 148456 | Background: | 179 | cpm |
| Probe Area: | 126 | $cm^2$ | Background σ: | 12.4 | cpm |
| | | | Sample Analysis Time: | 1 | min |

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.002 cpm/dpm
MDC: 524 dpm/100 $cm^2$

## *Summary of Scan Results - $^3H$*

| Location | Number of records | Gross CPM Minimum | Gross CPM Maximum | Gross CPM Average | Gross CPM STDEV | Activity (dpm/100cm²) Minimum | Activity (dpm/100cm²) Maximum | Activity (dpm/100cm²) Average | Activity (dpm/100cm²) STDEV |
|---|---|---|---|---|---|---|---|---|---|
| SU 1 | 158 | 165 | 370 | 253 | 40 | -269 | 395 | 16 | 129 |
| SU 2 | 162 | 202 | 457 | 312 | 43 | -149 | 677 | 208 | 140 |
| SU 3 | 164 | 207 | 414 | 298 | 42 | -133 | 538 | 163 | 135 |
| SU 4 | 184 | 200 | 450 | 319 | 47 | -155 | 654 | 230 | 153 |
| SU 5 | 163 | 123 | 279 | 201 | 29 | -405 | 100 | -152 | 93 |
| SU 6 | 159 | 147 | 419 | 251 | 46 | -327 | 554 | 11 | 149 |
| SU 7 | 156 | 190 | 399 | 285 | 38 | -188 | 489 | 121 | 124 |
| SU 8 | 161 | 153 | 404 | 262 | 48 | -308 | 505 | 45 | 155 |
| SU 9 | 186 | 100 | 366 | 199 | 47 | -479 | 382 | -160 | 152 |
| SU 10 | 158 | 197 | 416 | 316 | 43 | -165 | 544 | 221 | 140 |
| SU 11 | 161 | 123 | 313 | 228 | 38 | -405 | 211 | -66 | 123 |
| SU 12 | 180 | 260 | 507 | 383 | 44 | 39 | 839 | 437 | 144 |
| SU 13 | 253 | 168 | 380 | 271 | 45 | -259 | 428 | 74 | 147 |
| SU 14 | 158 | 94 | 294 | 191 | 34 | -499 | 149 | -184 | 111 |
| SU 15 | 159 | 106 | 462 | 199 | 56 | -460 | 693 | -159 | 181 |
| SU 16 | 156 | 175 | 364 | 274 | 37 | -236 | 376 | 86 | 121 |
| SU 17 | 165 | 109 | 332 | 242 | 40 | -450 | 272 | -21 | 130 |
| SU 18 | 163 | 164 | 359 | 270 | 39 | -272 | 360 | 72 | 127 |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No |
|---|---|---|
| Instrument: | 2360 | 253237 |
| Detector: | 44-110 | 268330 |
| Probe Area: | 126 | $cm^2$ |

Reference Material: Source Jig
Background: 249 cpm
Background σ: 23.6 cpm
Scan speed: 1 detector width / 2 sec
Observation interval: 1 recorded measurement / 2 sec

Total Efficiency: 0.245 cpm/dpm
Total Efficiency Uncertainty: 0.020 cpm/dpm
$MDC_{scan}$: 780 dpm/100 $cm^2$

## *Summary of Scan Results - $^{14}C$*

| Location | Number of records | Gross CPM Minimum | Gross CPM Maximum | Gross CPM Average | Gross CPM STDEV | Activity (dpm/100cm$^2$) Minimum | Activity (dpm/100cm$^2$) Maximum | Activity (dpm/100cm$^2$) Average | Activity (dpm/100cm$^2$) STDEV |
|---|---|---|---|---|---|---|---|---|---|
| SU 1 | 160 | 183 | 474 | 304 | 62 | -183 | 475 | 90 | 141 |
| SU 2 | 159 | 181 | 386 | 285 | 43 | -188 | 276 | 48 | 97 |
| SU 3 | 153 | 98 | 456 | 207 | 64 | -375 | 434 | -130 | 144 |
| SU 4 | 165 | 160 | 413 | 272 | 46 | -235 | 337 | 19 | 104 |
| SU 5 | 156 | 187 | 345 | 261 | 33 | -174 | 183 | -7 | 74 |
| SU 6 | 168 | 133 | 364 | 235 | 40 | -296 | 226 | -65 | 91 |
| SU 7 | 189 | 142 | 354 | 229 | 36 | -276 | 203 | -79 | 81 |
| SU 8 | 191 | 163 | 417 | 261 | 44 | -228 | 346 | -6 | 100 |
| SU 9 | 161 | 138 | 346 | 246 | 40 | -285 | 185 | -40 | 90 |
| SU 10 | 170 | 203 | 417 | 307 | 36 | -138 | 346 | 96 | 82 |
| SU 11 | 165 | 173 | 377 | 258 | 43 | -206 | 255 | -14 | 97 |
| SU 12 | 234 | 157 | 443 | 266 | 54 | -242 | 405 | 4 | 122 |
| SU 13 | 157 | 185 | 366 | 267 | 38 | -179 | 231 | 7 | 87 |
| SU 14 | 152 | 133 | 325 | 218 | 42 | -296 | 138 | -104 | 94 |
| SU 15 | 155 | 130 | 306 | 226 | 35 | -303 | 95 | -87 | 79 |
| SU 16 | 191 | 211 | 418 | 297 | 39 | -120 | 348 | 74 | 88 |
| SU 17 | 159 | 177 | 368 | 268 | 43 | -197 | 235 | 8 | 96 |
| SU 18 | 158 | 180 | 392 | 287 | 43 | -190 | 289 | 51 | 96 |

## *Instrument Data and Analysis Parameters*

| | Model | Serial No |
|---|---|---|
| Instrument: | 2360 | 253258 |
| Detector: | 43-37 | 265544 |
| Probe Area: | 582 | cm$^2$ |

Reference Material: Source Jig
Background: 264 cpm
Background σ: 14.1 cpm
Scan speed: 1 detector width / 2 sec
Observation interval: 1 recorded measurement / 2 sec

Total Efficiency: 0.076 cpm/dpm
Total Efficiency Uncertainty: 0.001 cpm/dpm
$MDC_{scan}$: 399 dpm/100 cm$^2$

# APPENDIX C

## INSTRUMENT CERTIFICATIONS AND DAILY CHECKS

**Contents**

Designer and Manufacturer of Scientific and Industrial Instruments

# CERTIFICATE OF CALIBRATION

**LUDLUM MEASUREMENTS, INC.**
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER TIDEWATER INC COLUBIA MD ORDER NO. 20139509/341499 20139502

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 141321

Mfg. Ludlum Measurements, Inc. Model 43-68 Serial No. PR-148456

Cal. Date 26-Aug-09 Cal Due Date 26-Aug-10 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T 75 °F RH 20 % Alt 699.6 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC ☐ RS-232 Port OK
☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set see comments V

☑ HV Readout (2 points) Ref./Inst. 500 / 507 V Ref./Inst. 1500 / 1500 V

Firmware Version: 39010-20
Alpha Threshold: 120 mv
Beta Threshold: 4 mv
Beta Window: 44 mv
Overload Checked but not set
Instrument calibrated with a 39" cable.
High voltage set with detector disconnected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 999999
Beta Alarm: 999999
A/B Alarm: 999999
Model 2360 Date: 8/26/09
Calibration Date Due: 8/26/10

**COMMENTS:** Calibrated w/39" cable

See Attachment for Efficiencies.
Operating voltage for 43-68 = 1550v
Operating voltage for 44-110 = 1750v
Currently set for 44-110 operation.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

| RANGE/MULTIPLIER | REFERENCE CAL. POINT | INSTRUMENT REC'D "AS FOUND READING" | INSTRUMENT METER READING* |
|---|---|---|---|
| x1000 | 400kcpm | 400 | 400 |
| x1000 | 100kcpm | 95 | 95 |
| x100 | 40kcpm | 400 | 400 |
| x100 | 10kcpm | 95 | 95 |
| x10 | 4kcpm | 400 | 400 |
| x10 | 1kcpm | 95 | 95 |
| x1 | 400kcpm | 400 | 400 |
| x1 | 100kcpm | 100 | 100 |

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

| | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* | | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* |
|---|---|---|---|---|---|---|---|
| Digital Readout | 400kcpm | 39840 (07) | 39840 (6) | Log Scale | | | |
| | 40kcpm | 3985 | 3985 | | | | |
| | 4kcpm | 398 | 398 | | | | |
| | 400cpm | 40 | 40 | | | | |
| | 40cpm | 4 | 4 | | | | |

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1983

**Reference Instruments and/or Sources:** ☐ S-364/1122 ☐ 1131 ☐ 781 ☐ 089 ☐ 280 ☐ 80646
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E562 ☐ E561 ☐ 720 ☐ 734 ☐ 1818 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Th230an:1495 ☑ Beta S/N Tc99an:NI-EV,C14an: 113/-5/ ☐ Other

☑ m 500 S/N 50800 ☐ Oscilloscope S/N ☑ Multimeter S/N 83990502

Calibrated By: Charles Lisk Date 26 Aug 09

Reviewed By: Dennis Ackl Date 28 Aug 09


FORM C228 10/15/2008

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed

**Model 2360 Log Data  Date: 08/26/2009  Time: 03:49:41 PM  Page: 1**

---

```
Header 1: 1st flr
Header 2: Beta Statics
Header 3: 2360 #141321
Header 4: 43-68 #148456
Header 5:
Header 6:
Location: Argonne

Calibration Due Date: 08/26/2010
     Model 2360 Date: 08/26/2009
     Model 2360 Time: 02:58:27 PM

Logged Samples:  0

User PC Scaler Count Time: 1.0 minutes

       Alpha Ratemeter Alarm Setpoint:   999999
        Beta Ratemeter Alarm Setpoint:   999999
Alpha + Beta Ratemeter Alarm Setpoint:   999999

       Alpha Scaler Alarm Setpoint:   999999
        Beta Scaler Alarm Setpoint:   999999
Alpha + Beta Scaler Alarm Setpoint:   999999
```

# ATTACHMENT

Detector: 43-68 m:PR-148456

Eff. For Th230m: 1495, Eff. ≈ 20%4pi, Source count ≈ 4035cpm - 0cpm background
Source size= 19800dpm

Eff. For C14 m: 1131-51, Eff. ≈ 9%4pi, Source count ≈ 22622cpm - 191cpm background
Source size= 247191dpm

Detector: 44-110 m:PR-258430

Eff. For C14 m: 1131-51, Eff. ≈ 3.4%4pi, Source count ≈ 8717cpm - 251cpm background
Source size= 247191dpm

Lewis

Designer and Manufacturer of Scientific and Industrial Instruments

**LUDLUM MEASUREMENTS, INC.**
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

## *Bench Test Data For Detector*

Detector 44-110 Serial No. PR-258430

Customer TIDEWATER INC COLUBIA MD Order #. 20139509/341499

Counter 2360 Serial No. 141321 Counter Input Sensitivity 4 mV

Count Time 1 minute Distance Source to Detector Surface

Other Calibrated w/39" cable

| High Voltage | Background | Isotope $H^3$ Size 2300 dpm | Isotope $C^{14}$ Size 247191 dpm | Isotope Size | Isotope Size |
|---|---|---|---|---|---|
| 1725 | 259 | 1092 | 8528 | | |
| 1750 | 251 | 1234 | 8717 | | |
| 1775 | 452 | 1331 | 10948 | | |
| 1800 | 486 | 1018 | 9607 | | |

Signature Charles Lisle Date 26 Aug 09

Designer and Manufacturer of Scientific and Industrial Instruments

**LUDLUM MEASUREMENTS, INC.**
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

## *Bench Test Data For Detector*

Detector 43-68 Serial No. PR-148456 Order #. 20139509/341499

Customer TIDEWATER INC COLUBIA MD

Alpha Input Sensitivity 120 mV

Counter 2360 Serial No. 141321 Beta Input Sensitivity 4 mV

Count Time 1Minute Beta Window 44 mV

Other Calibrated w/39" cable Distance Source to Detector Surface

| High Voltage | Background | | Isotope Th230 Size 17800 dpm | | Isotope Tc99 Size 22599 dpm | | Isotope C14 Size 247191 dpm | |
|---|---|---|---|---|---|---|---|---|
| | Alpha | Beta | Alpha | Beta | Alpha | Beta | Alpha | Beta |
| 1500 | 0 | 118 | 3583 | 1245 | 1 | 6739 | 1 | 22336 |
| 1525 | 0 | 134 | 3848 | 1385 | 1 | 7184 | 0 | 23324 |
| 1550 | 0 | 191 | 4055 | 1440 | 5 | 7478 | 0 | 22622 |
| 1575 | 1 | 242 | 4198 | 1259 | 13 | 7053 | 10 | 19147 |
| 1600 | 2 | 297 | 4403 | 1137 | 59 | 6538 | 145 | 15979 |

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 38" cable.

