

APPENDIX FIVE

# Characterization Report

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MC-40 Cyclotron Vault at the  
University of Texas Health Science Center  
1132-REP-001 Rev. 0

October 2017

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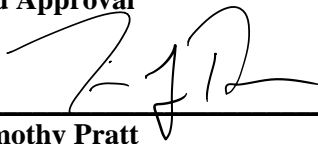
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- Attachment 1: Characterization Survey Packages
- Attachment 2: Laboratory Reports for Concrete Volumetric Samples
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- Attachment 4: Liquid Scintillation Counting Results

## Abbreviations and Acronyms

|              |                                                             |
|--------------|-------------------------------------------------------------|
| ALARA        | As Low As Reasonably Achievable                             |
| Ameriphysics | Ameriphysics, LLC                                           |
| cpm          | counts per minute                                           |
| CHP          | Certified Health Physicist                                  |
| DCGL         | Derived Concentration Guideline Level                       |
| dpm          | disintegration per minute                                   |
| DQO          | Data Quality Objective                                      |
| DSHS         | Texas Department of State Health Services                   |
| EH&S         | Environmental Health & Safety                               |
| LSC          | Liquid Scintillation Counter                                |
| MARSSIM      | Multi-Agency Radiation Survey and Site Investigation Manual |
| MDC          | Minimum Detectable Concentration                            |
| NaI          | Sodium Iodide                                               |
| NIST         | National Institute of Standards and Technology              |
| QAPP         | Quality Assurance Project Plan                              |
| RPD          | Relative Percent Difference                                 |
| TEDE         | Total Effective Dose Equivalent                             |
| UTHealth     | University of Texas Health Science Center at Houston        |

## 1. INTRODUCTION

The purpose of this Characterization Report is to provide the data necessary to aid in the decision-making process for decommissioning of University of Texas Health Science Center at Houston (UTHealth) MC-40 Cyclotron Vault located at 6431 Fannin St, Houston, TX, 77030. UTHealth contracted Ameriphysics, LLC (Ameriphysics) to perform the characterization activities described in this report. All work was performed under UTHealth's Texas Department of State Health Services (DSHS) radioactive material license.

The characterization plan used to develop this report was developed using the guidance provided in NUREG-1757, "Consolidated NMSS Decommissioning Guidance" and NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) and provided the approach, methods, and techniques for the radiological characterization of UTHealth's MC-40 Cyclotron Vault. These methods ensured technically defensible data were generated to aid in the decommissioning decision-making process.

Radiological requirements for license termination are described in 25 Texas Administrative Code §289.202(ddd)(1)(D)(2), *Radiological requirements for unrestricted use*. The release criterion is dose-based and cannot be measured directly. MARSSIM uses the term derived concentration guideline level (DCGL) to describe radionuclide-specific surface or volume residual radioactivity levels that correspond to the release criterion. The release criterion cannot be translated into radionuclide-specific DCGLs without characterization data. Consequently, obtaining high quality data for translation was a major focus of this project.

## 2. RADIONUCLIDES OF CONCERN

While the cyclotron was operated, neutrons were freed as a result of collisions with energized protons. In turn, these neutrons collided with surrounding nuclei and caused activation. As a result, induced radioactivity is expected in the cyclotron and any apparatus or building material near the cyclotron or along the beam travel path.

Studies pertaining to induced radioactivity in cyclotrons are published in a number of papers. The radionuclide distribution is material specific, and the concentration varies according to proximity to the beam and interferences that cause losses. Radiation emitted is beta and gamma; however, it is important to consider that atoms undergoing decay are trapped within the volume of the materials and surfaces. According to the Radiological Health Handbook, the maximum range of a 1 MeV beta particle is less than 1/10th of an inch in lead, copper, iron, aluminum, and concrete. At 0.1 MeV, the maximum range is less than 1/100th of an inch.

Unlike betas and other charged particles that exhibit finite ranges, gammas cannot be completely attenuated. Rather, the intensity of this radiation is reduced by increasingly thicker

absorbers. Consequently, gamma radiation is the radiation of concern except in instances where surface contamination is suspected or identified.

Based on experience on other cyclotron decommissioning projects, induced residual radioactivity in vault structures is almost exclusively attributed to Co-60 and Eu-152 after a few months of decay. However, there are a couple more radionuclides that routinely have positive results, these are Cs-134 and Eu-154. Small amounts of H-3 and Fe-55 have also been present at cyclotron sites and have been investigated in conjunction with this characterization. Since this site has not operated for more than 16 years, a significant amount of decay has occurred. However, samples sent for gamma spectroscopy were analyzed for all radionuclides of concern typically associated with neutron activation in the cyclotron equipment and building materials.

### **3. FACILITY DESCRIPTION**

UTHealth operated a Scanditronix MC-40 cyclotron to produce radioisotopes for positron emission tomography from 1984 to 2001 under DSHS License L03685. On June 8, 2001, the facility was inundated by water from Tropical Storm Allison which rendered the cyclotron permanently inoperable. Since 2001, the facility and supporting rooms have been repurposed for use by UTHealth Environmental Health & Safety (EH&S). The cyclotron line, associated materials, and activated components have remained in storage. EH&S has utilized available space within the facility for sealed source storage, other radioactive waste processing and storage under the UTHealth broad license, and chemical waste processing. On June 15, 2015, UTHealth was notified by DSHS that the renewed license would have a license condition imposed to complete the decommissioning process.

The cyclotron vault has a footprint of approximately 1,080 ft<sup>2</sup>. The floor, walls and ceiling are constructed of rebar reinforced concrete. The north and east walls are 6-feet thick and the south and west walls are 8-feet thick. Access to the vault is through a movable door at the southeast corner. An overview of the cyclotron vault is provided in Figure 1.



objective of the sampling was to determine the three-dimensional extent to which the vault surfaces were impacted and that may exceed the DSHS release criterion.

Gamma scans were conducted on all accessible interior surfaces of the cyclotron vault with a Ludlum 2221 survey instrument coupled to a shielded Ludlum 44-10 2" x 2" Sodium Iodide (NaI) detector. The scan was performed by passing the detector close to the surface at a speed of 0.5 meters per second. As the detector was moved across the surfaces of the vault, the only discernable increases in count rates were from items and equipment in the vault. Since it was difficult to identify elevated locations during the scan surveys, even when moving loose equipment, it was determined that contact static gamma measurements using the shielded NaI detector would provide better data for selection of concrete core sampling locations.

Static gamma measurements (on contact), beta-gamma smears, and LSC smears were taken at the intersections of a one meter systematic grid system that was marked onto the vault interior surfaces. Accessible locations on the ceiling were approximated relative to the floor grid. The grid system was documented on scaled drawings provided in Attachment 1. Gamma background measurements were performed outside the cyclotron vault door on the floor. Ten one-minute counts were taken and used to determine the average gamma background of 1,637 counts per minute (cpm).

One-minute static gamma measurements were collected with the NaI detector at each 1-meter grid intersection. Locations were identified by the surface and numbered location. The surfaces were floor (F), ceiling (C), east wall (E), west wall (W), north wall (N), south wall (S) and Pit (P). For example, location 26 on the floor was given the ID F26; location 13 on the east wall was given the ID E13, etc. The sample IDs with a "D" following the location number (e.g., N17D) are duplicate samples. The measurements were collected on contact with the surface. Since the vault still contained equipment that could not be moved easily, several locations were not accessible for survey. These included F36, F37, F67, F68, S8, E13, C50, and C60,

Following a careful examination of the gamma static measurements, Ameripysics determined locations for concrete core sampling based on either elevated static gamma measurements or proximity to the cyclotron and the target array. Thirty (30) separate concrete core sample locations were chosen. Cores samples were performed to a 15.5 inches (40 cm) depth at locations exhibiting the highest NaI count rates. Depths were less at lower count rate locations. The sample locations collected are provided in Table 5-1.

The core samples were moved to a low background area and separated into six inch (15 cm) sections. One-minute static counts were performed on contact with a NaI detector for each 3 inch (7.5 cm) increments and recorded. The net count rates are summarized in Table 5-1.



*Table 5-1: Concrete Core Sample Locations and  
Net One-Minute NaI Static Count Rates on Core Samples*

| Location | Net Readings in Counts per Minute |                              |                               |                                |                                 |
|----------|-----------------------------------|------------------------------|-------------------------------|--------------------------------|---------------------------------|
|          | 0-3<br>inches<br>(0-7.5 cm)       | 3-6<br>inches<br>(7.5-15 cm) | 6-9<br>inches<br>(15-22.5 cm) | 9-12<br>inches<br>(22.5-30 cm) | 12-15.5<br>inches<br>(30-40 cm) |
| F16      | <b>380</b>                        | <b>777</b>                   | 562                           | 583                            | -                               |
| F18      | <b>326</b>                        | <b>599</b>                   | 652                           | 592                            | 348                             |
| F20      | <b>297</b>                        | <b>408</b>                   | 387                           | 390                            | 317                             |
| F25      | <b>114</b>                        | <b>209</b>                   | 257                           | 265                            | -                               |
| F46      | <b>488</b>                        | <b>635</b>                   | <b>628</b>                    | <b>760</b>                     | 471                             |
| F51      | <b>1202</b>                       | <b>1142</b>                  | <b>1070</b>                   | <b>899</b>                     | <b>614</b>                      |
| F52      | <b>185</b>                        | <b>307</b>                   | 377                           | 346                            | -                               |
| F56      | <b>249</b>                        | <b>294</b>                   | 423                           | 348                            | -                               |
| F72      | <b>394</b>                        | <b>500</b>                   | 545                           | 480                            | -                               |
| F76      | <b>320</b>                        | <b>474</b>                   | 471                           | 491                            | -                               |
| F80      | <b>225</b>                        | <b>482</b>                   | 572                           | 445                            | 449                             |
| C46      | <b>242</b>                        | <b>438</b>                   | -                             | -                              | -                               |
| C52      | <b>270</b>                        | <b>380</b>                   | -                             | -                              | -                               |
| W3       | <b>581</b>                        | <b>819</b>                   | -                             | -                              | -                               |
| W5       | <b>413</b>                        | <b>525</b>                   | -                             | -                              | -                               |
| W11      | <b>405</b>                        | <b>541</b>                   | 446                           | 371                            | -                               |
| W17      | <b>465</b>                        | <b>696</b>                   | -                             | -                              | -                               |
| W19      | <b>623</b>                        | <b>563</b>                   | -                             | -                              | -                               |
| E2       | <b>80</b>                         | <b>245</b>                   | 268                           | -                              | -                               |
| E4       | <b>13</b>                         | <b>66</b>                    | -                             | -                              | -                               |
| E9       | <b>-55</b>                        | <b>70</b>                    | <b>-8</b>                     | 41                             | 134                             |
| E17      | <b>22</b>                         | <b>152</b>                   | -                             | -                              | -                               |
| N17      | <b>197</b>                        | <b>343</b>                   | -                             | -                              | -                               |
| N20      | <b>245</b>                        | <b>416</b>                   | -                             | -                              | -                               |
| N23      | <b>51</b>                         | <b>161</b>                   | <b>274</b>                    | <b>211</b>                     | -                               |
| N30      | <b>138</b>                        | <b>412</b>                   | -                             | -                              | -                               |
| S19      | <b>95</b>                         | <b>369</b>                   | 207                           | 276                            | -                               |
| S21      | <b>256</b>                        | <b>361</b>                   | -                             | -                              | -                               |
| S26      | <b>372</b>                        | <b>669</b>                   | 525                           | 309                            | -                               |
| S40      | <b>339</b>                        | <b>506</b>                   | -                             | -                              | -                               |

The contact NaI readings on the vault surfaces and the contact NaI readings on the actual core samples were used to determine which core sections were submitted for analysis. The samples that are **bolded** in Table 5-1 were sent for analysis via gamma spectroscopy at GEL Laboratories in Charleston, SC. GEL Laboratories has experience preparing and analyzing concrete from cyclotron facilities. Moreover, since the library they use was developed with the help of our cyclotron-experienced Certified Health Physicist (CHP), the possibility of drawing incorrect characterization decisions because of laboratory error or emission is minimized. The laboratory sample report is provided in Attachment 2. Sample custody was maintained at all times using a chain of custody form that accompanied the samples from collection to analysis.