☑ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Charles Lisk Date 26 Aug 09

FORM C49 04/08/2003

**Form RS-013.0-1**

**STANDARD DEVIATION DATA TABLE**

**SITE:** VAPH

| **Date:** | 04/15/10 | **For Month of:** | April |
|---|---|---|---|

| **Instrument Information** | | |
|---|---|---|
| Type/Serial # | 2360 | 141321 |
| **Probe/Serial #:** | 43-68 | 148456 |
| Calibration Due Date | 8/26/2010 | |
| Mode (count rate/dose rate) | Count rate | |
| Data Type (Source, Bkgd) | Bkgd | |

If the data type is a background for a specific material, list the material type

| **Source Information** | |
|---|---|
| Isotope | N/A |
| Serial # | N/A |
| 2π emission rate | N/A |

| D | C | C-(M) | $\|C-(M)\|^2$ |
|---|---|---|---|
| 1 | 192 | 13.2 | 174.2 |
| 2 | 176 | -2.8 | 7.8 |
| 3 | 170 | -8.8 | 77.4 |
| 4 | 177 | -1.8 | 3.2 |
| 5 | 190 | 11.2 | 125.4 |
| 6 | 172 | -6.8 | 46.2 |
| 7 | 169 | -9.8 | 96.0 |
| 8 | 204 | 25.2 | 635.0 |
| 9 | 188 | 9.2 | 84.6 |
| 10 | 193 | 14.2 | 201.6 |
| 11 | 168 | -10.8 | 116.6 |
| 12 | 162 | -16.8 | 282.2 |
| 13 | 162 | -16.8 | 282.2 |
| 14 | 166 | -12.8 | 163.8 |
| 15 | 180 | 1.2 | 1.4 |
| 16 | 181 | 2.2 | 4.8 |
| 17 | 199 | 20.2 | 408.0 |
| 18 | 165 | -13.8 | 190.4 |
| 19 | 180 | 1.2 | 1.4 |
| 20 | 182 | 3.2 | 10.2 |

Calculation Guidelines

1) Record number of data points (D) in the Data Table Summary (DTS).
2) Record the observed instrument reading ( C )
3) Sum Column C. Record in DTS.
4) Divide C by D. Record in DTS as Mean Net cpm (M)
5) Subtract (M) from each data point C. Record in C-(M) Column.
6) Square each C-(M). Record in $|C-(M)|^2$ Column
7) Total $|C-(M)|^2$ Column. Record in DTS.
8) Divide sum $|C-(M)|^2$ by D-1. Take the square root of the result and record as the Standard Deviation.
9) Multiply SD by 2 and by 3. Record.

Standard Deviation

| SD | 12.4 |
|---|---|
| 2 x SD | 24.8 |
| 3 x SD | 37.1 |

Data Table Summary

| # Data Points | Sum of C | Mn Net cpm (M) | Sum $\|C-(M)\|^2$ |
|---|---|---|---|
| 20 | 3576 | 178.8 | 2913.2 |

Performed by: Byron Bland

Reviewed by: Angel Reyes Date: 4/15/2010

**Form RS-013.0-1**

**STANDARD DEVIATION DATA TABLE**

**SITE:** VAPH

| **Date:** | 04/15/10 | **For Month of:** | April |
|---|---|---|---|

| **Instrument Information** | | |
|---|---|---|
| Type/Serial # | 2360 | 141321 |
| Probe/Serial #: | 43-68 | 148456 |
| Calibration Due Date | 8/26/2010 | |
| Mode (count rate/dose rate) | Count rate | |
| Data Type (Source, Bkgd) | Source | |

If the data type is a background for a specific material, list the material type

| **Source Information** | |
|---|---|
| Isotope | C-14 |
| Serial # | |
| 2π emission rate | N/A |

| D | C | C-(M) | $\|C-(M)\|^2$ |
|---|---|---|---|
| 1 | 1062 | -38.2 | 1455.4 |
| 2 | 1110 | 9.8 | 97.0 |
| 3 | 1079 | -21.2 | 447.3 |
| 4 | 1108 | 7.8 | 61.6 |
| 5 | 1109 | 8.8 | 78.3 |
| 6 | 1044 | -56.2 | 3152.8 |
| 7 | 1141 | 40.8 | 1668.7 |
| 8 | 1070 | -30.2 | 909.0 |
| 9 | 1138 | 37.8 | 1432.6 |
| 10 | 1082 | -18.2 | 329.4 |
| 11 | 1064 | -36.2 | 1306.8 |
| 12 | 1016 | -84.2 | 7081.2 |
| 13 | 1179 | 78.8 | 6217.3 |
| 14 | 1092 | -8.2 | 66.4 |
| 15 | 1113 | 12.8 | 165.1 |
| 16 | 1121 | 20.8 | 434.7 |
| 17 | 1149 | 48.8 | 2386.3 |
| 18 | 1129 | 28.8 | 832.3 |
| 19 | 1098 | -2.2 | 4.6 |
| 20 | 1099 | -1.2 | 1.3 |

Calculation Guidelines

1) Record number of data points (D) in the Data Table Summary (DTS).
2)Record the observed instrument reading ( C )
3) Sum Column C. Record in DTS.
4) Divide C by D. Record in DTS as Mean Net cpm (M)
5) Subtract (M) from each data point C. Record in C-(M) Column.
6) Square each C-(M). Record in $|C-(M)|^2$ Column
7) Total $|C-(M)|^2$ Column. Record in DTS.
8) Divide sum $|C-(M)|^2$ by D-1. Take the square root of the result and record as the Standard Deviation.
9) Multiply SD by 2 and by 3. Record.

Standard Deviation

| | |
|---|---|
| SD | 38.5 |
| 2 x SD | 77.0 |
| 3 x SD | 115.4 |

Data Table Summary

| # Data Points | Sum of C | Mn Net cpm (M) | Sum $\|C-(M)\|^2$ |
|---|---|---|---|
| 20 | 22003 | 1100.2 | 28128.6 |

Performed by: Byron Bland

Reviewed by: Angel Reyes Date: 4/15/2010

**Form RS-13.0-3**

**DAILY INSTRUMENT RESPONSE CHECK**
**SITE:** VAPH

| Date: | 04/15/10 | For Month of: April |
|---|---|---|

| Instrument Information | | |
|---|---|---|
| Type/Serial # | 2360 | 141321 |
| Probe/Serial #: | 43-68 | 148456 |
| Calibration Due: | 8/26/2010 | |

| Source Information | |
|---|---|
| Isotope | C-14 |
| Serial Number | 0 |
| 2π emission rate | |

| DATE | TIME | BACKGROUND CPM | SOURCE CPM | COMMENTS | TECH INITIALS |
|---|---|---|---|---|---|
| 4/15/2010 | 13:00 | 179 | 1100 | BOD | BB |
| 4/15/2010 | 19:30 | 159 | 998 | EOD | BB |
| 4/16/2010 | 8:15 | 160 | 1036 | BOD | BB |
| 4/16/2010 | 19:00 | 181 | 1201 | EOD | BB |
| 4/17/2010 | 7:25 | 153 | 1153 | BOD | ALR |
| 4/17/2010 | 18:45 | 169 | 1054 | EOD | ALR |
| 4/19/2010 | 9:00 | 157 | 954 | BOD | BB |
| 4/19/2010 | 18:30 | 193 | 1006 | EOD | BB |
| 4/20/2010 | 8:07 | 182 | 1137 | BOD | BB |
| 4/20/2010 | 19:00 | 168 | 1097 | EOD | BB |
| 4/21/2010 | 7:35 | 181 | 1275 | BOD | BB |
| 4/21/2010 | 19:15 | 167 | 1116 | EOD | BB |

| Mean from form RS-13.0-1 | 178.8 |
|---|---|

| Mean from form RS-13.0-1 | 1100.15 |
|---|---|

| Background Acceptance Limits | | | |
|---|---|---|---|
| M-20%= | 143.04 | M+20% = | 214.56 |

| Source Acceptance Limits | | | |
|---|---|---|---|
| M-20% = | 880.12 | M+20% = | 1320.18 |

Reviewed by: Angel Reyes

Date: 4/21/2010

Designer and Manufacturer of Scientific and Industrial Instruments

# CERTIFICATE OF CALIBRATION

**LUDLUM MEASUREMENTS, INC.**
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

20139502

CUSTOMER TIDEWATER INC COLUBIA MD ORDER NO. 20139509/341499

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. CS 235237 253237

Mfg. Ludlum Measurements, Inc. Model 43-68 Serial No. PR-148454

Cal. Date 26-Aug-09 Cal Due Date 26-Aug-10 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 20 % Alt 689.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☑ Reset ck. ☑ Window Operation ☑ Geotropism
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC ☐ RS-232 Port OK
☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89 ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97

Instrument Volt Set xc connects V

☑ HV Readout (2 points) Ref./Inst 500 / 512 V Ref./Inst 1500 / 1500 V

Firmware Version: 39010-24
Alpha Threshold: 120 mv
Beta Threshold: 4 mv
Beta Window: 50 mv
Overload Checked but not set
Instrument calibrated with a 39" cable
High voltage set with detector disconnected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 999999
Beta Alarm: 2115
A/B Alarm: 999999
Model 2360 Date: 8/26/09
Calibration Date Due: 8/26/10

**COMMENTS:**
See Attachment for Efficiencies.
Operating voltage for 43-68 = 1575v
Operating voltage for 44-110 = 1700v
Currently set for 44-110 operation.