Based on our experience on other projects, certain hard to detect radionuclides may be present within the activated concrete. Analyses for the hard-to-detect radionuclides (H-3 and Fe-55) were performed on 10% of the total number of samples (4 samples). These were selected based on the highest 2" x 2" NaI detector readings (vault surfaces) on core samples F51, W3, W17, and W19.

Removable contamination measurements (smears) were collected at each grid intersection. For each sample, an area of approximately 100 cm<sup>2</sup> was wiped. These samples were counted onsite with a Ludlum 3030 coupled to a Ludlum 43-10-1. LSC smears were also taken at each location and were counted on UTHealth's liquid scintillation counter. LSC results can be found in Attachment 4.

The minimum detectable concentration (MDC) in disintegrations per minute (dpm) per 100 cm<sup>2</sup> at a 95% confidence level for the instrument measuring removable beta/gamma contamination was calculated using the following equation, which is from NUREG-1507, "Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", Table 3.1 (Strom & Stansbury, 1992):

$$MDC_{smear} = \frac{3 + 3.29 \sqrt{B_r \cdot t_s \cdot \left(1 + \frac{t_s}{t_b}\right)}}{t_s \cdot E \cdot \frac{A}{100cm^2}} \quad 135 dpm/100cm^2 = \frac{3 + 3.29 \sqrt{56 \cdot 1 \cdot \left(1 + \frac{1}{1}\right)}}{1 \cdot 0.28 \cdot \frac{100}{100cm^2}}$$

Where:

- $MDC_{smear} = 135$  = minimum detectable concentration level in dpm/smear
- $B_r = 56$  = background count rate in cpm
- $t_b = 1$  = background count time in minutes
- $t_s = 1$  = sample count time in minutes
- $E = 0.28$  =  $4\pi$  instrument efficiency for radionuclide emission of interest
- $A = 100$  = physical area of the smear in cm<sup>2</sup>

The UTHealth LSC counter’s MDC is reported on each printout. The reported MDC values ranged between 40-42 dpm/smear. The following equation is used to determine the MDC for the LSC removable contamination measurements:

$$MDC_{smear} = \frac{2.71 + 4.75\sqrt{Background\{cpm\}}}{Efficiency}$$

The background value used in the calculation is the channel C value which is the counts from the entire spectrum (0-2000 keV). The efficiency used in the calculations is H-3 efficiency on an unquenched H-3 calibration standard.

The UTHealth action level in cpm for LSC removable contamination is determined from the following equation:

$$Action\_Level = Background + MDA \times Efficiency$$

### 5.1. Survey Instrumentation

Based on potential contaminants, their associated radiations, and the types of residual contamination categories to be evaluated, the detection sensitivities of various instruments and techniques were evaluated for use. Instruments were evaluated for use during surface scans, discrete measurements, and analysis of removable contamination wipes.

The instrumentation used for the characterization surveys is summarized in the following tables. Table 5-2 lists the standard features of each instrument such as detector area and efficiency. Table 5-3 lists the actual operational parameters used such as scan rate, count time, and the associated Minimum Detectable Concentration (MDC).

*Table 5-2: Instrumentation Specifications*

| Detector Model  | Detector Serial Number | Detector Type            | Detector Area       | Meter Model     | Meter Serial Number | Window Thickness       | Typical Total Efficiency |
|-----------------|------------------------|--------------------------|---------------------|-----------------|---------------------|------------------------|--------------------------|
| Ludlum 44-10    | 190200                 | Gamma Scintillation      | 2" x 2" NaI         | Ludlum 2221     | PR135860            | N/A                    | ~675 cpm/μrem/hr         |
| Ludlum 44-10    | 196085                 | Gamma Scintillation      | 2" x 2" NaI         | Ludlum 2221     | PR181829            | N/A                    | ~675 cpm/μrem/hr         |
| Ludlum 43-10-1  | PR337587               | Alpha/Beta Scintillation | 100 cm <sup>2</sup> | Ludlum 3030     | 328277              | 0.4 mg/cm <sup>2</sup> | 28% – Beta               |
| Tri-Carb 4900TR | SGLO3415 0058          | Liquid Scintillation     | 100 cm <sup>2</sup> | Tri-Carb 4900TR | SGLO3415 0058       | N/A                    | 62% - H-3                |

Table 5-3: Instrument Operating Parameters and Sensitivities

| Measurement Type            | Detector Model     | Meter Model        | Scan Rate     | Count Time | Background (cpm) | MDC                          |
|-----------------------------|--------------------|--------------------|---------------|------------|------------------|------------------------------|
| Gamma Scans                 | 44-10<br>190200    | Ludlum<br>2221     | 0.5<br>m/sec. | N/A        | 1,637            | ~1.5 pCi/g                   |
| Gamma Scans                 | 44-10<br>196085    | Ludlum<br>2221     | 0.5<br>m/sec. | N/A        | 1,648            | ~1.5 pCi/g                   |
| Removable Beta Activity     | Ludlum<br>43-10-1  | Ludlum<br>3030     | N/A           | 60 sec.    | 56 – Beta        | 135 dpm/100cm <sup>2</sup>   |
| Removable H-3/C-14 Activity | Tri-Carb<br>4900TR | Tri-Carb<br>4900TR | N/A           | 60 sec.    | 22-25            | 40-42 dpm/100cm <sup>2</sup> |

These instruments are not equipped to distinguish between radionuclides. Where radionuclide-specific results were needed, samples were obtained and sent offsite for gamma spectroscopic analysis.

## 5.2. Instrument Calibration

Laboratory and portable field instruments are calibrated at least annually with National Institute of Standards and Technology (NIST) traceable sources and to radiation emission types and energies that provide detection capabilities similar to the nuclides of concern.

## 5.3. Daily Response Checks

For radiological instruments operated by Ameriphysics, a reference source was measured prior to use each day. The result is accurate if it fell within  $\pm 20\%$  of originally determined values. This is consistent with the guidance in Section 6.5.4 of MARSSIM, Instrument Calibration. Background readings were taken as part of the daily response checks and compared with the acceptance range for instrument and site conditions determined during instrument set up in accordance with Ameriphysics Survey Instrument Procedure, RCP 4-3. All instrument successfully passed their daily response checks during the course of the project.

The LSC counter was operated by UTHealth personnel according to their procedures. The system is normalized daily using its SNC protocol.

## 5.4. Data Validation

Field data was reviewed and validated to ensure:

- Completeness of forms and that the type of survey was correctly assigned to the survey unit.

- The MDCs for measurements meet the established Data Quality Objectives (DQOs); independent calculations are performed for a representative sample of data sheets and survey areas.
- Instrument calibrations and daily functional checks were performed accurately and at the required frequency.
- QC samples were collected at the frequency prescribed in the Quality Assurance Project Plan (QAPP).
- Duplicate sample results were within 50% relative percent difference of the original sample.
- Chain of custody was maintained for all samples that were not controlled by the survey technician until the analysis is performed.

## **6. DATA INTERPRETATION**

Characterization field survey data is provided in Attachment 1. The static gamma measurement results are reported in units of net cpm. These results were used along with the static NaI counts on the concrete core sections to determine which core samples were sent to the laboratory for gamma spectroscopy. Removable beta measurements at each location are reported in dpm/100 cm<sup>2</sup>.

All concrete core samples were transferred under chain of custody to GEL Laboratories. The sample results returned by the laboratory are provided in Attachment 2. The results of the locations with the highest activities and second highest activities were used in RESRAD-BUILD modelling to compare to the release criterion of 25 mrem/yr which is discussed in further detail in Section 8.

## **7. FINDINGS AND RESULTS**

The results of the characterization survey for the UTHealth MC-40 Cyclotron Vault are discussed in the following sections.

### **7.1. Explanation of Data Presentation**

Attachment 1 of this report provides the field characterization survey results for the cyclotron vault floor, ceiling, walls, and pit. The survey results include:

1. Survey Instruction Sheets
2. General survey requirements
3. Instrument requirements with associated MDCs, count times and scan rates
4. Survey Data Results Sheets

5. Survey Maps
  - a. Overview maps detailing survey locations
  - b. Survey sub-unit maps with additional sample location information, as needed
6. Signatures of Data Collector and Reviewer

## **7.2. Surface Scans**

Surface scans were performed on 100% of accessible surfaces to identify areas of elevated activity. The scan surveys did not indicate any areas that required any additional investigation other than the planned static measurements. However, the count rates did increase slightly on the floors and walls nearest the target array on the west side of the vault. There was significant interference in the scan readings due to the cyclotron, beam lines, target array, and various activated material in the vault.

## **7.3. Surface Activity Measurements**

Static gamma measurements were taken with a shielded 2" x 2" NaI detector on the vault surfaces (floor, walls and ceiling). These were collected on contact with the surface at each intersection of a one-meter grid system. Even though a shielded NaI detector was used, there was some interference with the readings due to the cyclotron, target array, and other activated materials that remained in the vault when the measurements were collected.

Removable contamination measurements were collected at each accessible grid intersection. All beta/gamma removable contamination results were less than the MDC of 135 dpm/100cm<sup>2</sup> and are provided in Attachment 1. All LSC results were less than action levels determined by UHealth except the initial count on sample C93. The initial result for sample C93 was 49 cpm in channel C and the action level was 47 cpm. Sample C93 was recounted and the result was 24 cpm compared to an action level of 47 cpm. The LSC results are provided in Attachment 4.

## **7.4. Radionuclide Concentrations in Samples**

The radionuclides found in concrete core sample results were H-3, Co-60, Eu-152, and Eu-154.

The sample results are summarized in Table 7-1. Note that the samples ID includes the depth of the sample in inches. For example, F16 (1-6) is the sample collected at location F16 to a depth of 6 inches (15 cm).

Table 7-1: Core Sample Results

| Location ID | Concentration in pCi/g for Radionuclides Detected |       |        |        |
|-------------|---------------------------------------------------|-------|--------|--------|
|             | H-3                                               | Co-60 | Eu-152 | Eu-154 |
| F16 (1-6)   | ND                                                | 0.592 | 8.91   | ND     |
| F18 (1-6)   | ND                                                | 0.547 | 8.49   | 0.523  |
| F20 (1-6)   | ND                                                | 0.603 | 7.01   | ND     |
| F25 (1-6)   | ND                                                | 0.199 | 3.27   | ND     |
| F46 (1-6)   | ND                                                | 0.544 | 7.2    | 0.759  |
| F46 (7-12)  | ND                                                | 0.508 | 5.42   | 0.382  |
| F51 (1-6)   | 5.19                                              | 1.22  | 16.3   | 0.847  |
| F51 (7-12)  | ND                                                | 1.10  | 13.8   | 1.22   |
| F51 (13-16) | ND                                                | 0.768 | 9.67   | 0.783  |
| F52 (1-6)   | ND                                                | 0.268 | 4.56   | ND     |
| F56 (1-6)   | ND                                                | 0.192 | 3.1    | ND     |
| F72 (1-6)   | ND                                                | 0.472 | 5.25   | ND     |
| F72D (1-6)  | ND                                                | 0.531 | 6.46   | 0.432  |
| F76 (1-6)   | ND                                                | 0.335 | 5.02   | ND     |
| F80 (1-6)   | ND                                                | 0.412 | 4.65   | ND     |
| C46 (1-6)   | ND                                                | 0.484 | 6.21   | ND     |
| C52 (1-6)   | ND                                                | 0.469 | 3.71   | ND     |
| W3 (1-6)    | ND                                                | 0.750 | 6.56   | ND     |
| W5 (1-6)    | ND                                                | 0.440 | 4.26   | ND     |
| W5D (1-6)   | ND                                                | 0.717 | 3.83   | 0.439  |
| W11 (1-6)   | ND                                                | 0.524 | 5.34   | ND     |
| W11D (1-6)  | ND                                                | 0.713 | 5.13   | 0.244  |
| W17 (1-6)   | 5.28                                              | 0.901 | 6.90   | ND     |
| W19 (1-6)   | ND                                                | 0.766 | 4.37   | ND     |
| E2 (1-6)    | ND                                                | 0.412 | 2.83   | ND     |
| E4 (1-6)    | ND                                                | 0.373 | 2.48   | ND     |
| E9 (1-6)    | ND                                                | 0.310 | 3.09   | ND     |
| E17 (1-6)   | ND                                                | 0.313 | 2.51   | ND     |
| N17 (1-6)   | ND                                                | 0.659 | 4.21   | ND     |
| N17D (1-6)  | ND                                                | 0.478 | 3.92   | 0.334  |
| N20 (1-6)   | ND                                                | 0.616 | 4.63   | ND     |
| N23 (1-6)   | ND                                                | 0.436 | 2.78   | 0.222  |
| N23 (7-12)  | ND                                                | 0.106 | 1.12   | ND     |
| N30 (1-6)   | ND                                                | 0.291 | 3.48   | ND     |
| S19 (1-6)   | ND                                                | 0.407 | 3.03   | ND     |
| S21 (1-6)   | ND                                                | 0.655 | 4.72   | ND     |
| S26 (1-6)   | ND                                                | 0.536 | 4.64   | 0.393  |
| S40 (1-6)   | ND                                                | 0.765 | 5.40   | 0.473  |

ND – Not detected above MDC.

## 7.5. Quality Control

Calculations were performed to determine the survey percent completeness and relative percent differences (RPD) for samples with results greater than five times MDC for static measurements and volumetric samples.

Percent completeness calculations were performed for static and removable measurements and all exceeded the 90% requirements. All volumetric samples that were planned were successfully collected and analyzed.

RPD calculations were all within 50%.

Laboratory data reports were reviewed and all quality control requirements specified in the QAPP were met.

## 8. COMPARISON OF RESULTS WITH GUIDELINES

All direct measurement results were evaluated to determine locations to be considered for remediation. Core sample results were reported in pCi/g and were compared directly to the release criterion of 25 mrem/yr. TEDE.

The samples analyzed from location F51 resulted in the highest activity concentrations (in pCi/g). Dose modeling software, RESRAD-BUILD (Argonne National Laboratory), V3.50, October 30, 2009 was run using the laboratory results from the most radioactive sample, the 0-6 inch (0-15 cm), sample from location F51 (1132-F51 (1-6)). Other than the radionuclides and concentrations, default parameters were used. The RESRAD-BUILD report for this analysis is provided in Attachment 3. The dose resulting from this model is 41.9 mrem/yr. which is greater than the release criterion of 25 mrem/yr TEDE. The areal extent of the elevated activity can be bounded by the surrounding surface NaI readings. This results in approximately four square meters of area in which remediation may be required to meet the release criterion.

The sample with the second highest sample results was location F18. RESRAD-BUILD was run with the radionuclides and concentrations reported for this sample. The RESRAD-BUILD report for this analysis is provided in the second part of Attachment 3. The dose resulting from this model is 21.7 mrem/yr. which is less than the release criterion of 25 mrem/yr. TEDE. Since the balance of the sample locations have results that are less than those reported for location F18, it is safe to assume any required remediation of additional areas to meet the release criterion will be minor. Once the cyclotron and other components are removed, it will be easier to determine if any other areas of activation exceed the release criterion exist.



## 9. RECOMMENDED REMEDIATION OF VAULT SURFACES

As discussed in Section 8, approximately four square meters of surface area surrounding location F51 may require remediation to meet the release criterion. Based on the results from the 15-30 cm sample and the 30-40 cm sample at location F51, the depth of remediation for this location is estimated at 50 cm. The area surrounding location F51 appears to be the only area that would require remediation to meet the release criterion, but this assumption should be verified following removal of the cyclotron and other activated components.

There may be a need for some additional spot remediation in other areas that could not be properly characterized because of interference with scans and static readings from the cyclotron and other components still in the room.

This area surrounding location F51 would result in approximately 70 ft<sup>3</sup> (in place volume) or 10,500 lbs. of activated concrete waste.

In addition, the cyclotron and other components will also need to be disposed of as radioactive waste. The MC-40 cyclotron is estimated to weigh approximately 130,000 lbs. (~255 ft<sup>3</sup>). The cyclotron beam lines, target array, and various other components are estimated at approximately 1,080 ft<sup>3</sup>. These are estimates only and should be verified/determined prior to shipment and disposal.

There are also used components and other activated material that reside in the vault. There are roughly 50 potentially activated lead bricks dispersed around the vault. Other waste found in cyclotron vault includes: four drums of concrete slurry from characterization concrete core samples, eleven 55-gallon drums of radioactive material (at least one of these contains lead), two 10-gallon drums, ten black trash bags of assorted waste, and an assortment of unpackaged radioactive material.

## 10. CONCLUSIONS

Based on the NaI surveys performed and the core sample results, it is evident that there is activation in most of the vault surfaces. However, most of the vault surfaces would be less than the release criterion of 25 mrem/yr when using RESRAD-BUILD. The exception is approximately four square meters of the concrete floor surrounding location F51. This location is right below the beam line as it exits the cyclotron.

## 11. REFERENCES

1. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM)
2. NUREG-1505, "A Nonparametric Statistical Methodology for the Design and Analysis of Final Decommissioning Surveys"
3. NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"
4. NUREG-1757, Volume 2 "Consolidated NMSS Decommissioning Guidance"
5. 25 Texas Administrative Code §289.202(ddd)(1)(D)(2), Radiological requirements for unrestricted use

**ATTACHMENT 1**

**Characterization Survey Package**

# Characterization Survey Design Package

|                                           |                                   |                                        |           |
|-------------------------------------------|-----------------------------------|----------------------------------------|-----------|
| <b>Building:</b> <u>Science Center</u>    | <b>Survey Unit ID:</b> <u>SU1</u> | <b>Page</b>                            | <b>of</b> |
| <b>MARSSIM Classification:</b> <u>N/A</u> |                                   |                                        |           |
| <b>Room Nos. Included in Survey Unit:</b> |                                   | <u>UT Health MC-40 Cyclotron Vault</u> |           |

## Approvals

**Prepared By:**

Robbie Hansen/

Print Name / Signature



9/7/2017

Date

**Reviewed By:**

Tim Pratt/

Print Name / Signature



9/7/2017

Date

## Completion and Review

**Data Collected and/or Converted By:**

Robbie Hansen/

Print Name / Signature



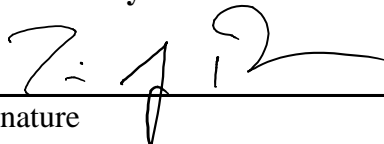
9/16/2017

Date

**Reviewed and Verified By:**

Tim Pratt/

Print Name / Signature



10/24/2017

Date

## Characterization Survey Design Package

|                                           |                                 |                        |            |             |           |
|-------------------------------------------|---------------------------------|------------------------|------------|-------------|-----------|
| <b>Building:</b>                          | <u>Science Center</u>           | <b>Survey Unit ID:</b> | <u>SU1</u> | <b>Page</b> | <b>of</b> |
| <b>MARSSIM Classification:</b>            | <u>N/A</u>                      |                        |            |             |           |
| <b>Room Nos. Included in Survey Unit:</b> | UT Health MC-40 Cyclotron Vault |                        |            |             |           |

|                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Radionuclides of Concern:</b>                                                                                                         |
| Ag-108m, Ag-110m, Cd-109, Co-56, Co-57, Co-58, Co-60, Cs-134, Eu-152, Eu-154, Eu-155, Fe-59, Mn-54, Na-22, Nb-95, Sb-124, Sc-46, & Zn-65 |

| Release Limits (DCGLs) |                       |                          |                  |
|------------------------|-----------------------|--------------------------|------------------|
|                        | Total Activity Limits | Removable Activity Limit | Limits Based On: |
| Alpha                  | n/a                   | n/a                      | n/a              |
| Gamma                  | n/a                   | n/a                      | n/a              |
| Beta/Gamma             | n/a                   | n/a                      | n/a              |

| Applicable Survey Unit Surfaces                                      | % of Accessible Surface for Scan Surveys |                                  |                                          |
|----------------------------------------------------------------------|------------------------------------------|----------------------------------|------------------------------------------|
| <input checked="" type="checkbox"/> Floors                           | <input type="checkbox"/> 10%             | <input type="checkbox"/> 25-100% | <input checked="" type="checkbox"/> 100% |
| <input checked="" type="checkbox"/> Lower Walls                      | <input type="checkbox"/> 10%             | <input type="checkbox"/> 25-100% | <input checked="" type="checkbox"/> 100% |
| <input checked="" type="checkbox"/> Upper Walls                      | <input type="checkbox"/> 10%             | <input type="checkbox"/> 25-100% | <input checked="" type="checkbox"/> 100% |
| <input checked="" type="checkbox"/> Ceiling                          | <input type="checkbox"/> 10%             | <input type="checkbox"/> 25-100% | <input checked="" type="checkbox"/> 100% |
| <input type="checkbox"/> Structures (Interior and Exterior Surfaces) | <input type="checkbox"/> 10%             | <input type="checkbox"/> 25-100% | <input type="checkbox"/> 100%            |

| Required Survey Instrumentation | Measurement Type           | Static Count Time: | Scan Rate        | Efficiency Based On: |
|---------------------------------|----------------------------|--------------------|------------------|----------------------|
| Ludlum 2221 / 44-10             | Gamma                      | 1 minute           | 1/2<br>meter/sec | Co-60                |
| Ludlum 3030E / 43-10-1          | Beta Removable<br>Activity | 1 minute           | N/A              | Beta Tc-99           |
| Other: <u>(Specify)</u>         | N/A                        | N/A                | N/A              | N/A                  |