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

| RANGE/MULTIPLIER | REFERENCE CAL. POINT | INSTRUMENT REC'D "AS FOUND READING" | INSTRUMENT METER READING* |
|---|---|---|---|
| x1000 | 400kcpm | 400 | 400 |
| x1000 | 100kcpm | 100 | 100 |
| x100 | 40kcpm | 400 | 400 |
| x100 | 10kcpm | 100 | 100 |
| x10 | 4kcpm | 400 | 400 |
| x10 | 1kcpm | 100 | 100 |
| x1 | 400kcpm | 400 | 400 |
| x1 | 100kcpm | 100 | 100 |

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

| | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* | | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* |
|---|---|---|---|---|---|---|---|
| Digital Readout | 400kcpm | 39872 (c) | 39872 (c) | Log Scale | | | |
| | 40kcpm | 3987 | 3987 | | | | |
| | 4kcpm | 399 | 399 | | | | |
| | 400cpm | 40 | 40 | | | | |
| | 40cpm | 4 | 4 | | | | |

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

**Reference Instruments and/or Sources:** ☐ S-364/1122 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E561 ☐ 720 ☐ 734 ☐ 1618 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Th230sn:1495 ☑ Beta S/N Tc99sn:NI-EV,C14sn:I/3-51 ☐ Other

☑ m 500 S/N 50800 ☐ Oscilloscope S/N ☑ Multimeter S/N 83990502

Calibrated By: Charles Disk Date 26 Aug 09

Reviewed By: Duane Arn Date 28 Aug 09


FORM C226 10/15/2008

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer of Scientific and Industrial Instruments

**LUDLUM MEASUREMENTS, INC.**
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

## *Bench Test Data For Detector*

Detector 44-110 Serial No. PR-268330

Customer TIDEWATER INC COLUBIA MD Order #. 20139509/341499

Counter 2360 Serial No. ~~235237~~ 253237 Counter Input Sensitivity 4 mV

Count Time 1 minute Distance Source to Detector Surface

Other Calibrated w/ 39" cable

| High Voltage | Background | Isotope H3 Size 2300 dpm | Isotope C14 Size 247191 dpm | Isotope Size | Isotope Size |
|---|---|---|---|---|---|
| 1650 | 265 | 888 | 18854 | | |
| 1675 | 271 | 974 | 14887 | | |
| 1700 | 278 | 1125 | 10650 | | |
| 1725 | 315 | 1260 | 8028 | | |
| 1750 | 391 | 1357 | 7915 | | |
| 1775 | 447 | 1600 | 9899 | | |

Signature Charles Dick Date 26 Aug 09

FORM CAL 04/08/2009

• *Serving The Nuclear Industry Since 1962* •

**Model 2360 Log Data  Date: 08/26/2009  Time: 05:26:17 PM  Page: 1**

---

```
Header 1: Bkg Counts
Header 2: SN: 253237
Header 3: SN: PR-148454
Header 4: sample logged
Header 5: to ensure
Header 6: hndle operation
Location: Table 007

Calibration Due Date: 08/26/2010
     Model 2360 Date: 08/26/2009
     Model 2360 Time: 05:42:28 PM

Logged Samples:  0

User PC Scaler Count Time: 1.0 minutes

       Alpha Ratemeter Alarm Setpoint:   999999
        Beta Ratemeter Alarm Setpoint:     2115
Alpha + Beta Ratemeter Alarm Setpoint:   999999

       Alpha Scaler Alarm Setpoint:   999999
        Beta Scaler Alarm Setpoint:   999999
Alpha + Beta Scaler Alarm Setpoint:   999999
```

# ATTACHMENT

Detector: 43-68 m:PR-148434

Eff. For Th230m: 1495, Eff. ≈ 19.3%4pi, Source count ≈ 3827cpm - 1cpm background
Source size= 19800dpm

Eff. For C14 m: 1131-51, Eff. ≈ 8.4%4pi, Source count ≈ 21141cpm - 160cpm background
Source size= 247191dpm

Detector: 44-110 m:PR-268330

Eff. For C14 m: 1131-51, Eff. ≈ 4.1%4pi, Source count ≈ 10650cpm - 278cpm background
Source size= 247191dpm

Designer and Manufacturer of Scientific and Industrial Instruments

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POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

## *Bench Test Data For Detector*

Detector 43-68 Serial No. PR-148454 Order #. 20139509/341499
Customer TIDEWATER INC COLUBIA MD Alpha Input Sensitivity 120 mV
Counter 2360 Serial No. 253237 Beta Input Sensitivity 4 mV
Count Time 1Minute Beta Window 50 mV
Other Calibrated w/ 39" cable Distance Source to Detector Surface

| High Voltage | Background | | Isotope Th230 Size 17800 dpm | | Isotope Tc99 Size 22599 dpm | | Isotope C14 Size 247191 dpm | |
|---|---|---|---|---|---|---|---|---|
| | Alpha | Beta | Alpha | Beta | Alpha | Beta | Alpha | Beta |
| 1550 | 2 | 108 | 3450 | 1350 | 4 | 6895 | 1 | 20756 |
| 1575 | 1 | 160 | 3827 | 1381 | 2 | 7393 | 1 | 21141 |
| 1600 | 3 | 218 | 3838 | 1461 | 13 | 7206 | 15 | 19273 |
| 1625 | 1 | 249 | 4155 | 1287 | 70 | 6675 | 139 | 17026 |

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.
☑ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Charles Risk Date 26 Aug 09

FORM C-68 04/09/2003

*Serving The Nuclear Industry Since 1962*

**Form RS-013.0-1**

## STANDARD DEVIATION DATA TABLE

**SITE:** VAPH

| Date: | 04/15/10 | For Month of: | April |
|---|---|---|---|

| Instrument Information | | |
|---|---|---|
| Type/Serial # | 2360 | 253237 |
| Probe/Serial #: | 44-110 | 268330 |
| Calibration Due Date | 8/26/2010 | |
| Mode (count rate/dose rate) | Count rate | |
| Data Type (Source, Bkgd) | Bkgd | |

If the data type is a background for a specific material, list the material type

| Source Information | |
|---|---|
| Isotope | N/A |
| Serial # | N/A |
| 2π emission rate | N/A |

| D | C | C-(M) | $\|C-(M)\|^2$ |
|---|---|---|---|
| 1 | 287 | 38.3 | 1463.1 |
| 2 | 280 | 31.3 | 976.6 |
| 3 | 252 | 3.3 | 10.6 |
| 4 | 249 | 0.3 | 0.1 |
| 5 | 245 | -3.8 | 14.1 |
| 6 | 253 | 4.3 | 18.1 |
| 7 | 265 | 16.3 | 264.1 |
| 8 | 260 | 11.3 | 126.6 |
| 9 | 267 | 18.3 | 333.1 |
| 10 | 248 | -0.8 | 0.6 |
| 11 | 273 | 24.3 | 588.1 |
| 12 | 288 | 39.3 | 1540.6 |
| 13 | 218 | -30.8 | 945.6 |
| 14 | 238 | -10.8 | 115.6 |
| 15 | 205 | -43.8 | 1914.1 |
| 16 | 237 | -11.8 | 138.1 |
| 17 | 227 | -21.8 | 473.1 |
| 18 | 236 | -12.8 | 162.6 |
| 19 | 233 | -15.8 | 248.1 |
| 20 | 214 | -34.8 | 1207.6 |

### Calculation Guidelines

1) Record number of data points (D) in the Data Table Summary (DTS).
2) Record the observed instrument reading ( C )
3) Sum Column C. Record in DTS.
4) Divide C by D. Record in DTS as Mean Net cpm (M)
5) Subtract (M) from each data point C. Record in C-(M) Column.
6) Square each C-(M). Record in $|C-(M)|^2$ Column
7) Total $|C-(M)|^2$ Column. Record in DTS.
8) Divide sum $|C-(M)|^2$ by D-1. Take the square root of the result and record as the Standard Deviation.
9) Multiply SD by 2 and by 3. Record.

### Standard Deviation

| | |
|---|---|
| SD | 23.6 |
| 2 x SD | 47.1 |
| 3 x SD | 70.7 |

### Data Table Summary

| # Data Points | Sum of C | Mn Net cpm (M) | Sum $\|C-(M)\|^2$ |
|---|---|---|---|
| 20 | 4975 | 248.8 | 10539.8 |

Performed by: Byron Bland

Reviewed by: Angel Reyes Date: 4/15/2010

**Form RS-013.0-1**

**STANDARD DEVIATION DATA TABLE**

**SITE:** VAPH

| **Date:** | **04/15/10** | **For Month of:** | April |
|---|---|---|---|

| **Instrument Information** | | |
|---|---|---|
| Type/Serial # | 2360 | 253237 |
| Probe/Serial #: | 44-110 | 268330 |
| Calibration Due Date | 8/26/2010 | |
| Mode (count rate/dose rate) | Count rate | |
| Data Type (Source, Bkgd) | Source | |

If the data type is a background for a specific material, list the material type

| **Source Information** | |
|---|---|
| Isotope | Fe-55 |
| Serial # | |
| 2π emission rate | N/A |

| D | C | C-(M) | $\|C-(M)\|^2$ |
|---|---|---|---|
| 1 | 365186 | 49083.1 | 2409150705.6 |
| 2 | 367381 | 51278.1 | 2629443539.6 |
| 3 | 369382 | 53279.1 | 2838662496.8 |
| 4 | 358436 | 42333.1 | 1792091355.6 |
| 5 | 332675 | 16572.1 | 274634498.4 |
| 6 | 333879 | 17776.1 | 315989731.2 |
| 7 | 316961 | 858.1 | 736335.6 |
| 8 | 285701 | -30401.9 | 924275523.6 |
| 9 | 287645 | -28457.9 | 809852072.4 |
| 10 | 289586 | -26516.9 | 703145985.6 |
| 11 | 295705 | -20397.9 | 416074324.4 |
| 12 | 298432 | -17670.9 | 312260706.8 |
| 13 | 300676 | -15426.9 | 237989243.6 |
| 14 | 300821 | -15281.9 | 233536467.6 |
| 15 | 302253 | -13849.9 | 191819730.0 |
| 16 | 301673 | -14429.9 | 208222014.0 |
| 17 | 302630 | -13472.9 | 181519034.4 |
| 18 | 303659 | -12443.9 | 154850647.2 |
| 19 | 304326 | -11776.9 | 138695373.6 |
| 20 | 305051 | -11051.9 | 122144493.6 |

Calculation Guidelines

1) Record number of data points (D) in the Data Table Summary (DTS).
2) Record the observed instrument reading ( C )
3) Sum Column C. Record in DTS.
4) Divide C by D. Record in DTS as Mean Net cpm (M)
5) Subtract (M) from each data point C. Record in C-(M) Column.
6) Square each C-(M). Record in $|C-(M)|^2$ Column
7) Total $|C-(M)|^2$ Column. Record in DTS.
8) Divide sum $|C-(M)|^2$ by D-1. Take the square root of the result and record as the Standard Deviation.
9) Multiply SD by 2 and by 3. Record.

Standard Deviation

| | |
|---|---|
| SD | 27999.1 |
| 2 x SD | 55998.3 |
| 3 x SD | 83997.4 |

Data Table Summary

| # Data Points | Sum of C | Mn Net cpm (M) | Sum $\|C-(M)\|^2$ |
|---|---|---|---|
| 20 | 6322058 | 316102.9 | 14895094279.8 |

Performed by: Byron Bland

Reviewed by: Angel Reyes Date: 4/15/2010

**Form RS-13.0-3**

**DAILY INSTRUMENT RESPONSE CHECK**
**SITE:** VAPH

| Date: | 4-15-120 | For Month of: April |
|---|---|---|

| Instrument Information | | |
|---|---|---|
| Type/Serial # | 2360 | 253237 |
| Probe/Serial #: | 44-110 | 268330 |
| Calibration Due: | 8/26/2010 | |

| Source Information | |
|---|---|
| Isotope | Fe-55 |
| Serial Number | 0 |
| 2π emission rate | |

| DATE | TIME | BACKGROUND CPM | SOURCE CPM | COMMENTS | TECH INITIALS |
|---|---|---|---|---|---|
| 4/15/2010 | 13:00 | 249 | 316103 | BOD | BB |
| 4/15/2010 | 19:30 | 241 | 300197 | EOD | BB |
| 4/16/2010 | 8:15 | 234 | 364718 | BOD | BB |
| 4/16/2010 | 19:00 | 260 | 329102 | EOD | BB |
| 4/17/2010 | 7:25 | 222 | 329463 | BOD | ALR |
| 4/17/2010 | 18:45 | 275 | 317567 | EOD | ALR |
| 4/19/2010 | 9:00 | 297 | 293806 | BOD | BB |
| 4/19/2010 | 18:30 | 239 | 321116 | EOD | BB |
| 4/20/2010 | 8:07 | 253 | 290129 | BOD | BB |
| 4/20/2010 | 19:00 | 259 | 359321 | EOD | BB |
| 4/21/2010 | 7:35 | 272 | 333912 | BOD | BB |
| 4/21/2010 | 19:15 | 288 | 299452 | EOD | BB |
| | | | | | |
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| | | | | | |

| Mean from form RS-13.0-1 | 248.75 |
|---|---|

| Mean from form RS-13.0-1 | 316102.9 |
|---|---|

| Background Acceptance Limits | | | |
|---|---|---|---|
| M-20%= | 199 | M+20% = | 298.5 |

| Source Acceptance Limits | | | |
|---|---|---|---|
| M-20% = | 252882.32 | M+20% = | 379323 |

Reviewed by: Angel Reyes

Date: 4/21/2010

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

of Scientific and Industrial Instruments

# CERTIFICATE OF CALIBRATION

CUSTOMER TIDEWATER INC ORDER NO. 20144239/344319

Mfg. Ludlum Measurements, Inc. Model 2360 Serial No. 253258

Mfg. Ludlum Measurements, Inc. Model 43-37 Serial No. PR-265544

Cal. Date 20-Nov-09 Cal Due Date 20-Nov-10 Cal. Interval 1 Year Meterface 202-855

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 20 % Alt 701.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

| | | | |
|---|---|---|---|
| ☑ Mechanical ck. | ☑ Meter Zeroed | ☐ Background Subtract | ☐ Input Sens. Linearity |
| ☐ F/S Resp. ck | ☑ Reset ck. | ☑ Window Operation | ☑ Geotropism |
| ☑ Audio ck. | ☐ Alarm Setting ck. | ☑ Batt. ck. (Min. Volt) 2.2 VDC | ☐ RS-232 Port OK |

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 1575 V

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 1500 / 1500 V

Firmware Version: 39010-24
Alpha Threshold: 100 mv
Beta Threshold: 4 mv
Beta Window: 40 mv
Overload checked but not set
Instrument calibrated with a 39" cable.
High voltage set with detector disconnected

(EEPROM Settings)
User Time: 1.0
Alpha Alarm: 999999
Beta Alarm: 999999
A/B Alarm: 999999
Model 2360 Date: 11/20/09
Calibration Date Due: 11/20/10

**COMMENTS:**
Eff. for Tc99sn: NI-EV ≈ 43% 2pi
Eff. for C14 sn: 1131-51 ≈ 17.5% 2pi

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

| RANGE/MULTIPLIER | REFERENCE CAL. POINT | INSTRUMENT REC'D "AS FOUND READING" | INSTRUMENT METER READING* |
|---|---|---|---|
| x1000 | 400kcpm | 400 | 400 |
| x1000 | 100kcpm | 100 | 100 |
| x100 | 40kcpm | 400 | 400 |
| x100 | 10kcpm | 100 | 100 |
| x10 | 4kcpm | 400 | 400 |
| x10 | 1kcpm | 100 | 100 |
| x1 | 400kcpm | 400 | 400 |
| x1 | 100kcpm | 100 | 100 |

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

| | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* | | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* |
|---|---|---|---|---|---|---|---|
| Digital Readout | 400kcpm | 39825 (0) | 39825 (0) | Log Scale | | | |
| | 40kcpm | 3983 | 3983 | | | | |
| | 4kcpm | 398 | 398 | | | | |
| | 400cpm | 40 | 40 | | | | |
| | 40cpm | 4 | 4 | | | | |

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978 State of Texas Calibration License No. LO-1963

**Reference Instruments and/or Sources:** ☐ S-394/1122 ☐ 1131 ☐ 781 ☐ 059 ☐ 280 ☐ 60646
Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ 720 ☐ 734 ☐ 1616 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Pu239sn:8744 ☑ Beta S/N Tc99sn:NI-EV, C14 SN 1131-51 ☐ Other

☑ m 500 S/N 50800 ☐ Oscilloscope S/N ☑ Multimeter S/N 83990502

Calibrated By: Charles Arsik Date 20 Nov 09

Reviewed By: Brandi Hein Date 20 Nov 09


FORM C228 10/15/2008

AC Inst. Only ☐ Passed Dielectric (Hi-Pot) and Continuity Test ☐ Failed:

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 325-235-5494
501 OAK STREET FAX NO. 325-235-4672
SWEETWATER, TEXAS 79556, U.S.A.



## Bench Test Data For Detector

Detector 43-37 Serial No. PR-265544 Order #. 20144239/344319

Customer TIDEWATER INC Alpha Input Sensitivity 100 mV

Counter 2360 Serial No. 253258 Beta Input Sensitivity 4 mV

Count Time 1Minute Beta Window 40 mV

Other _____ Distance Source to Detector Surface

| High Voltage | Background | | Isotope Pu 239 Size 186000cpm | | Isotope Tc 99 Size 14100cpm | | Isotope C14 Size 123592cp | |
|---|---|---|---|---|---|---|---|---|
| | Alpha | Beta | Alpha | Beta | Alpha | Beta | Alpha | Beta |
| 1525 | 3 | 209 | 65583 | 3387 | 4 | 4578 | 2 | 16792 |
| 1550 | 3 | 275 | 70758 | 3630 | 2 | 5391 | 3 | 19295 |
| 1575 | 3 | 304 | 74898 | 3671 | 7 | 6359 | 4 | 22007 |
| 1600 | 9 | 431 | 80235 | 4066 | 4 | 7331 | 5 | 23924 |

☐ Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

☑ Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature Charles Lisk Date 20 Nov 09

FORM C4B 04/09/2003

Model 2360 Log Data  Date: 11/20/2009  Time: 11:59:21 AM

---

Header 1: exterior
Header 2: a-b
Header 3: 2360 #253258
Header 4: 43-37#PR265544
Header 5:
Header 6:
Location: window

Calibration Due Date: 11/20/2010
Model 2360 Date: 11/20/2009
Model 2360 Time: 11:01:32 AM

Logged Samples: 0

User PC Scaler Count Time: 2.5 minutes

| | |
|---|---|
| Alpha Ratemeter Alarm Setpoint: | 999999 |
| Beta Ratemeter Alarm Setpoint: | 999999 |
| Alpha + Beta Ratemeter Alarm Setpoint: | 999999 |
| Alpha Scaler Alarm Setpoint: | 999999 |
| Beta Scaler Alarm Setpoint: | 999999 |
| Alpha + Beta Scaler Alarm Setpoint: | 999999 |

**Form RS-013.0-1**

**STANDARD DEVIATION DATA TABLE**

SITE: VAPH

| Date: | 04/15/10 | For Month of: | April |
|---|---|---|---|

| Instrument Information | | |
|---|---|---|
| Type/Serial # | 2360 | 253258 |
| Probe/Serial #: | 43-37 | 265544 |
| Calibration Due Date | 11/20/2010 | |
| Mode (count rate/dose rate) | Count rate | |
| Data Type (Source, Bkgd) | Bkgd | |

If the data type is a background for a specific material, list the material type

| Source Information | |
|---|---|
| Isotope | N/A |
| Serial # | N/A |
| 2π emission rate | N/A |

| D | C | C-(M) | $\|C-(M)\|^2$ |
|---|---|---|---|
| 1 | 255 | -9.0 | 81.0 |
| 2 | 264 | 0.0 | 0.0 |
| 3 | 269 | 5.0 | 25.0 |
| 4 | 259 | -5.0 | 25.0 |
| 5 | 264 | 0.0 | 0.0 |
| 6 | 273 | 9.0 | 81.0 |
| 7 | 252 | -12.0 | 144.0 |
| 8 | 280 | 16.0 | 256.0 |
| 9 | 276 | 12.0 | 144.0 |
| 10 | 279 | 15.0 | 225.0 |
| 11 | 259 | -5.0 | 25.0 |
| 12 | 268 | 4.0 | 16.0 |
| 13 | 268 | 4.0 | 16.0 |
| 14 | 280 | 16.0 | 256.0 |
| 15 | 271 | 7.0 | 49.0 |
| 16 | 253 | -11.0 | 121.0 |
| 17 | 281 | 17.0 | 289.0 |
| 18 | 232 | -32.0 | 1024.0 |
| 19 | 232 | -32.0 | 1024.0 |
| 20 | 265 | 1.0 | 1.0 |

Calculation Guidelines

1) Record number of data points (D) in the Data Table Summary (DTS).
2)Record the observed instrument reading ( C )
3) Sum Column C. Record in DTS.
4) Divide C by D. Record in DTS as Mean Net cpm (M)
5) Subtract (M) from each data point C. Record in C-(M) Column.
6) Square each C-(M). Record in $|C-(M)|^2$ Column
7) Total $|C-(M)|^2$ Column. Record in DTS.
8) Divide sum $|C-(M)|^2$ by D-1. Take the square root of the result and record as the Standard Deviation.
9) Multiply SD by 2 and by 3. Record.

Standard Deviation

| | |
|---|---|
| SD | 14.1 |
| 2 x SD | 28.3 |
| 3 x SD | 42.4 |

Data Table Summary

| # Data Points | Sum of C | Mn Net cpm (M) | Sum $\|C-(M)\|^2$ |
|---|---|---|---|
| 20 | 5280 | 264.0 | 3802.0 |

Performed by: Byron Bland

Reviewed by: Angel Reyes Date: 4/15/2010

**Form RS-013.0-1**

**STANDARD DEVIATION DATA TABLE**

**SITE:** VAPH

| **Date:** | 04/15/10 | **For Month of:** | April |
|---|---|---|---|

| Instrument Information | | |
|---|---|---|
| Type/Serial # | 2360 | 253258 |
| Probe/Serial #: | 43-37 | 265544 |
| Calibration Due Date | 11/20/2010 | |
| Mode (count rate/dose rate) | Count rate | |
| Data Type (Source, Bkgd) | Source | |

If the data type is a background for a specific material, list the material type

| Source Information | |
|---|---|
| Isotope | C-14 |
| Serial # | |
| 2π emission rate | N/A |

| D | C | C-(M) | $\|C-(M)\|^2$ |
|---|---|---|---|
| 1 | 6041 | 172.1 | 29601.2 |
| 2 | 6050 | 181.1 | 32779.1 |
| 3 | 5937 | 68.1 | 4630.8 |
| 4 | 5920 | 51.1 | 2606.1 |
| 5 | 5870 | 1.1 | 1.1 |
| 6 | 5818 | -50.9 | 2595.9 |
| 7 | 5928 | 59.1 | 3486.9 |
| 8 | 5838 | -30.9 | 957.9 |
| 9 | 5936 | 67.1 | 4495.7 |
| 10 | 5770 | -98.9 | 9791.1 |
| 11 | 5800 | -68.9 | 4754.1 |
| 12 | 5957 | 88.1 | 7752.8 |
| 13 | 5798 | -70.9 | 5033.9 |
| 14 | 5888 | 19.1 | 362.9 |
| 15 | 5847 | -21.9 | 481.8 |
| 16 | 5708 | -161.0 | 25904.9 |
| 17 | 5841 | -27.9 | 781.2 |
| 18 | 5913 | 44.1 | 1940.4 |
| 19 | 5692 | -177.0 | 31311.3 |
| 20 | 5827 | -41.9 | 1759.8 |

Calculation Guidelines

1) Record number of data points (D) in the Data Table Summary (DTS).
2)Record the observed instrument reading ( C )
3) Sum Column C. Record in DTS.
4) Divide C by D. Record in DTS as Mean Net cpm (M)
5) Subtract (M) from each data point C. Record in C-(M) Column.
6) Square each C-(M). Record in $|C-(M)|^2$ Column
7) Total $|C-(M)|^2$ Column. Record in DTS.
8) Divide sum $|C-(M)|^2$ by D-1. Take the square root of the result and record as the Standard Deviation.
9) Multiply SD by 2 and by 3. Record.