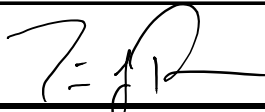
# Characterization Survey Design Package

|                                           |                                 |                        |            |             |           |
|-------------------------------------------|---------------------------------|------------------------|------------|-------------|-----------|
| <b>Building:</b>                          | <u>Science Center</u>           | <b>Survey Unit ID:</b> | <u>SU1</u> | <b>Page</b> | <b>of</b> |
| <b>MARSSIM Classification:</b>            | <u>N/A</u>                      |                        |            |             |           |
| <b>Room Nos. Included in Survey Unit:</b> | UT Health MC-40 Cyclotron Vault |                        |            |             |           |

| Survey Instructions |                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1)                  | Judgmentally select an origin for each surface area to surveyed. Origin selection should be chosen to correspond with the location of the cyclotron in relation to that surface. For each surface, lay out a one-meter grid system.                                                                                                                                                |
| 2)                  | For each surface (floor, wall, or ceiling), mark the grid intersections on a scaled drawing.                                                                                                                                                                                                                                                                                       |
| 3)                  | Perform the required scan surveys at the rate prescribed on the previous page. Document the performance of the scan survey on the attached survey maps using markings and legends as necessary to allow the reviewer enough information to verify that sufficient area has been covered                                                                                            |
| 4)                  | Collect static measurements for gross gamma at each identified grid intersection (close to the surface). Collect wipe samples for gross beta/gamma and for Liquid Scintillation Counter at each gamma sample location. Document the results on the associated data results sheets. Additional measurements may be taken in suspect areas at the discretion of the Project Manager. |
| 5)                  | Collect core samples at locations determined by the Cerified Health Physicist and the Radiation Safety Officer. Separate samples into 6 inch long segments. Before shipping, move 6-inch segments to a low background area and perform one-minute static counts on contact.                                                                                                        |
| 6)                  | Collect 5% duplicate static measurements for gross gamma. Collect 5% duplicate wipe samples for gross beta/gamma. Document the results on the associated data results sheets.                                                                                                                                                                                                      |
| 7)                  | Notify the Project Manager of any elevated activity is determined during static measurements or applicable removable contamination measurements.                                                                                                                                                                                                                                   |
| 8)                  | Ensure that all package information is completed and signed prior to turning in this survey package to the Project Manager for review.                                                                                                                                                                                                                                             |

# Characterization Survey Design Package

|                                                                                  |                                   |            |          |
|----------------------------------------------------------------------------------|-----------------------------------|------------|----------|
| <b>Building:</b> Science Center                                                  | <b>Survey Unit ID:</b> <u>SU1</u> | Page _____ | of _____ |
| <b>Marssim Classification:</b> N/A                                               |                                   |            |          |
| <b>Room Nos. Included in Survey Unit:</b> <u>UT Health MC-40 Cyclotron Vault</u> |                                   |            |          |

|                                                                                      |                                |                            |                                              |                         |                                    |                                                                                                          |
|--------------------------------------------------------------------------------------|--------------------------------|----------------------------|----------------------------------------------|-------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Project Name:</b><br>UT Health Science Center Vault                               | <b>Project Number:</b><br>1132 | <b>Survey Number:</b><br>1 | <b>Date:</b> 9/15/2017<br><b>Time:</b> 17:00 |                         |                                    |                                                                                                          |
| <b>Instrument / Detector</b>                                                         | <b>Serial Number</b>           | <b>Cal. Due Date</b>       | <b>Total Efficiency</b>                      | <b>Background (cpm)</b> | <b>Probe Area (cm<sup>2</sup>)</b> | <b>Surveyor:</b> Robbie Hansen / Tom Hansen III                                                          |
| Ludlum 3030 / Ludlum 43-10-1                                                         | 328277 / PR337587              | 3/3/2018                   | 0.2828                                       | 46                      | 100                                | <b>Signature:</b><br> |
| Ludlum 2221 / Ludlum 44-10                                                           | 190200 / PR135860              | 12/7/2017                  | n/a                                          | 1637                    | n/a                                |                                                                                                          |
| Ludlum 2221 / Ludlum 44-10                                                           | 196085 / PR196085              | 12/7/2017                  | n/a                                          | 1648                    | n/a                                | <b>Reviewer:</b> Tim Pratt                                                                               |
| <div style="border: 1px solid black; display: inline-block; padding: 5px;">N/A</div> |                                |                            |                                              |                         |                                    | <b>Signature:</b><br> |

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| N1            | n/a                    | n/a        | n/a                             | 8188         | 1637       | 6551    | n/a                        | n/a                             | 47           | 4                               |
| N2            | n/a                    | n/a        | n/a                             | 9844         | 1637       | 8207    | n/a                        | n/a                             | 56           | 35                              |
| N3            | n/a                    | n/a        | n/a                             | 9144         | 1637       | 7507    | n/a                        | n/a                             | 39           | -25                             |
| N4            | n/a                    | n/a        | n/a                             | 9050         | 1637       | 7413    | n/a                        | n/a                             | 36           | -35                             |
| N5            | n/a                    | n/a        | n/a                             | 9310         | 1637       | 7673    | n/a                        | n/a                             | 44           | -7                              |
| N6            | n/a                    | n/a        | n/a                             | 9169         | 1637       | 7532    | n/a                        | n/a                             | 47           | 4                               |
| N7            | n/a                    | n/a        | n/a                             | 9957         | 1637       | 8320    | n/a                        | n/a                             | 51           | 18                              |
| N8            | n/a                    | n/a        | n/a                             | 10676        | 1637       | 9039    | n/a                        | n/a                             | 35           | -39                             |
| N9            | n/a                    | n/a        | n/a                             | 11066        | 1637       | 9429    | n/a                        | n/a                             | 50           | 14                              |
| N10           | n/a                    | n/a        | n/a                             | 9295         | 1637       | 7658    | n/a                        | n/a                             | 52           | 21                              |
| N11           | n/a                    | n/a        | n/a                             | 7697         | 1637       | 6060    | n/a                        | n/a                             | 41           | -18                             |

# Characterization Survey Design Package

**Building:** Science Center                      **Survey Unit ID:** SU1                      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| N12           | n/a                    | n/a        | n/a                             | 7230         | 1637       | 5593    | n/a                        | n/a                             | 55           | 32                              |
| N13           | n/a                    | n/a        | n/a                             | 6445         | 1637       | 4808    | n/a                        | n/a                             | 50           | 14                              |
| N14           | n/a                    | n/a        | n/a                             | 7912         | 1637       | 6275    | n/a                        | n/a                             | 43           | -11                             |
| N15           | n/a                    | n/a        | n/a                             | 8830         | 1637       | 7193    | n/a                        | n/a                             | 42           | -14                             |
| N16           | n/a                    | n/a        | n/a                             | 8468         | 1637       | 6831    | n/a                        | n/a                             | 56           | 35                              |
| N17           | n/a                    | n/a        | n/a                             | 8762         | 1637       | 7125    | n/a                        | n/a                             | 44           | -7                              |
| N18           | n/a                    | n/a        | n/a                             | 8844         | 1637       | 7207    | n/a                        | n/a                             | 42           | -14                             |
| N19           | n/a                    | n/a        | n/a                             | 9391         | 1637       | 7754    | n/a                        | n/a                             | 54           | 28                              |
| N20           | n/a                    | n/a        | n/a                             | 10848        | 1637       | 9211    | n/a                        | n/a                             | 51           | 18                              |
| N21           | n/a                    | n/a        | n/a                             | 10322        | 1637       | 8685    | n/a                        | n/a                             | 49           | 11                              |
| N22           | n/a                    | n/a        | n/a                             | 9706         | 1637       | 8069    | n/a                        | n/a                             | 54           | 28                              |
| N23           | n/a                    | n/a        | n/a                             | 8587         | 1637       | 6950    | n/a                        | n/a                             | 45           | -4                              |
| N24           | n/a                    | n/a        | n/a                             | 6295         | 1637       | 4658    | n/a                        | n/a                             | 52           | 21                              |
| N25           | n/a                    | n/a        | n/a                             | 6542         | 1637       | 4905    | n/a                        | n/a                             | 45           | -4                              |
| N26           | n/a                    | n/a        | n/a                             | 6516         | 1637       | 4879    | n/a                        | n/a                             | 52           | 21                              |
| N27           | n/a                    | n/a        | n/a                             | 8751         | 1637       | 7114    | n/a                        | n/a                             | 45           | -4                              |
| N28           | n/a                    | n/a        | n/a                             | 9581         | 1637       | 7944    | n/a                        | n/a                             | 59           | 46                              |
| N29           | n/a                    | n/a        | n/a                             | 10312        | 1637       | 8675    | n/a                        | n/a                             | 56           | 35                              |
| N30           | n/a                    | n/a        | n/a                             | 10900        | 1637       | 9263    | n/a                        | n/a                             | 34           | -42                             |
| N31           | n/a                    | n/a        | n/a                             | 10713        | 1637       | 9076    | n/a                        | n/a                             | 64           | 64                              |
| N32           | n/a                    | n/a        | n/a                             | 10516        | 1637       | 8879    | n/a                        | n/a                             | 51           | 18                              |
| N33           | n/a                    | n/a        | n/a                             | 11271        | 1637       | 9634    | n/a                        | n/a                             | 56           | 35                              |
| N34           | n/a                    | n/a        | n/a                             | 11367        | 1637       | 9730    | n/a                        | n/a                             | 43           | -11                             |
| N35           | n/a                    | n/a        | n/a                             | 10094        | 1637       | 8457    | n/a                        | n/a                             | 49           | 11                              |
| N36           | n/a                    | n/a        | n/a                             | 8397         | 1637       | 6760    | n/a                        | n/a                             | 54           | 28                              |



# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| N37           | n/a                    | n/a        | n/a                             | 7250         | 1637       | 5613    | n/a                        | n/a                             | 50           | 14                              |
| N38           | n/a                    | n/a        | n/a                             | 6618         | 1637       | 4981    | n/a                        | n/a                             | 57           | 39                              |
| N39           | n/a                    | n/a        | n/a                             | 6203         | 1637       | 4566    | n/a                        | n/a                             | 57           | 39                              |
| N40           | n/a                    | n/a        | n/a                             | 7751         | 1637       | 6114    | n/a                        | n/a                             | 45           | -4                              |
| S1            | n/a                    | n/a        | n/a                             | 7105         | 1637       | 5468    | n/a                        | n/a                             | 41           | -18                             |
| S2            | n/a                    | n/a        | n/a                             | 7066         | 1637       | 5429    | n/a                        | n/a                             | 47           | 4                               |
| S3            | n/a                    | n/a        | n/a                             | 5631         | 1637       | 3994    | n/a                        | n/a                             | 35           | -39                             |
| S4            | n/a                    | n/a        | n/a                             | 7107         | 1637       | 5470    | n/a                        | n/a                             | 34           | -42                             |
| S5            | n/a                    | n/a        | n/a                             | 8508         | 1637       | 6871    | n/a                        | n/a                             | 42           | -14                             |
| S6            | n/a                    | n/a        | n/a                             | 10691        | 1637       | 9054    | n/a                        | n/a                             | 45           | -4                              |
| S7            | n/a                    | n/a        | n/a                             | 19190        | 1637       | 17553   | n/a                        | n/a                             | 43           | -11                             |
| S8            | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| S9            | n/a                    | n/a        | n/a                             | 14000        | 1637       | 12363   | n/a                        | n/a                             | 45           | -4                              |
| S10           | n/a                    | n/a        | n/a                             | 12073        | 1637       | 10436   | n/a                        | n/a                             | 47           | 4                               |
| S11           | n/a                    | n/a        | n/a                             | 12798        | 1637       | 11161   | n/a                        | n/a                             | 41           | -18                             |
| S12           | n/a                    | n/a        | n/a                             | 10770        | 1637       | 9133    | n/a                        | n/a                             | 47           | 4                               |
| S13           | n/a                    | n/a        | n/a                             | 10522        | 1637       | 8885    | n/a                        | n/a                             | 42           | -14                             |
| S14           | n/a                    | n/a        | n/a                             | 8496         | 1637       | 6859    | n/a                        | n/a                             | 37           | -32                             |
| S15           | n/a                    | n/a        | n/a                             | 8112         | 1637       | 6475    | n/a                        | n/a                             | 40           | -21                             |
| S16           | n/a                    | n/a        | n/a                             | 7906         | 1637       | 6269    | n/a                        | n/a                             | 39           | -25                             |
| S17           | n/a                    | n/a        | n/a                             | 5274         | 1637       | 3637    | n/a                        | n/a                             | 48           | 7                               |
| S18           | n/a                    | n/a        | n/a                             | 7251         | 1637       | 5614    | n/a                        | n/a                             | 59           | 46                              |
| S19           | n/a                    | n/a        | n/a                             | 9605         | 1637       | 7968    | n/a                        | n/a                             | 43           | -11                             |
| S20           | n/a                    | n/a        | n/a                             | 10748        | 1637       | 9111    | n/a                        | n/a                             | 51           | 18                              |
| S21           | n/a                    | n/a        | n/a                             | 15501        | 1637       | 13864   | n/a                        | n/a                             | 43           | -11                             |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| S22           | n/a                    | n/a        | n/a                             | 24287        | 1637       | 22650   | n/a                        | n/a                             | 47           | 4                               |
| S23           | n/a                    | n/a        | n/a                             | 12922        | 1637       | 11285   | n/a                        | n/a                             | 38           | -28                             |
| S24           | n/a                    | n/a        | n/a                             | 11017        | 1637       | 9380    | n/a                        | n/a                             | 39           | -25                             |
| S25           | n/a                    | n/a        | n/a                             | 11001        | 1637       | 9364    | n/a                        | n/a                             | 44           | -7                              |
| S26           | n/a                    | n/a        | n/a                             | 12151        | 1637       | 10514   | n/a                        | n/a                             | 53           | 25                              |
| S27           | n/a                    | n/a        | n/a                             | 12051        | 1637       | 10414   | n/a                        | n/a                             | 52           | 21                              |
| S28           | n/a                    | n/a        | n/a                             | 8575         | 1637       | 6938    | n/a                        | n/a                             | 51           | 18                              |
| S29           | n/a                    | n/a        | n/a                             | 8160         | 1637       | 6523    | n/a                        | n/a                             | 50           | 14                              |
| S30           | n/a                    | n/a        | n/a                             | 8245         | 1637       | 6608    | n/a                        | n/a                             | 43           | -11                             |
| S31           | n/a                    | n/a        | n/a                             | 6640         | 1637       | 5003    | n/a                        | n/a                             | 61           | 53                              |
| S32           | n/a                    | n/a        | n/a                             | 7457         | 1637       | 5820    | n/a                        | n/a                             | 36           | -35                             |
| S33           | n/a                    | n/a        | n/a                             | 8631         | 1637       | 6994    | n/a                        | n/a                             | 46           | 0                               |
| S34           | n/a                    | n/a        | n/a                             | 10247        | 1637       | 8610    | n/a                        | n/a                             | 44           | -7                              |
| S35           | n/a                    | n/a        | n/a                             | 12112        | 1637       | 10475   | n/a                        | n/a                             | 45           | -4                              |
| S36           | n/a                    | n/a        | n/a                             | 12363        | 1637       | 10726   | n/a                        | n/a                             | 34           | -42                             |
| S37           | n/a                    | n/a        | n/a                             | 11810        | 1637       | 10173   | n/a                        | n/a                             | 48           | 7                               |
| S38           | n/a                    | n/a        | n/a                             | 11890        | 1637       | 10253   | n/a                        | n/a                             | 49           | 11                              |
| S39           | n/a                    | n/a        | n/a                             | 12001        | 1637       | 10364   | n/a                        | n/a                             | 52           | 21                              |
| S40           | n/a                    | n/a        | n/a                             | 12380        | 1637       | 10743   | n/a                        | n/a                             | 31           | -53                             |
| S41           | n/a                    | n/a        | n/a                             | 11653        | 1637       | 10016   | n/a                        | n/a                             | 54           | 28                              |
| S42           | n/a                    | n/a        | n/a                             | 12113        | 1637       | 10476   | n/a                        | n/a                             | 49           | 11                              |
| S43           | n/a                    | n/a        | n/a                             | 3816         | 1637       | 2179    | n/a                        | n/a                             | 46           | 0                               |
| S44           | n/a                    | n/a        | n/a                             | 4577         | 1637       | 2940    | n/a                        | n/a                             | 47           | 4                               |
| S45           | n/a                    | n/a        | n/a                             | 9413         | 1637       | 7776    | n/a                        | n/a                             | 46           | 0                               |
| W1            | n/a                    | n/a        | n/a                             | 8350         | 1637       | 6713    | n/a                        | n/a                             | 48           | 7                               |

# Characterization Survey Design Package

**Building:** Science Center                      **Survey Unit ID:** SU1                      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| W2            | n/a                    | n/a        | n/a                             | 9053         | 1637       | 7416    | n/a                        | n/a                             | 45           | -4                              |
| W3            | n/a                    | n/a        | n/a                             | 10558        | 1637       | 8921    | n/a                        | n/a                             | 51           | 18                              |
| W4            | n/a                    | n/a        | n/a                             | 12358        | 1637       | 10721   | n/a                        | n/a                             | 39           | -25                             |
| W5            | n/a                    | n/a        | n/a                             | 9430         | 1637       | 7793    | n/a                        | n/a                             | 47           | 4                               |
| W6            | n/a                    | n/a        | n/a                             | 8575         | 1637       | 6938    | n/a                        | n/a                             | 43           | -11                             |
| W7            | n/a                    | n/a        | n/a                             | 7410         | 1637       | 5773    | n/a                        | n/a                             | 41           | -18                             |
| W8            | n/a                    | n/a        | n/a                             | 8541         | 1637       | 6904    | n/a                        | n/a                             | 43           | -11                             |
| W9            | n/a                    | n/a        | n/a                             | 9451         | 1637       | 7814    | n/a                        | n/a                             | 43           | -11                             |
| W10           | n/a                    | n/a        | n/a                             | 9971         | 1637       | 8334    | n/a                        | n/a                             | 35           | -39                             |
| W11           | n/a                    | n/a        | n/a                             | 11036        | 1637       | 9399    | n/a                        | n/a                             | 41           | -18                             |
| W12           | n/a                    | n/a        | n/a                             | 8894         | 1637       | 7257    | n/a                        | n/a                             | 44           | -7                              |
| W13           | n/a                    | n/a        | n/a                             | 8195         | 1637       | 6558    | n/a                        | n/a                             | 35           | -39                             |
| W14           | n/a                    | n/a        | n/a                             | 7499         | 1637       | 5862    | n/a                        | n/a                             | 55           | 32                              |
| W15           | n/a                    | n/a        | n/a                             | 9873         | 1637       | 8236    | n/a                        | n/a                             | 41           | -18                             |
| W16           | n/a                    | n/a        | n/a                             | 10821        | 1637       | 9184    | n/a                        | n/a                             | 43           | -11                             |
| W17           | n/a                    | n/a        | n/a                             | 12957        | 1637       | 11320   | n/a                        | n/a                             | 47           | 4                               |
| W18           | n/a                    | n/a        | n/a                             | 12366        | 1637       | 10729   | n/a                        | n/a                             | 46           | 0                               |
| W19           | n/a                    | n/a        | n/a                             | 11049        | 1637       | 9412    | n/a                        | n/a                             | 36           | -35                             |
| W20           | n/a                    | n/a        | n/a                             | 9209         | 1637       | 7572    | n/a                        | n/a                             | 47           | 4                               |
| W21           | n/a                    | n/a        | n/a                             | 8471         | 1637       | 6834    | n/a                        | n/a                             | 46           | 0                               |
| W22           | n/a                    | n/a        | n/a                             | 9295         | 1637       | 7658    | n/a                        | n/a                             | 54           | 28                              |
| W23           | n/a                    | n/a        | n/a                             | 9800         | 1637       | 8163    | n/a                        | n/a                             | 49           | 11                              |
| W24           | n/a                    | n/a        | n/a                             | 8854         | 1637       | 7217    | n/a                        | n/a                             | 62           | 57                              |
| W25           | n/a                    | n/a        | n/a                             | 8094         | 1637       | 6457    | n/a                        | n/a                             | 66           | 71                              |
| E1            | n/a                    | n/a        | n/a                             | 9607         | 1637       | 7970    | n/a                        | n/a                             | 33           | -46                             |