Standard Deviation

| | |
|---|---|
| SD | 94.9 |
| 2 x SD | 189.8 |
| 3 x SD | 284.6 |

Data Table Summary

| # Data Points | Sum of C | Mn Net cpm (M) | Sum $\|C-(M)\|^2$ |
|---|---|---|---|
| 20 | 117379 | 5869.0 | 171029.0 |

Performed by: Byron Bland

Reviewed by: Angel Reyes Date: 4/15/2010

**Form RS-13.0-3**

**DAILY INSTRUMENT RESPONSE CHECK**
**SITE:** VAPH

| **Date:** | **4-15-120** | **For Month of: April** |
|---|---|---|

| **Instrument Information** | | |
|---|---|---|
| Type/Serial # | 2360 | 253258 |
| Probe/Serial #: | 43-37 | 265544 |
| Calibration Due: | 11/20/2010 | |

| **Source Information** | |
|---|---|
| Isotope | C-14 |
| Serial Number | 0 |
| 2π emission rate | |

| DATE | TIME | BACKGROUND CPM |
|---|---|---|
| 4/15/2010 | 13:00 | 264 |
| 4/15/2010 | 19:30 | 279 |
| 4/16/2010 | 8:15 | 222 |
| 4/16/2010 | 19:00 | 249 |
| 4/17/2010 | 7:25 | 232 |
| 4/17/2010 | 18:45 | 269 |
| 4/19/2010 | 9:00 | 227 |
| 4/19/2010 | 18:30 | 231 |
| 4/20/2010 | 8:07 | 249 |
| 4/20/2010 | 19:00 | 266 |
| 4/21/2010 | 7:35 | 234 |
| 4/21/2010 | 19:15 | 300 |

| SOURCE CPM | COMMENTS | TECH INITIALS |
|---|---|---|
| 5869 | BOD | BB |
| 5577 | EOD | BB |
| 5526 | BOD | BB |
| 4925 | EOD | BB |
| 6565 | BOD | ALR |
| 5909 | EOD | ALR |
| 5105 | BOD | BB |
| 5989 | EOD | BB |
| 5613 | BOD | BB |
| 5883 | EOD | BB |
| 5234 | BOD | BB |
| 6101 | EOD | BB |

| Mean from form RS-13.0-1 | 264 |
|---|---|

| Background Acceptance Limits | | | |
|---|---|---|---|
| M-20%= | 211.2 | M+20% = | 316.8 |

| Mean from form RS-13.0-1 | 5868.95 |
|---|---|

| Source Acceptance Limits | | | |
|---|---|---|---|
| M-20% = | 4695.16 | M+20% = | 7042.74 |

Reviewed by: Angel Reyes

Date: 4/21/2010

# APPENDIX D

## SMEAR RESULTS

RSO, Inc.

Radiation Service Organization

May 4, 2010

Claude Wiblin
Tidewater Chesapeake Nuclear
7161 Columbia Gateway Drive
Columbia, MD 21046

RE: Project VAPH #CN118-000

Dear Mr. Wiblin,

Attached is the laboratory analytical report for samples received on 4/21/10 along with a copy of the Chain of Custody forms.

The analytical results are for samples collected on the following date(s) as shown on the Chain of Custody:

19-Apr-10

Call me if you have any questions or need additional information.

Sincerely,

James W. Dean
Manager, Radiation Safety Services
Radiation Safety Officer

P.O. Box 1450, Laurel, Maryland 20725-1450
Washington (301) 953-2482 Fax (301) 498-3017 Baltimore (410) 792-7444

# RSO, Inc. CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

5204 Minnick Road • Laurel, Maryland 20707 • 301-953-2482 • 410-792-7444 • FAX 301-498-3017

| | | |
|---|---|---|
| NAME: Angel "Chico" Reyes | CONTRACT/P.O. NUMBER: | (LAB USE ONLY) LAB CONTROL #: REVIEWED BY: 2010-254 |
| ADDRESS: 7161 Columbia Gateway Dr. | SAMPLE TURNAROUND TIME: | |
| Columbia, Md. 21046 | PROJECT NAME#: VAPH #CN118-000 | |
| | COMMENTS: | SAMPLER: |
| PHONE: 610-310-1031 FAX: | | |

| SAMPLE ID | SAMPLE LOCATION | MATRIX | CONTAINER DESCRIPTION | # of CONTAINERS | DATE | TIME | ANALYSIS REQUIRED/COMMENTS |
|---|---|---|---|---|---|---|---|
| VAC-1,2 | | LSC | 7ml LSC vial | 2 | 4/19/2010 | 16:00 | C14, H3 |
| 1-2,4,6,19 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 2-2,4,6,8,20 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 3-2,4,6,19 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 4-2,4,6,8, 20 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 5-2,4,6,19 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 6-2,4,6,19 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 7-2,4,6,8,20 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 8-2,4,6,8,20 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 9-2,4,6,8,20 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 10-21,23,25,27,29,31 | | LSC | 7ml LSC vial | 6 | 4/19/2010 | 16:00 | C14, H3 |
| 11-21,23,25,27,29,31 | | LSC | 7ml LSC vial | 6 | 4/19/2010 | 16:00 | C14, H3 |

| | | | | |
|---|---|---|---|---|
| TRANSFERRED BY: | RECEIVED BY: | DATE 4/20/10 | TIME 16:30 | REMARKS: |
| TRANSFERRED BY: | RECEIVED BY: | DATE 4/21 | TIME 11:00 | |
| TRANSFERRED BY: | RECEIVED BY: | DATE | TIME | |

# RSO, Inc. CHAIN OF CUSTODY / SAMPLE INFORMATION FORM

5204 Minnick Road • Laurel, Maryland 20707 • 301-953-2482 • 410-792-7444 • FAX 301-498-3017

| | | |
|---|---|---|
| NAME: Angel "Chico" Reyes | CONTRACT/P.O. NUMBER: | (LAB USE ONLY) LAB CONTROL #: REVIEWED BY: 2010-254 |
| ADDRESS: 7161 Columbia Gateway Dr. | SAMPLE TURNAROUND TIME: | |
| Columbia, Md. 21046 | PROJECT NAME/#: VAPH #CN118-000 | |
| | COMMENTS: | SAMPLER: |
| PHONE: 610-310-1031 FAX: | | |

| SAMPLE ID | SAMPLE LOCATION | MATRIX | CONTAINER DESCRIPTION | # of CONTAINERS | DATE | TIME | ANALYSIS REQUIRED/COMMENTS |
|---|---|---|---|---|---|---|---|
| 12-2,4,8,19 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 13-2,4,8,8,10,21 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 14-2,4,8,8,10,21 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 15-2,4,8,8,10,21 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 16-2,4,9,8,10,21 to 31 | | LSC | 7ml LSC vial | 16 | 4/19/2010 | 16:00 | C14, H3 |
| 17-21,23,25,27,29,31 | | LSC | 7ml LSC vial | 6 | 4/19/2010 | 16:00 | C14, H3 |
| 18-21,23,25,27,29,31 | | LSC | 7ml LSC vial | 6 | 4/19/2010 | 16:00 | C14, H3 |
| H1 to 9 | | LSC | 7ml LSC vial | 9 | 4/19/2010 | 16:00 | C14, H3 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| | | | | |
|---|---|---|---|---|
| TRANSFERRED BY: | RECEIVED BY: | DATE: 4/20/10 | TIME: 16:00 | REMARKS: |
| TRANSFERRED BY: | RECEIVED BY: | DATE: 4/21/10 | TIME: 11:20 | |
| TRANSFERRED BY: | RECEIVED BY: | DATE | TIME | |

RSO, Inc.

Radiation Service Organization

Analytical Laboratory
5204 Minnick Road
Laurel, MD 20707

Phone - 301.953.2482
Fax - 301.498.3017

Lab Control Number: **2010-254**

Client: Tidewater Chesapeake Nuclear
7161 Columbia Gateway Drive
Columbia, MD 21046
Customer Project #: VAPH #CN 118-000
Customer Contact: Angel "Chico" Reyes
Contact Phone: 610.310.1931

Lab Analyst: Richard Emmons

# Laboratory Analytical Report

**Received Date:** 21-Apr-2010
**Report Date:** 3-May-2010
**Sample Matrix:** Wipe Tests
**Sample Analysis:** Beta
**Instrument:** Packard Tricarb 2900
S/N: 424560 Cal Date: 20-Apr-10

| Count Time (min) | Ch1 Background (cpm) | Ch2 Background (cpm) | Ch3 Background (cpm) | Ch1 H-3 Efficiency (cpm/dpm) | H-3 MDA (dpm) | Ch2 C-14 Efficiency (cpm/dpm) | C-14 MDA (dpm) | Ch3 P-32 Efficiency (cpm/dpm) | P-32 MDA (dpm) |
|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 3 | 9 | 5 | 43% | 26 | 82% | 21 | 90% | 15 |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VAC-1 | N/A | 1 | 2 | 13 | 3 | 40 | -2 | 82 | 5 | -2 | <MDA |
| VAC-2 | N/A | 1 | 5 | 9 | 5 | 36 | 5 | 81 | 0 | 0 | <MDA |
| 01 - 02 | N/A | 1 | 9 | 8 | 4 | 41 | 14 | 82 | -1 | -1 | <MDA |
| 01 - 04 | N/A | 1 | 6 | 13 | 5 | 42 | 7 | 82 | 5 | 0 | <MDA |
| 01 - 06 | N/A | 1 | 8 | 6 | 11 | 42 | 12 | 82 | -4 | 7 | <MDA |
| 01 - 19 | N/A | 1 | 4 | 17 | 9 | 41 | 2 | 82 | 10 | 4 | <MDA |
| 01 - 20 | N/A | 1 | 4 | 10 | 3 | 41 | 2 | 82 | 1 | -2 | <MDA |
| 01 - 21 | N/A | 1 | 8 | 8 | 7 | 42 | 12 | 82 | -1 | 2 | <MDA |
| 01 - 22 | N/A | 1 | 6 | 15 | 5 | 40 | 7 | 82 | 7 | 0 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 - 23 | N/A | 1 | 6 | 7 | 4 | 39 | 7 | 82 | -2 | -1 | <MDA |
| 01 - 24 | N/A | 1 | 0 | 11 | 6 | 35 | -7 | 81 | 2 | 1 | <MDA |
| 01 - 25 | N/A | 1 | 7 | 10 | 8 | 40 | 9 | 82 | 1 | 3 | <MDA |
| 01 - 26 | N/A | 1 | 3 | 6 | 9 | 37 | 0 | 81 | -4 | 4 | <MDA |
| 01 - 27 | N/A | 1 | 4 | 6 | 8 | 39 | 2 | 82 | -4 | 3 | <MDA |
| 01 - 28 | N/A | 1 | 6 | 8 | 8 | 40 | 7 | 82 | -1 | 3 | <MDA |
| 01 - 29 | N/A | 1 | 6 | 14 | 4 | 41 | 7 | 82 | 6 | -1 | <MDA |
| 01 - 30 | N/A | 1 | 2 | 10 | 7 | 41 | -2 | 82 | 1 | 2 | <MDA |
| 01 - 31 | N/A | 1 | 3 | 9 | 4 | 45 | 0 | 83 | 0 | -1 | <MDA |
| 02 - 02 | N/A | 1 | 6 | 11 | 7 | 43 | 7 | 82 | 2 | 2 | <MDA |
| 02 - 04 | N/A | 1 | 4 | 10 | 7 | 41 | 2 | 82 | 1 | 2 | <MDA |
| 02 - 06 | N/A | 1 | 6 | 12 | 3 | 42 | 7 | 82 | 4 | -2 | <MDA |
| 02 - 08 | N/A | 1 | 2 | 11 | 4 | 42 | -2 | 82 | 2 | -1 | <MDA |
| 02 - 20 | N/A | 1 | 5 | 12 | 8 | 42 | 5 | 82 | 4 | 3 | <MDA |
| 02 - 21 | N/A | 1 | 11 | 11 | 9 | 43 | 19 | 82 | 2 | 4 | <MDA |
| 02 - 22 | N/A | 1 | 6 | 8 | 6 | 42 | 7 | 82 | -1 | 1 | <MDA |
| 02 - 23 | N/A | 1 | 10 | 6 | 7 | 41 | 16 | 82 | -4 | 2 | <MDA |
| 02 - 24 | N/A | 1 | 8 | 13 | 2 | 42 | 12 | 82 | 5 | -3 | <MDA |
| 02 - 25 | N/A | 1 | 5 | 9 | 7 | 42 | 5 | 82 | 0 | 2 | <MDA |
| 02 - 26 | N/A | 1 | 5 | 11 | 8 | 41 | 5 | 82 | 2 | 3 | <MDA |
| 02 - 27 | N/A | 1 | 7 | 7 | 3 | 40 | 9 | 82 | -2 | -2 | <MDA |
| 02 - 28 | N/A | 1 | 7 | 6 | 8 | 42 | 9 | 82 | -4 | 3 | <MDA |
| 02 - 29 | N/A | 1 | 6 | 10 | 5 | 42 | 7 | 82 | 1 | 0 | <MDA |
| 02 - 30 | N/A | 1 | 9 | 14 | 3 | 41 | 14 | 82 | 6 | -2 | <MDA |
| 02 - 31 | N/A | 1 | 5 | 12 | 5 | 45 | 5 | 83 | 4 | 0 | <MDA |
| 03 - 02 | N/A | 1 | 1 | 8 | 4 | 42 | -5 | 82 | -1 | -1 | <MDA |
| 03 - 04 | N/A | 1 | 5 | 13 | 7 | 41 | 5 | 82 | 5 | 2 | <MDA |
| 03 - 06 | N/A | 1 | 5 | 5 | 8 | 39 | 5 | 82 | -5 | 3 | <MDA |
| 03 - 19 | N/A | 1 | 2 | 5 | 3 | 42 | -2 | 82 | -5 | -2 | <MDA |
| 03 - 20 | N/A | 1 | 6 | 12 | 5 | 39 | 7 | 82 | 4 | 0 | <MDA |
| 03 - 21 | N/A | 1 | 7 | 13 | 8 | 41 | 9 | 82 | 5 | 3 | <MDA |
| 03 - 22 | N/A | 1 | 9 | 10 | 8 | 41 | 14 | 82 | 1 | 3 | <MDA |
| 03 - 23 | N/A | 1 | 4 | 8 | 8 | 37 | 2 | 81 | -1 | 3 | <MDA |
| 03 - 24 | N/A | 1 | 4 | 5 | 7 | 42 | 2 | 82 | -5 | 2 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 03 - 25 | N/A | 1 | 8 | 8 | 5 | 41 | 12 | 82 | -1 | 0 | <MDA |
| 03 - 26 | N/A | 1 | 5 | 8 | 3 | 41 | 5 | 82 | -1 | -2 | <MDA |
| 03 - 27 | N/A | 1 | 5 | 9 | 10 | 41 | 5 | 82 | 0 | 6 | <MDA |
| 03 - 28 | N/A | 1 | 6 | 9 | 10 | 42 | 7 | 82 | 0 | 6 | <MDA |
| 03 - 29 | N/A | 1 | 13 | 8 | 4 | 42 | 23 | 82 | -1 | -1 | <MDA |
| 03 - 30 | N/A | 1 | 5 | 11 | 9 | 43 | 5 | 82 | 2 | 4 | <MDA |
| 03 - 31 | N/A | 1 | 11 | 14 | 4 | 45 | 19 | 83 | 6 | -1 | <MDA |
| 04 - 02 | N/A | 1 | 7 | 15 | 7 | 40 | 9 | 82 | 7 | 2 | <MDA |
| 04 - 04 | N/A | 1 | 3 | 8 | 5 | 39 | 0 | 82 | -1 | 0 | <MDA |
| 04 - 06 | N/A | 1 | 12 | 12 | 6 | 40 | 21 | 82 | 4 | 1 | <MDA |
| 04 - 08 | N/A | 1 | 10 | 5 | 6 | 42 | 16 | 82 | -5 | 1 | <MDA |
| 04 - 20 | N/A | 1 | 5 | 10 | 5 | 43 | 5 | 83 | 1 | 0 | <MDA |
| 04 - 21 | N/A | 1 | 6 | 7 | 9 | 42 | 7 | 82 | -2 | 4 | <MDA |
| 04 - 22 | N/A | 1 | 3 | 10 | 7 | 41 | 0 | 82 | 1 | 2 | <MDA |
| 04 - 23 | N/A | 1 | 8 | 9 | 8 | 40 | 12 | 82 | 0 | 3 | <MDA |
| 04 - 24 | N/A | 1 | 7 | 5 | 7 | 42 | 9 | 82 | -5 | 2 | <MDA |
| 04 - 25 | N/A | 1 | 5 | 9 | 4 | 41 | 5 | 82 | 0 | -1 | <MDA |
| 04 - 26 | N/A | 1 | 4 | 10 | 9 | 41 | 2 | 82 | 1 | 4 | <MDA |
| 04 - 27 | N/A | 1 | 9 | 7 | 4 | 41 | 14 | 82 | -2 | -1 | <MDA |
| 04 - 28 | N/A | 1 | 6 | 10 | 3 | 42 | 7 | 82 | 1 | -2 | <MDA |
| 04 - 29 | N/A | 1 | 7 | 11 | 3 | 42 | 9 | 82 | 2 | -2 | <MDA |
| 04 - 30 | N/A | 1 | 4 | 12 | 7 | 41 | 2 | 82 | 4 | 2 | <MDA |
| 04 - 31 | N/A | 1 | 7 | 12 | 4 | 44 | 9 | 83 | 4 | -1 | <MDA |
| 05 - 02 | N/A | 1 | 15 | 11 | 2 | 42 | 28 | 82 | 2 | -3 | [redacted] |
| 05 - 04 | N/A | 1 | 12 | 12 | 11 | 42 | 21 | 82 | 4 | 7 | <MDA |
| 05 - 06 | N/A | 1 | 5 | 11 | 7 | 42 | 5 | 82 | 2 | 2 | <MDA |
| 05 - 19 | N/A | 1 | 6 | 14 | 4 | 43 | 7 | 82 | 6 | -1 | <MDA |
| 05 - 20 | N/A | 1 | 8 | 6 | 2 | 43 | 12 | 82 | -4 | -3 | <MDA |
| 05 - 21 | N/A | 1 | 7 | 11 | 7 | 42 | 9 | 82 | 2 | 2 | <MDA |
| 05 - 22 | N/A | 1 | 5 | 7 | 4 | 41 | 5 | 82 | -2 | -1 | <MDA |
| 05 - 23 | N/A | 1 | 6 | 11 | 2 | 40 | 7 | 82 | 2 | -3 | <MDA |
| 05 - 24 | N/A | 1 | 4 | 4 | 5 | 43 | 2 | 82 | -6 | 0 | <MDA |
| 05 - 25 | N/A | 1 | 8 | 13 | 3 | 41 | 12 | 82 | 5 | -2 | <MDA |
| 05 - 26 | N/A | 1 | 10 | 12 | 7 | 42 | 16 | 82 | 4 | 2 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 05 - 27 | N/A | 1 | 4 | 9 | 5 | 42 | 2 | 82 | 0 | 0 | <MDA |
| 05 - 28 | N/A | 1 | 8 | 6 | 3 | 42 | 12 | 82 | -4 | -2 | <MDA |
| 05 - 29 | N/A | 1 | 8 | 10 | 6 | 42 | 12 | 82 | 1 | 1 | <MDA |
| 05 - 30 | N/A | 1 | 4 | 10 | 3 | 42 | 2 | 82 | 1 | -2 | <MDA |
| 05 - 31 | N/A | 1 | 4 | 11 | 6 | 44 | 2 | 83 | 2 | 1 | <MDA |
| 06 - 02 | N/A | 1 | 4 | 11 | 8 | 43 | 2 | 82 | 2 | 3 | <MDA |
| 06 - 04 | N/A | 1 | 7 | 5 | 3 | 42 | 9 | 82 | -5 | -2 | <MDA |
| 06 - 06 | N/A | 1 | 4 | 10 | 5 | 41 | 2 | 82 | 1 | 0 | <MDA |
| 06 - 19 | N/A | 1 | 4 | 11 | 11 | 42 | 2 | 82 | 2 | 7 | <MDA |
| 06 - 20 | N/A | 1 | 8 | 11 | 8 | 43 | 12 | 82 | 2 | 3 | <MDA |
| 06 - 21 | N/A | 1 | 7 | 7 | 7 | 43 | 9 | 82 | -2 | 2 | <MDA |
| 06 - 22 | N/A | 1 | 4 | 6 | 0 | 42 | 2 | 82 | -4 | -6 | <MDA |
| 06 - 23 | N/A | 1 | 5 | 12 | 8 | 42 | 5 | 82 | 4 | 3 | <MDA |
| 06 - 24 | N/A | 1 | 6 | 10 | 5 | 42 | 7 | 82 | 1 | 0 | <MDA |
| 06 - 25 | N/A | 1 | 3 | 6 | 5 | 42 | 0 | 82 | -4 | 0 | <MDA |
| 06 - 26 | N/A | 1 | 6 | 9 | 8 | 43 | 7 | 82 | 0 | 3 | <MDA |
| 06 - 27 | N/A | 1 | 2 | 11 | 6 | 41 | -2 | 82 | 2 | 1 | <MDA |
| 06 - 28 | N/A | 1 | 3 | 6 | 3 | 42 | 0 | 82 | -4 | -2 | <MDA |
| 06 - 29 | N/A | 1 | 4 | 10 | 9 | 43 | 2 | 82 | 1 | 4 | <MDA |
| 06 - 30 | N/A | 1 | 5 | 8 | 6 | 42 | 5 | 82 | -1 | 1 | <MDA |
| 06 - 31 | N/A | 1 | 5 | 16 | 11 | 43 | 5 | 83 | 8 | 7 | <MDA |
| 07 - 02 | N/A | 1 | 5 | 8 | 4 | 42 | 5 | 82 | -1 | -1 | <MDA |
| 07 - 04 | N/A | 1 | 7 | 13 | 7 | 41 | 9 | 82 | 5 | 2 | <MDA |
| 07 - 06 | N/A | 1 | 7 | 12 | 2 | 42 | 9 | 82 | 4 | -3 | <MDA |
| 07 - 08 | N/A | 1 | 10 | 8 | 3 | 43 | 16 | 82 | -1 | -2 | <MDA |
| 07 - 20 | N/A | 1 | 10 | 3 | 7 | 42 | 16 | 82 | -7 | 2 | <MDA |
| 07 - 21 | N/A | 1 | 5 | 8 | 4 | 42 | 5 | 82 | -1 | -1 | <MDA |
| 07 - 22 | N/A | 1 | 4 | 10 | 7 | 40 | 2 | 82 | 1 | 2 | <MDA |
| 07 - 23 | N/A | 1 | 5 | 10 | 8 | 42 | 5 | 82 | 1 | 3 | <MDA |
| 07 - 24 | N/A | 1 | 3 | 5 | 9 | 42 | 0 | 82 | -5 | 4 | <MDA |
| 07 - 25 | N/A | 1 | 7 | 11 | 6 | 42 | 9 | 82 | 2 | 1 | <MDA |
| 07 - 26 | N/A | 1 | 3 | 5 | 5 | 40 | 0 | 82 | -5 | 0 | <MDA |
| 07 - 27 | N/A | 1 | 13 | 11 | 16 | 42 | 23 | 82 | 2 | 12 | <MDA |
| 07 - 28 | N/A | 1 | 4 | 6 | 8 | 43 | 2 | 82 | -4 | 3 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 07 - 29 | N/A | 1 | 5 | 12 | 5 | 41 | 5 | 82 | 4 | 0 | <MDA |
| 07 - 30 | N/A | 1 | 10 | 10 | 8 | 41 | 16 | 82 | 1 | 3 | <MDA |
| 07 - 31 | N/A | 1 | 4 | 11 | 7 | 44 | 2 | 83 | 2 | 2 | <MDA |
| 08 - 02 | N/A | 1 | 6 | 9 | 5 | 41 | 7 | 82 | 0 | 0 | <MDA |
| 08 - 04 | N/A | 1 | 5 | 12 | 5 | 42 | 5 | 82 | 4 | 0 | <MDA |
| 08 - 06 | N/A | 1 | 8 | 11 | 3 | 43 | 12 | 82 | 2 | -2 | <MDA |
| 08 - 08 | N/A | 1 | 5 | 5 | 6 | 44 | 5 | 83 | -5 | 1 | <MDA |
| 08 - 20 | N/A | 1 | 6 | 4 | 7 | 41 | 7 | 82 | -6 | 2 | <MDA |
| 08 - 21 | N/A | 1 | 11 | 9 | 3 | 40 | 19 | 82 | 0 | -2 | <MDA |
| 08 - 22 | N/A | 1 | 6 | 11 | 7 | 37 | 7 | 81 | 2 | 2 | <MDA |
| 08 - 23 | N/A | 1 | 3 | 8 | 5 | 41 | 0 | 82 | -1 | 0 | <MDA |
| 08 - 24 | N/A | 1 | 9 | 13 | 4 | 39 | 14 | 82 | 5 | -1 | <MDA |
| 08 - 25 | N/A | 1 | 4 | 9 | 6 | 39 | 2 | 82 | 0 | 1 | <MDA |
| 08 - 26 | N/A | 1 | 11 | 7 | 4 | 40 | 19 | 82 | -2 | -1 | <MDA |
| 08 - 27 | N/A | 1 | 3 | 13 | 9 | 39 | 0 | 82 | 5 | 4 | <MDA |
| 08 - 28 | N/A | 1 | 2 | 7 | 3 | 40 | -2 | 82 | -2 | -2 | <MDA |
| 08 - 29 | N/A | 1 | 7 | 10 | 6 | 40 | 9 | 82 | 1 | 1 | <MDA |
| 08 - 30 | N/A | 1 | 8 | 12 | 4 | 40 | 12 | 82 | 4 | -1 | <MDA |
| 08 - 31 | N/A | 1 | 6 | 13 | 6 | 44 | 7 | 83 | 5 | 1 | <MDA |
| 09 - 02 | N/A | 1 | 9 | 16 | 4 | 42 | 14 | 82 | 8 | -1 | <MDA |
| 09 - 04 | N/A | 1 | 3 | 13 | 4 | 36 | 0 | 81 | 5 | -1 | <MDA |
| 09 - 06 | N/A | 1 | 6 | 9 | 7 | 38 | 7 | 82 | 0 | 2 | <MDA |
| 09 - 08 | N/A | 1 | 7 | 7 | 6 | 41 | 9 | 82 | -2 | 1 | <MDA |
| 09 - 20 | N/A | 1 | 13 | 12 | 5 | 41 | 23 | 82 | 4 | 0 | <MDA |
| 09 - 21 | N/A | 1 | 6 | 11 | 7 | 38 | 7 | 81 | 2 | 2 | <MDA |
| 09 - 22 | N/A | 1 | 7 | 10 | 4 | 40 | 9 | 82 | 1 | -1 | <MDA |
| 09 - 23 | N/A | 1 | 10 | 6 | 6 | 41 | 16 | 82 | -4 | 1 | <MDA |
| 09 - 24 | N/A | 1 | 5 | 12 | 8 | 41 | 5 | 82 | 4 | 3 | <MDA |
| 09 - 25 | N/A | 1 | 7 | 10 | 5 | 41 | 9 | 82 | 1 | 0 | <MDA |
| 09 - 26 | N/A | 1 | 6 | 14 | 3 | 41 | 7 | 82 | 6 | -2 | <MDA |
| 09 - 27 | N/A | 1 | 7 | 7 | 10 | 39 | 9 | 82 | -2 | 6 | <MDA |
| 09 - 28 | N/A | 1 | 4 | 10 | 7 | 36 | 2 | 81 | 1 | 2 | <MDA |
| 09 - 29 | N/A | 1 | 5 | 11 | 4 | 40 | 5 | 82 | 2 | -1 | <MDA |
| 09 - 30 | N/A | 1 | 6 | 8 | 8 | 41 | 7 | 82 | -1 | 3 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 09 - 31 | N/A | 1 | 13 | 6 | 6 | 44 | 23 | 83 | -4 | 1 | <MDA |
| 10 - 21 | N/A | 1 | 5 | 7 | 4 | 41 | 5 | 82 | -2 | -1 | <MDA |
| 10 - 23 | N/A | 1 | 6 | 15 | 6 | 39 | 7 | 82 | 7 | 1 | <MDA |
| 10 - 25 | N/A | 1 | 7 | 15 | 5 | 41 | 9 | 82 | 7 | 0 | <MDA |
| 10 - 27 | N/A | 1 | 4 | 9 | 9 | 40 | 2 | 82 | 0 | 4 | <MDA |
| 10 - 29 | N/A | 1 | 4 | 5 | 6 | 41 | 2 | 82 | -5 | 1 | <MDA |
| 10 - 31 | N/A | 1 | 12 | 8 | 8 | 45 | 21 | 83 | -1 | 3 | <MDA |
| 11 - 21 | N/A | 1 | 9 | 7 | 4 | 42 | 14 | 82 | -2 | -1 | <MDA |
| 11 - 23 | N/A | 1 | 2 | 9 | 5 | 42 | -2 | 82 | 0 | 0 | <MDA |
| 11 - 25 | N/A | 1 | 5 | 12 | 5 | 39 | 5 | 82 | 4 | 0 | <MDA |
| 11 - 27 | N/A | 1 | 3 | 9 | 5 | 41 | 0 | 82 | 0 | 0 | <MDA |
| 11 - 29 | N/A | 1 | 3 | 8 | 6 | 41 | 0 | 82 | -1 | 1 | <MDA |
| 11 - 31 | N/A | 1 | 2 | 12 | 2 | 44 | -2 | 83 | 4 | -3 | <MDA |
| 12 - 02 | N/A | 1 | 4 | 8 | 3 | 41 | 2 | 82 | -1 | -2 | <MDA |
| 12 - 04 | N/A | 1 | 4 | 8 | 7 | 41 | 2 | 82 | -1 | 2 | <MDA |
| 12 - 06 | N/A | 1 | 5 | 8 | 3 | 42 | 5 | 82 | -1 | -2 | <MDA |
| 12 - 19 | N/A | 1 | 3 | 12 | 7 | 41 | 0 | 82 | 4 | 2 | <MDA |
| 12 - 20 | N/A | 1 | 9 | 8 | 5 | 42 | 14 | 82 | -1 | 0 | <MDA |
| 12 - 21 | N/A | 1 | 9 | 10 | 11 | 41 | 14 | 82 | 1 | 7 | <MDA |
| 12 - 22 | N/A | 1 | 7 | 3 | 8 | 42 | 9 | 82 | -7 | 3 | <MDA |
| 12 - 23 | N/A | 1 | 10 | 14 | 6 | 41 | 16 | 82 | 6 | 1 | <MDA |
| 12 - 24 | N/A | 1 | 9 | 10 | 4 | 43 | 14 | 82 | 1 | -1 | <MDA |
| 12 - 25 | N/A | 1 | 2 | 8 | 2 | 43 | -2 | 82 | -1 | -3 | <MDA |
| 12 - 26 | N/A | 1 | 7 | 7 | 12 | 43 | 9 | 82 | -2 | 8 | <MDA |
| 12 - 27 | N/A | 1 | 5 | 13 | 8 | 43 | 5 | 82 | 5 | 3 | <MDA |
| 12 - 28 | N/A | 1 | 7 | 8 | 7 | 44 | 9 | 83 | -1 | 2 | <MDA |
| 12 - 29 | N/A | 1 | 4 | 12 | 4 | 42 | 2 | 82 | 4 | -1 | <MDA |
| 12 - 30 | N/A | 1 | 3 | 4 | 6 | 42 | 0 | 82 | -6 | 1 | <MDA |
| 12 - 31 | N/A | 1 | 5 | 9 | 10 | 45 | 5 | 83 | 0 | 6 | <MDA |
| 13 - 02 | N/A | 1 | 9 | 8 | 9 | 42 | 14 | 82 | -1 | 4 | <MDA |
| 13 - 04 | N/A | 1 | 9 | 11 | 2 | 40 | 14 | 82 | 2 | -3 | <MDA |
| 13 - 06 | N/A | 1 | 4 | 4 | 4 | 41 | 2 | 82 | -6 | -1 | <MDA |
| 13 - 08 | N/A | 1 | 6 | 12 | 9 | 35 | 7 | 81 | 4 | 4 | <MDA |
| 13 - 10 | N/A | 1 | 3 | 10 | 4 | 40 | 0 | 82 | 1 | -1 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 - 21 | N/A | 1 | 3 | 16 | 7 | 34 | 0 | 81 | 8 | 2 | <MDA |
| 13 - 22 | N/A | 1 | 3 | 10 | 3 | 36 | 0 | 81 | 1 | -2 | <MDA |
| 13 - 23 | N/A | 1 | 5 | 11 | 5 | 39 | 5 | 82 | 2 | 0 | <MDA |
| 13 - 24 | N/A | 1 | 9 | 5 | 3 | 41 | 14 | 82 | -5 | -2 | <MDA |
| 13 - 25 | N/A | 1 | 10 | 10 | 9 | 41 | 16 | 82 | 1 | 4 | <MDA |
| 13 - 26 | N/A | 1 | 6 | 10 | 3 | 40 | 7 | 82 | 1 | -2 | <MDA |
| 13 - 27 | N/A | 1 | 3 | 8 | 5 | 41 | 0 | 82 | -1 | 0 | <MDA |
| 13 - 28 | N/A | 1 | 7 | 9 | 2 | 40 | 9 | 82 | 0 | -3 | <MDA |
| 13 - 29 | N/A | 1 | 3 | 11 | 6 | 40 | 0 | 82 | 2 | 1 | <MDA |
| 13 - 30 | N/A | 1 | 5 | 13 | 1 | 42 | 5 | 82 | 5 | -4 | <MDA |
| 13 - 31 | N/A | 1 | 2 | 8 | 4 | 47 | -2 | 83 | -1 | -1 | <MDA |
| 14 - 02 | N/A | 1 | 4 | 11 | 4 | 41 | 2 | 82 | 2 | -1 | <MDA |
| 14 - 04 | N/A | 1 | 3 | 11 | 3 | 41 | 0 | 82 | 2 | -2 | <MDA |
| 14 - 06 | N/A | 1 | 4 | 11 | 6 | 42 | 2 | 82 | 2 | 1 | <MDA |
| 14 - 08 | N/A | 1 | 3 | 8 | 5 | 43 | 0 | 82 | -1 | 0 | <MDA |
| 14 - 10 | N/A | 1 | 7 | 12 | 5 | 40 | 9 | 82 | 4 | 0 | <MDA |
| 14 - 21 | N/A | 1 | 3 | 8 | 9 | 42 | 0 | 82 | -1 | 4 | <MDA |
| 14 - 22 | N/A | 1 | 5 | 14 | 6 | 41 | 5 | 82 | 6 | 1 | <MDA |
| 14 - 23 | N/A | 1 | 3 | 9 | 6 | 42 | 0 | 82 | 0 | 1 | <MDA |
| 14 - 24 | N/A | 1 | 4 | 15 | 3 | 43 | 2 | 82 | 7 | -2 | <MDA |
| 14 - 25 | N/A | 1 | 4 | 6 | 2 | 40 | 2 | 82 | -4 | -3 | <MDA |
| 14 - 26 | N/A | 1 | 6 | 7 | 6 | 41 | 7 | 82 | -2 | 1 | <MDA |
| 14 - 27 | N/A | 1 | 4 | 11 | 3 | 42 | 2 | 82 | 2 | -2 | <MDA |
| 14 - 28 | N/A | 1 | 3 | 6 | 1 | 42 | 0 | 82 | -4 | -4 | <MDA |
| 14 - 29 | N/A | 1 | 1 | 9 | 10 | 42 | -5 | 82 | 0 | 6 | <MDA |
| 14 - 30 | N/A | 1 | 9 | 7 | 4 | 42 | 14 | 82 | -2 | -1 | <MDA |
| 14 - 31 | N/A | 1 | 5 | 11 | 10 | 44 | 5 | 83 | 2 | 6 | <MDA |
| 15 - 02 | N/A | 1 | 6 | 12 | 3 | 41 | 7 | 82 | 4 | -2 | <MDA |
| 15 - 04 | N/A | 1 | 4 | 10 | 7 | 42 | 2 | 82 | 1 | 2 | <MDA |
| 15 - 06 | N/A | 1 | 9 | 11 | 7 | 44 | 14 | 83 | 2 | 2 | <MDA |
| 15 - 08 | N/A | 1 | 3 | 9 | 9 | 45 | 0 | 83 | 0 | 4 | <MDA |
| 15 - 10 | N/A | 1 | 6 | 6 | 6 | 44 | 7 | 83 | -4 | 1 | <MDA |
| 15 - 21 | N/A | 1 | 3 | 15 | 2 | 40 | 0 | 82 | 7 | -3 | <MDA |
| 15 - 22 | N/A | 1 | 9 | 5 | 5 | 41 | 14 | 82 | -5 | 0 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 - 23 | N/A | 1 | 2 | 5 | 4 | 42 | -2 | 82 | -5 | -1 | <MDA |
| 15 - 24 | N/A | 1 | 5 | 9 | 4 | 42 | 5 | 82 | 0 | -1 | <MDA |
| 15 - 25 | N/A | 1 | 11 | 10 | 5 | 42 | 19 | 82 | 1 | 0 | <MDA |
| 15 - 26 | N/A | 1 | 4 | 7 | 5 | 43 | 2 | 82 | -2 | 0 | <MDA |
| 15 - 27 | N/A | 1 | 9 | 6 | 4 | 43 | 14 | 82 | -4 | -1 | <MDA |
| 15 - 28 | N/A | 1 | 7 | 3 | 11 | 43 | 9 | 82 | -7 | 7 | <MDA |
| 15 - 29 | N/A | 1 | 9 | 11 | 5 | 42 | 14 | 82 | 2 | 0 | <MDA |
| 15 - 30 | N/A | 1 | 4 | 10 | 8 | 42 | 2 | 82 | 1 | 3 | <MDA |
| 15 - 31 | N/A | 1 | 4 | 8 | 3 | 44 | 2 | 83 | -1 | -2 | <MDA |
| 16 - 02 | N/A | 1 | 9 | 9 | 8 | 41 | 14 | 82 | 0 | 3 | <MDA |
| 16 - 04 | N/A | 1 | 1 | 8 | 10 | 37 | -5 | 81 | -1 | 6 | <MDA |
| 16 - 06 | N/A | 1 | 4 | 10 | 5 | 41 | 2 | 82 | 1 | 0 | <MDA |
| 16 - 08 | N/A | 1 | 10 | 12 | 7 | 41 | 16 | 82 | 4 | 2 | <MDA |
| 16 - 10 | N/A | 1 | 7 | 12 | 7 | 41 | 9 | 82 | 4 | 2 | <MDA |
| 16 - 21 | N/A | 1 | 12 | 10 | 5 | 39 | 21 | 82 | 1 | 0 | <MDA |
| 16 - 22 | N/A | 1 | 8 | 11 | 4 | 41 | 12 | 82 | 2 | -1 | <MDA |
| 16 - 23 | N/A | 1 | 9 | 12 | 8 | 40 | 14 | 82 | 4 | 3 | <MDA |
| 16 - 24 | N/A | 1 | 6 | 8 | 1 | 41 | 7 | 82 | -1 | -4 | <MDA |
| 16 - 25 | N/A | 1 | 4 | 11 | 5 | 41 | 2 | 82 | 2 | 0 | <MDA |
| 16 - 26 | N/A | 1 | 5 | 19 | 6 | 42 | 5 | 82 | 12 | 1 | <MDA |
| 16 - 27 | N/A | 1 | 5 | 11 | 5 | 41 | 5 | 82 | 2 | 0 | <MDA |
| 16 - 28 | N/A | 1 | 7 | 14 | 8 | 41 | 9 | 82 | 6 | 3 | <MDA |
| 16 - 29 | N/A | 1 | 1 | 10 | 11 | 41 | -5 | 82 | 1 | 7 | <MDA |
| 16 - 30 | N/A | 1 | 4 | 7 | 4 | 40 | 2 | 82 | -2 | -1 | <MDA |
| 16 - 31 | N/A | 1 | 6 | 10 | 7 | 45 | 7 | 83 | 1 | 2 | <MDA |
| 17 - 21 | N/A | 1 | 1 | 11 | 3 | 43 | -5 | 82 | 2 | -2 | <MDA |
| 17 - 23 | N/A | 1 | 3 | 18 | 4 | 43 | 0 | 82 | 11 | -1 | <MDA |
| 17 - 25 | N/A | 1 | 9 | 9 | 4 | 43 | 14 | 82 | 0 | -1 | <MDA |
| 17 - 27 | N/A | 1 | 6 | 9 | 8 | 42 | 7 | 82 | 0 | 3 | <MDA |
| 17 - 29 | N/A | 1 | 8 | 12 | 8 | 43 | 12 | 83 | 4 | 3 | <MDA |
| 17 - 31 | N/A | 1 | 4 | 8 | 8 | 45 | 2 | 83 | -1 | 3 | <MDA |
| 18 - 21 | N/A | 1 | 6 | 9 | 5 | 39 | 7 | 82 | 0 | 0 | <MDA |
| 18 - 23 | N/A | 1 | 8 | 7 | 10 | 41 | 12 | 82 | -2 | 6 | <MDA |
| 18 - 25 | N/A | 1 | 7 | 6 | 2 | 42 | 9 | 82 | -4 | -3 | <MDA |