# Characterization Survey Design Package

**Building:** Science Center                      **Survey Unit ID:** SU1                      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| E2            | n/a                    | n/a        | n/a                             | 9845         | 1637       | 8208    | n/a                        | n/a                             | 51           | 18                              |
| E3            | n/a                    | n/a        | n/a                             | 7819         | 1637       | 6182    | n/a                        | n/a                             | 39           | -25                             |
| E4            | n/a                    | n/a        | n/a                             | 8524         | 1637       | 6887    | n/a                        | n/a                             | 48           | 7                               |
| E5            | n/a                    | n/a        | n/a                             | 6631         | 1637       | 4994    | n/a                        | n/a                             | 37           | -32                             |
| E6            | n/a                    | n/a        | n/a                             | 5796         | 1637       | 4159    | n/a                        | n/a                             | 51           | 18                              |
| E7            | n/a                    | n/a        | n/a                             | 11501        | 1637       | 9864    | n/a                        | n/a                             | 48           | 7                               |
| E8            | n/a                    | n/a        | n/a                             | 7702         | 1637       | 6065    | n/a                        | n/a                             | 31           | -53                             |
| E9            | n/a                    | n/a        | n/a                             | 7616         | 1637       | 5979    | n/a                        | n/a                             | 47           | 4                               |
| E10           | n/a                    | n/a        | n/a                             | 9186         | 1637       | 7549    | n/a                        | n/a                             | 39           | -25                             |
| E11           | n/a                    | n/a        | n/a                             | 10042        | 1637       | 8405    | n/a                        | n/a                             | 46           | 0                               |
| E12           | n/a                    | n/a        | n/a                             | 8570         | 1637       | 6933    | n/a                        | n/a                             | 49           | 11                              |
| E13           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | 48           | 7                               |
| E14           | n/a                    | n/a        | n/a                             | 8295         | 1637       | 6658    | n/a                        | n/a                             | 49           | 11                              |
| E15           | n/a                    | n/a        | n/a                             | 8872         | 1637       | 7235    | n/a                        | n/a                             | 36           | -35                             |
| E16           | n/a                    | n/a        | n/a                             | 7404         | 1637       | 5767    | n/a                        | n/a                             | 44           | -7                              |
| E17           | n/a                    | n/a        | n/a                             | 7994         | 1637       | 6357    | n/a                        | n/a                             | 50           | 14                              |
| E18           | n/a                    | n/a        | n/a                             | 6903         | 1637       | 5266    | n/a                        | n/a                             | 34           | -42                             |
| E19           | n/a                    | n/a        | n/a                             | 4819         | 1637       | 3182    | n/a                        | n/a                             | 50           | 14                              |
| C1            | n/a                    | n/a        | n/a                             | 9887         | 1637       | 8250    | n/a                        | n/a                             | 43           | -11                             |
| C2            | n/a                    | n/a        | n/a                             | 10484        | 1637       | 8847    | n/a                        | n/a                             | 46           | 0                               |
| C3            | n/a                    | n/a        | n/a                             | 10607        | 1637       | 8970    | n/a                        | n/a                             | 49           | 11                              |
| C4            | n/a                    | n/a        | n/a                             | 10432        | 1637       | 8795    | n/a                        | n/a                             | 46           | 0                               |
| C5            | n/a                    | n/a        | n/a                             | 11073        | 1637       | 9436    | n/a                        | n/a                             | 39           | -25                             |
| C6            | n/a                    | n/a        | n/a                             | 9938         | 1637       | 8301    | n/a                        | n/a                             | 38           | -28                             |
| C7            | n/a                    | n/a        | n/a                             | 9713         | 1637       | 8076    | n/a                        | n/a                             | 45           | -4                              |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| C8            | n/a                    | n/a        | n/a                             | 9755         | 1637       | 8118    | n/a                        | n/a                             | 40           | -21                             |
| C9            | n/a                    | n/a        | n/a                             | 8861         | 1637       | 7224    | n/a                        | n/a                             | 53           | 25                              |
| C10           | n/a                    | n/a        | n/a                             | 7166         | 1648       | 5518    | n/a                        | n/a                             | 45           | -4                              |
| C11           | n/a                    | n/a        | n/a                             | 6499         | 1648       | 4851    | n/a                        | n/a                             | 39           | -25                             |
| C12           | n/a                    | n/a        | n/a                             | 6312         | 1648       | 4664    | n/a                        | n/a                             | 52           | 21                              |
| C13           | n/a                    | n/a        | n/a                             | 5978         | 1637       | 4341    | n/a                        | n/a                             | 44           | -7                              |
| C14           | n/a                    | n/a        | n/a                             | 5145         | 1637       | 3508    | n/a                        | n/a                             | 50           | 14                              |
| C15           | n/a                    | n/a        | n/a                             | 10870        | 1637       | 9233    | n/a                        | n/a                             | 55           | 32                              |
| C16           | n/a                    | n/a        | n/a                             | 11396        | 1637       | 9759    | n/a                        | n/a                             | 43           | -11                             |
| C17           | n/a                    | n/a        | n/a                             | 11471        | 1637       | 9834    | n/a                        | n/a                             | 47           | 4                               |
| C18           | n/a                    | n/a        | n/a                             | 11478        | 1637       | 9841    | n/a                        | n/a                             | 38           | -28                             |
| C19           | n/a                    | n/a        | n/a                             | 10778        | 1637       | 9141    | n/a                        | n/a                             | 53           | 25                              |
| C20           | n/a                    | n/a        | n/a                             | 11192        | 1637       | 9555    | n/a                        | n/a                             | 41           | -18                             |
| C21           | n/a                    | n/a        | n/a                             | 10812        | 1637       | 9175    | n/a                        | n/a                             | 35           | -39                             |
| C22           | n/a                    | n/a        | n/a                             | 11338        | 1637       | 9701    | n/a                        | n/a                             | 38           | -28                             |
| C23           | n/a                    | n/a        | n/a                             | 10016        | 1637       | 8379    | n/a                        | n/a                             | 43           | -11                             |
| C24           | n/a                    | n/a        | n/a                             | 6843         | 1648       | 5195    | n/a                        | n/a                             | 35           | -39                             |
| C25           | n/a                    | n/a        | n/a                             | 7024         | 1648       | 5376    | n/a                        | n/a                             | 39           | -25                             |
| C26           | n/a                    | n/a        | n/a                             | 7283         | 1648       | 5635    | n/a                        | n/a                             | 46           | 0                               |
| C27           | n/a                    | n/a        | n/a                             | 6666         | 1637       | 5029    | n/a                        | n/a                             | 45           | -4                              |
| C28           | n/a                    | n/a        | n/a                             | 5922         | 1637       | 4285    | n/a                        | n/a                             | 33           | -46                             |
| C29           | n/a                    | n/a        | n/a                             | 10468        | 1637       | 8831    | n/a                        | n/a                             | 52           | 21                              |
| C30           | n/a                    | n/a        | n/a                             | 12204        | 1637       | 10567   | n/a                        | n/a                             | 39           | -25                             |
| C31           | n/a                    | n/a        | n/a                             | 12427        | 1637       | 10790   | n/a                        | n/a                             | 47           | 4                               |
| C32           | n/a                    | n/a        | n/a                             | 13485        | 1637       | 11848   | n/a                        | n/a                             | 44           | -7                              |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| C33           | n/a                    | n/a        | n/a                             | 11726        | 1637       | 10089   | n/a                        | n/a                             | 38           | -28                             |
| C34           | n/a                    | n/a        | n/a                             | 11669        | 1637       | 10032   | n/a                        | n/a                             | 43           | -11                             |
| C35           | n/a                    | n/a        | n/a                             | 11535        | 1637       | 9898    | n/a                        | n/a                             | 43           | -11                             |
| C36           | n/a                    | n/a        | n/a                             | 12171        | 1637       | 10534   | n/a                        | n/a                             | 41           | -18                             |
| C37           | n/a                    | n/a        | n/a                             | 9287         | 1648       | 7639    | n/a                        | n/a                             | 51           | 18                              |
| C38           | n/a                    | n/a        | n/a                             | 7366         | 1648       | 5718    | n/a                        | n/a                             | 40           | -21                             |
| C39           | n/a                    | n/a        | n/a                             | 7264         | 1648       | 5616    | n/a                        | n/a                             | 42           | -14                             |
| C40           | n/a                    | n/a        | n/a                             | 7871         | 1637       | 6234    | n/a                        | n/a                             | 46           | 0                               |
| C41           | n/a                    | n/a        | n/a                             | 7211         | 1637       | 5574    | n/a                        | n/a                             | 41           | -18                             |
| C42           | n/a                    | n/a        | n/a                             | 5820         | 1637       | 4183    | n/a                        | n/a                             | 41           | -18                             |
| C43           | n/a                    | n/a        | n/a                             | 9952         | 1637       | 8315    | n/a                        | n/a                             | 44           | -7                              |
| C44           | n/a                    | n/a        | n/a                             | 11648        | 1637       | 10011   | n/a                        | n/a                             | 35           | -39                             |
| C45           | n/a                    | n/a        | n/a                             | 12866        | 1637       | 11229   | n/a                        | n/a                             | 53           | 25                              |
| C46           | n/a                    | n/a        | n/a                             | 13003        | 1637       | 11366   | n/a                        | n/a                             | 52           | 21                              |
| C47           | n/a                    | n/a        | n/a                             | 12626        | 1637       | 10989   | n/a                        | n/a                             | 47           | 4                               |
| C48           | n/a                    | n/a        | n/a                             | 12919        | 1637       | 11282   | n/a                        | n/a                             | 47           | 4                               |
| C49           | n/a                    | n/a        | n/a                             | 12794        | 1637       | 11157   | n/a                        | n/a                             | 40           | -21                             |
| C50           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| C51           | n/a                    | n/a        | n/a                             | 10971        | 1648       | 9323    | n/a                        | n/a                             | 38           | -28                             |
| C52           | n/a                    | n/a        | n/a                             | 7777         | 1648       | 6129    | n/a                        | n/a                             | 57           | 39                              |
| C53           | n/a                    | n/a        | n/a                             | 7758         | 1648       | 6110    | n/a                        | n/a                             | 37           | -32                             |
| C54           | n/a                    | n/a        | n/a                             | 7583         | 1637       | 5946    | n/a                        | n/a                             | 41           | -18                             |
| C55           | n/a                    | n/a        | n/a                             | 7346         | 1637       | 5709    | n/a                        | n/a                             | 38           | -28                             |
| C56           | n/a                    | n/a        | n/a                             | 6187         | 1637       | 4550    | n/a                        | n/a                             | 43           | -11                             |
| C57           | n/a                    | n/a        | n/a                             | 10353        | 1637       | 8716    | n/a                        | n/a                             | 62           | 57                              |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| C58           | n/a                    | n/a        | n/a                             | 10308        | 1637       | 8671    | n/a                        | n/a                             | 58           | 42                              |
| C59           | n/a                    | n/a        | n/a                             | 11717        | 1637       | 10080   | n/a                        | n/a                             | 54           | 28                              |
| C60           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| C61           | n/a                    | n/a        | n/a                             | 11584        | 1648       | 9936    | n/a                        | n/a                             | 45           | -4                              |
| C62           | n/a                    | n/a        | n/a                             | 11796        | 1648       | 10148   | n/a                        | n/a                             | 42           | -14                             |
| C63           | n/a                    | n/a        | n/a                             | 11519        | 1648       | 9871    | n/a                        | n/a                             | 43           | -11                             |
| C64           | n/a                    | n/a        | n/a                             | 11257        | 1648       | 9609    | n/a                        | n/a                             | 42           | -14                             |
| C65           | n/a                    | n/a        | n/a                             | 11222        | 1648       | 9574    | n/a                        | n/a                             | 33           | -46                             |
| C66           | n/a                    | n/a        | n/a                             | 7811         | 1648       | 6163    | n/a                        | n/a                             | 48           | 7                               |
| C67           | n/a                    | n/a        | n/a                             | 6472         | 1648       | 4824    | n/a                        | n/a                             | 44           | -7                              |
| C68           | n/a                    | n/a        | n/a                             | 6607         | 1637       | 4970    | n/a                        | n/a                             | 35           | -39                             |
| C69           | n/a                    | n/a        | n/a                             | 6205         | 1637       | 4568    | n/a                        | n/a                             | 48           | 7                               |
| C70           | n/a                    | n/a        | n/a                             | 5823         | 1637       | 4186    | n/a                        | n/a                             | 41           | -18                             |
| C71           | n/a                    | n/a        | n/a                             | 9009         | 1637       | 7372    | n/a                        | n/a                             | 49           | 11                              |
| C72           | n/a                    | n/a        | n/a                             | 9632         | 1637       | 7995    | n/a                        | n/a                             | 58           | 42                              |
| C73           | n/a                    | n/a        | n/a                             | 11130        | 1637       | 9493    | n/a                        | n/a                             | 37           | -32                             |
| C74           | n/a                    | n/a        | n/a                             | 11747        | 1637       | 10110   | n/a                        | n/a                             | 41           | -18                             |
| C75           | n/a                    | n/a        | n/a                             | 11299        | 1637       | 9662    | n/a                        | n/a                             | 31           | -53                             |
| C76           | n/a                    | n/a        | n/a                             | 12068        | 1637       | 10431   | n/a                        | n/a                             | 44           | -7                              |
| C77           | n/a                    | n/a        | n/a                             | 11855        | 1637       | 10218   | n/a                        | n/a                             | 46           | 0                               |
| C78           | n/a                    | n/a        | n/a                             | 11822        | 1637       | 10185   | n/a                        | n/a                             | 46           | 0                               |
| C79           | n/a                    | n/a        | n/a                             | 11186        | 1637       | 9549    | n/a                        | n/a                             | 43           | -11                             |
| C80           | n/a                    | n/a        | n/a                             | 8737         | 1637       | 7100    | n/a                        | n/a                             | 42           | -14                             |
| C81           | n/a                    | n/a        | n/a                             | 6664         | 1648       | 5016    | n/a                        | n/a                             | 36           | -35                             |
| C82           | n/a                    | n/a        | n/a                             | 6714         | 1637       | 5077    | n/a                        | n/a                             | 45           | -4                              |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| C83           | n/a                    | n/a        | n/a                             | 6557         | 1637       | 4920    | n/a                        | n/a                             | 42           | -14                             |
| C84           | n/a                    | n/a        | n/a                             | 5905         | 1637       | 4268    | n/a                        | n/a                             | 40           | -21                             |
| C85           | n/a                    | n/a        | n/a                             | 5599         | 1637       | 3962    | n/a                        | n/a                             | 47           | 4                               |
| C86           | n/a                    | n/a        | n/a                             | 8282         | 1637       | 6645    | n/a                        | n/a                             | 58           | 42                              |
| C87           | n/a                    | n/a        | n/a                             | 8574         | 1637       | 6937    | n/a                        | n/a                             | 46           | 0                               |
| C88           | n/a                    | n/a        | n/a                             | 8978         | 1637       | 7341    | n/a                        | n/a                             | 43           | -11                             |
| C89           | n/a                    | n/a        | n/a                             | 9334         | 1637       | 7697    | n/a                        | n/a                             | 48           | 7                               |
| C90           | n/a                    | n/a        | n/a                             | 9875         | 1637       | 8238    | n/a                        | n/a                             | 51           | 18                              |
| C91           | n/a                    | n/a        | n/a                             | 9258         | 1637       | 7621    | n/a                        | n/a                             | 46           | 0                               |
| C92           | n/a                    | n/a        | n/a                             | 10167        | 1637       | 8530    | n/a                        | n/a                             | 45           | -4                              |
| C93           | n/a                    | n/a        | n/a                             | 10346        | 1637       | 8709    | n/a                        | n/a                             | 34           | -42                             |
| C94           | n/a                    | n/a        | n/a                             | 8890         | 1637       | 7253    | n/a                        | n/a                             | 58           | 42                              |
| C95           | n/a                    | n/a        | n/a                             | 7989         | 1637       | 6352    | n/a                        | n/a                             | 48           | 7                               |
| C96           | n/a                    | n/a        | n/a                             | 6182         | 1637       | 4545    | n/a                        | n/a                             | 39           | -25                             |
| C97           | n/a                    | n/a        | n/a                             | 5833         | 1637       | 4196    | n/a                        | n/a                             | 48           | 7                               |
| C98           | n/a                    | n/a        | n/a                             | 5629         | 1637       | 3992    | n/a                        | n/a                             | 50           | 14                              |
| F1            | n/a                    | n/a        | n/a                             | 10172        | 1637       | 8535    | n/a                        | n/a                             | 43           | -11                             |
| F2            | n/a                    | n/a        | n/a                             | 11794        | 1637       | 10157   | n/a                        | n/a                             | 41           | -18                             |
| F3            | n/a                    | n/a        | n/a                             | 17226        | 1637       | 15589   | n/a                        | n/a                             | 54           | 28                              |
| F4            | n/a                    | n/a        | n/a                             | 15173        | 1637       | 13536   | n/a                        | n/a                             | 38           | -28                             |
| F5            | n/a                    | n/a        | n/a                             | 14527        | 1637       | 12890   | n/a                        | n/a                             | 49           | 11                              |
| F6            | n/a                    | n/a        | n/a                             | 14419        | 1637       | 12782   | n/a                        | n/a                             | 39           | -25                             |
| F7            | n/a                    | n/a        | n/a                             | 20712        | 1637       | 19075   | n/a                        | n/a                             | 52           | 21                              |
| F8            | n/a                    | n/a        | n/a                             | 18635        | 1637       | 16998   | n/a                        | n/a                             | 47           | 4                               |
| F9            | n/a                    | n/a        | n/a                             | 12811        | 1637       | 11174   | n/a                        | n/a                             | 37           | -32                             |



# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| F10           | n/a                    | n/a        | n/a                             | 8839         | 1637       | 7202    | n/a                        | n/a                             | 43           | -11                             |
| F11           | n/a                    | n/a        | n/a                             | 7365         | 1637       | 5728    | n/a                        | n/a                             | 38           | -28                             |
| F12           | n/a                    | n/a        | n/a                             | 7530         | 1637       | 5893    | n/a                        | n/a                             | 35           | -39                             |
| F13           | n/a                    | n/a        | n/a                             | 8781         | 1637       | 7144    | n/a                        | n/a                             | 38           | -28                             |
| F14           | n/a                    | n/a        | n/a                             | 6645         | 1637       | 5008    | n/a                        | n/a                             | 64           | 64                              |
| F15           | n/a                    | n/a        | n/a                             | 11973        | 1637       | 10336   | n/a                        | n/a                             | 65           | 67                              |
| F16           | n/a                    | n/a        | n/a                             | 14592        | 1637       | 12955   | n/a                        | n/a                             | 55           | 32                              |
| F17           | n/a                    | n/a        | n/a                             | 17286        | 1637       | 15649   | n/a                        | n/a                             | 60           | 50                              |
| F18           | n/a                    | n/a        | n/a                             | 17653        | 1637       | 16016   | n/a                        | n/a                             | 64           | 64                              |
| F19           | n/a                    | n/a        | n/a                             | 15113        | 1637       | 13476   | n/a                        | n/a                             | 55           | 32                              |
| F20           | n/a                    | n/a        | n/a                             | 15860        | 1637       | 14223   | n/a                        | n/a                             | 56           | 35                              |
| F21           | n/a                    | n/a        | n/a                             | 16694        | 1637       | 15057   | n/a                        | n/a                             | 59           | 46                              |
| F22           | n/a                    | n/a        | n/a                             | 19369        | 1637       | 17732   | n/a                        | n/a                             | 62           | 57                              |
| F23           | n/a                    | n/a        | n/a                             | 19119        | 1637       | 17482   | n/a                        | n/a                             | 61           | 53                              |
| F24           | n/a                    | n/a        | n/a                             | 11085        | 1637       | 9448    | n/a                        | n/a                             | 66           | 71                              |
| F25           | n/a                    | n/a        | n/a                             | 7714         | 1637       | 6077    | n/a                        | n/a                             | 47           | 4                               |
| F26           | n/a                    | n/a        | n/a                             | 11803        | 1637       | 10166   | n/a                        | n/a                             | 52           | 21                              |
| F27           | n/a                    | n/a        | n/a                             | 10383        | 1637       | 8746    | n/a                        | n/a                             | 52           | 21                              |
| F28           | n/a                    | n/a        | n/a                             | 7618         | 1637       | 5981    | n/a                        | n/a                             | 52           | 21                              |
| F29           | n/a                    | n/a        | n/a                             | 12682        | 1637       | 11045   | n/a                        | n/a                             | 47           | 4                               |
| F30           | n/a                    | n/a        | n/a                             | 17382        | 1637       | 15745   | n/a                        | n/a                             | 53           | 25                              |
| F31           | n/a                    | n/a        | n/a                             | 23273        | 1637       | 21636   | n/a                        | n/a                             | 54           | 28                              |
| F32           | n/a                    | n/a        | n/a                             | 22204        | 1637       | 20567   | n/a                        | n/a                             | 55           | 32                              |
| F33           | n/a                    | n/a        | n/a                             | 21063        | 1637       | 19426   | n/a                        | n/a                             | 62           | 57                              |
| F34           | n/a                    | n/a        | n/a                             | 18277        | 1637       | 16640   | n/a                        | n/a                             | 62           | 57                              |