| Sample # | ID or Description | Count Time (min) | Ch1 Count Rate (cpm) | Ch2 Count Rate (cpm) | Ch3 Count Rate (cpm) | Ch1 H-3 Efficiency % (cpm/dpm) | Ch1 H-3 Activity (dpm) | Ch2 C-14 Efficiency % (cpm/dpm) | Ch2 C-14 Activity (dpm) | Ch3 P-32 Activity (dpm) | MDA Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 - 27 | N/A | 1 | 6 | 12 | 5 | 42 | 7 | 82 | 4 | 0 | <MDA |
| 18 - 29 | N/A | 1 | 5 | 8 | 6 | 43 | 5 | 82 | -1 | 1 | <MDA |
| 18 - 31 | N/A | 1 | 6 | 7 | 6 | 45 | 7 | 83 | -2 | 1 | <MDA |
| H-01 | N/A | 1 | 2 | 9 | 6 | 36 | -2 | 82 | 0 | 1 | <MDA |
| H-02 | N/A | 1 | 3 | 13 | 6 | 39 | 0 | 82 | 5 | 1 | <MDA |
| H-03 | N/A | 1 | 5 | 13 | 6 | 38 | 5 | 81 | 5 | 1 | <MDA |
| H-04 | N/A | 1 | 9 | 10 | 4 | 43 | 14 | 82 | 1 | -1 | <MDA |
| H-05 | N/A | 1 | 6 | 6 | 6 | 40 | 7 | 82 | -4 | 1 | <MDA |
| H-06 | N/A | 1 | 8 | 6 | 6 | 42 | 12 | 82 | -4 | 1 | <MDA |
| H-07 | N/A | 1 | 7 | 15 | 9 | 38 | 9 | 82 | 7 | 4 | <MDA |
| H-08 | N/A | 1 | 11 | 11 | 7 | 41 | 19 | 82 | 2 | 2 | <MDA |
| H-09 | N/A | 1 | 5 | 7 | 7 | 39 | 5 | 82 | -2 | 2 | <MDA |
| | N | | 259 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | |
| | Max | | 15.0 | 19.0 | 16.0 | 46.6 | 27.8 | 82.9 | 12.1 | 12.2 | |
| | Min | | 0.0 | 3.0 | 0.0 | 34.4 | -7.0 | 80.9 | -7.3 | -5.6 | |
| | Average | | 5.9 | 9.6 | 5.8 | 41.3 | 6.7 | 82.2 | 0.8 | 0.9 | |
| | Standard Deviation | | 2.7 | 2.9 | 2.4 | 1.8 | 6.2 | 0.3 | 3.5 | 2.7 | |

Packard Instrument Performance Assessment (IPA)

| 21-Apr-10 Packard IPA: | H-3 | Range | Comments | C-14 | Range | Comments |
|---|---|---|---|---|---|---|
| IPA Standard Background Counts: | 12.57 | 4 SD | QC Pass | 16.92 | 4 SD | QC Pass |
| Counting Efficiency: | 60.1 | >50 | QC Pass | 95.11 | >90 | QC Pass |
| Figure-of-Merit (Efficiency2/Background): | 286 | >125 | QC Pass | 651 | >324 | QC Pass |
| Chi-Square: | 9.35 | 7.63 to 36.19 | QC Pass | 17.20 | 7.63 to 36.19 | QC Pass |

Prepared By: James W. Dean
James W. Dean, Laboratory Manager

Reviewed By: G D Smith CHP
Gregory Dean Smith, CHP

KELLY MAYO
5012571571
VHA NATIONAL HEALTH PHYSICS PR
2200 FT ROOTS DR B101 R208D
NORTH LITTLE ROCK AR 72114

5 LBS PAK 1 OF 1

**SHIP TO:**
CASSANDRA F FRAZIER
5012571571
NUCLEAR REGULATORY COMMISSION
REGION 3
DIVISION OF NUCLEAR MATERIALS SAFET
2443 WARRENVILLE RD, SUITE 210
**LISLE IL 60532-4352**

IL 603 9-03

**UPS NEXT DAY AIR** **1**
TRACKING #: 1Z A47 7F5 01 9572 5989

BILLING: P/P

Reference # 1: KRM

CS 12.0.28 WXPNV50 03.0A 04/2010

TM