# Characterization Survey Design Package

**Building:** Science Center                      **Survey Unit ID:** SU1                      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| F35           | n/a                    | n/a        | n/a                             | 19529        | 1637       | 17892   | n/a                        | n/a                             | 51           | 18                              |
| F36           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| F37           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| F38           | n/a                    | n/a        | n/a                             | 11073        | 1637       | 9436    | n/a                        | n/a                             | 47           | 4                               |
| F39           | n/a                    | n/a        | n/a                             | 19283        | 1637       | 17646   | n/a                        | n/a                             | 49           | 11                              |
| F40           | n/a                    | n/a        | n/a                             | 13772        | 1637       | 12135   | n/a                        | n/a                             | 45           | -4                              |
| F41           | n/a                    | n/a        | n/a                             | 9953         | 1637       | 8316    | n/a                        | n/a                             | 65           | 67                              |
| F42           | n/a                    | n/a        | n/a                             | 8249         | 1637       | 6612    | n/a                        | n/a                             | 40           | -21                             |
| F43           | n/a                    | n/a        | n/a                             | 11455        | 1637       | 9818    | n/a                        | n/a                             | 50           | 14                              |
| F44           | n/a                    | n/a        | n/a                             | 13704        | 1637       | 12067   | n/a                        | n/a                             | 46           | 0                               |
| F45           | n/a                    | n/a        | n/a                             | 21605        | 1637       | 19968   | n/a                        | n/a                             | 46           | 0                               |
| F46           | n/a                    | n/a        | n/a                             | 25742        | 1637       | 24105   | n/a                        | n/a                             | 42           | -14                             |
| F47           | n/a                    | n/a        | n/a                             | 25622        | 1637       | 23985   | n/a                        | n/a                             | 49           | 11                              |
| F48           | n/a                    | n/a        | n/a                             | 18284        | 1637       | 16647   | n/a                        | n/a                             | 43           | -11                             |
| F49           | n/a                    | n/a        | n/a                             | 18563        | 1637       | 16926   | n/a                        | n/a                             | 40           | -21                             |
| F50           | n/a                    | n/a        | n/a                             | 34225        | 1637       | 32588   | n/a                        | n/a                             | 44           | -7                              |
| F51           | n/a                    | n/a        | n/a                             | 42536        | 1637       | 40899   | n/a                        | n/a                             | 46           | 0                               |
| F52           | n/a                    | n/a        | n/a                             | 12645        | 1637       | 11008   | n/a                        | n/a                             | 54           | 28                              |
| F53           | n/a                    | n/a        | n/a                             | 7960         | 1637       | 6323    | n/a                        | n/a                             | 39           | -25                             |
| F54           | n/a                    | n/a        | n/a                             | 12685        | 1637       | 11048   | n/a                        | n/a                             | 46           | 0                               |
| F55           | n/a                    | n/a        | n/a                             | 11872        | 1637       | 10235   | n/a                        | n/a                             | 41           | -18                             |
| F56           | n/a                    | n/a        | n/a                             | 8252         | 1637       | 6615    | n/a                        | n/a                             | 40           | -21                             |
| F57           | n/a                    | n/a        | n/a                             | 10194        | 1637       | 8557    | n/a                        | n/a                             | 53           | 25                              |
| F58           | n/a                    | n/a        | n/a                             | 12325        | 1637       | 10688   | n/a                        | n/a                             | 40           | -21                             |
| F59           | n/a                    | n/a        | n/a                             | 19632        | 1637       | 17995   | n/a                        | n/a                             | 59           | 46                              |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| F60           | n/a                    | n/a        | n/a                             | 42382        | 1637       | 40745   | n/a                        | n/a                             | 36           | -35                             |
| F61           | n/a                    | n/a        | n/a                             | 26014        | 1637       | 24377   | n/a                        | n/a                             | 48           | 7                               |
| F62           | n/a                    | n/a        | n/a                             | 16618        | 1637       | 14981   | n/a                        | n/a                             | 40           | -21                             |
| F63           | n/a                    | n/a        | n/a                             | 15114        | 1637       | 13477   | n/a                        | n/a                             | 46           | 0                               |
| F64           | n/a                    | n/a        | n/a                             | 21746        | 1637       | 20109   | n/a                        | n/a                             | 37           | -32                             |
| F65           | n/a                    | n/a        | n/a                             | 33691        | 1637       | 32054   | n/a                        | n/a                             | 47           | 4                               |
| F66           | n/a                    | n/a        | n/a                             | 9049         | 1637       | 7412    | n/a                        | n/a                             | 47           | 4                               |
| F67           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| F68           | n/a                    | n/a        | n/a                             | n/a          | n/a        | n/a     | n/a                        | n/a                             | n/a          | n/a                             |
| F69           | n/a                    | n/a        | n/a                             | 9433         | 1637       | 7796    | n/a                        | n/a                             | 47           | 4                               |
| F70           | n/a                    | n/a        | n/a                             | 9431         | 1637       | 7794    | n/a                        | n/a                             | 48           | 7                               |
| F71           | n/a                    | n/a        | n/a                             | 9012         | 1637       | 7375    | n/a                        | n/a                             | 47           | 4                               |
| F72           | n/a                    | n/a        | n/a                             | 13766        | 1637       | 12129   | n/a                        | n/a                             | 42           | -14                             |
| F73           | n/a                    | n/a        | n/a                             | 16512        | 1637       | 14875   | n/a                        | n/a                             | 45           | -4                              |
| F74           | n/a                    | n/a        | n/a                             | 25948        | 1637       | 24311   | n/a                        | n/a                             | 45           | -4                              |
| F75           | n/a                    | n/a        | n/a                             | 14843        | 1637       | 13206   | n/a                        | n/a                             | 36           | -35                             |
| F76           | n/a                    | n/a        | n/a                             | 13810        | 1637       | 12173   | n/a                        | n/a                             | 40           | -21                             |
| F77           | n/a                    | n/a        | n/a                             | 12578        | 1637       | 10941   | n/a                        | n/a                             | 53           | 25                              |
| F78           | n/a                    | n/a        | n/a                             | 16926        | 1637       | 15289   | n/a                        | n/a                             | 59           | 46                              |
| F79           | n/a                    | n/a        | n/a                             | 16130        | 1637       | 14493   | n/a                        | n/a                             | 35           | -39                             |
| F80           | n/a                    | n/a        | n/a                             | 12358        | 1637       | 10721   | n/a                        | n/a                             | 40           | -21                             |
| F81           | n/a                    | n/a        | n/a                             | 9871         | 1637       | 8234    | n/a                        | n/a                             | 46           | 0                               |
| F82           | n/a                    | n/a        | n/a                             | 9537         | 1637       | 7900    | n/a                        | n/a                             | 52           | 21                              |
| F83           | n/a                    | n/a        | n/a                             | 7788         | 1637       | 6151    | n/a                        | n/a                             | 34           | -42                             |
| F84           | n/a                    | n/a        | n/a                             | 8155         | 1637       | 6518    | n/a                        | n/a                             | 44           | -7                              |

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| F85           | n/a                    | n/a        | n/a                             | 7560         | 1637       | 5923    | n/a                        | n/a                             | 46           | 0                               |
| F86           | n/a                    | n/a        | n/a                             | 8682         | 1637       | 7045    | n/a                        | n/a                             | 34           | -42                             |
| F87           | n/a                    | n/a        | n/a                             | 10376        | 1637       | 8739    | n/a                        | n/a                             | 39           | -25                             |
| F88           | n/a                    | n/a        | n/a                             | 12413        | 1637       | 10776   | n/a                        | n/a                             | 46           | 0                               |
| F89           | n/a                    | n/a        | n/a                             | 10755        | 1637       | 9118    | n/a                        | n/a                             | 51           | 18                              |
| F90           | n/a                    | n/a        | n/a                             | 10957        | 1637       | 9320    | n/a                        | n/a                             | 44           | -7                              |
| F91           | n/a                    | n/a        | n/a                             | 10664        | 1637       | 9027    | n/a                        | n/a                             | 41           | -18                             |
| F92           | n/a                    | n/a        | n/a                             | 11053        | 1637       | 9416    | n/a                        | n/a                             | 50           | 14                              |
| F93           | n/a                    | n/a        | n/a                             | 11888        | 1637       | 10251   | n/a                        | n/a                             | 56           | 35                              |
| F94           | n/a                    | n/a        | n/a                             | 12088        | 1637       | 10451   | n/a                        | n/a                             | 37           | -32                             |
| F95           | n/a                    | n/a        | n/a                             | 10982        | 1637       | 9345    | n/a                        | n/a                             | 33           | -46                             |
| F96           | n/a                    | n/a        | n/a                             | 10145        | 1637       | 8508    | n/a                        | n/a                             | 42           | -14                             |
| F97           | n/a                    | n/a        | n/a                             | 7950         | 1637       | 6313    | n/a                        | n/a                             | 37           | -32                             |
| F98           | n/a                    | n/a        | n/a                             | 8101         | 1637       | 6464    | n/a                        | n/a                             | 39           | -25                             |
| F99           | n/a                    | n/a        | n/a                             | 4343         | 1637       | 2706    | n/a                        | n/a                             | 50           | 14                              |
| F100          | n/a                    | n/a        | n/a                             | 4601         | 1637       | 2964    | n/a                        | n/a                             | 42           | -14                             |
| P1            | n/a                    | n/a        | n/a                             | 25498        | 1637       | 23861   | n/a                        | n/a                             | 38           | -28                             |
| P2            | n/a                    | n/a        | n/a                             | 25542        | 1637       | 23905   | n/a                        | n/a                             | 44           | -7                              |
| P3            | n/a                    | n/a        | n/a                             | 10795        | 1637       | 9158    | n/a                        | n/a                             | 50           | 14                              |
| P4            | n/a                    | n/a        | n/a                             | 13811        | 1637       | 12174   | n/a                        | n/a                             | 36           | -35                             |
| P5            | n/a                    | n/a        | n/a                             | 13975        | 1637       | 12338   | n/a                        | n/a                             | 52           | 21                              |
| P6            | n/a                    | n/a        | n/a                             | 8557         | 1637       | 6920    | n/a                        | n/a                             | 40           | -21                             |
| P7            | n/a                    | n/a        | n/a                             | 6696         | 1637       | 5059    | n/a                        | n/a                             | 39           | -25                             |
| P8            | n/a                    | n/a        | n/a                             | 7414         | 1637       | 5777    | n/a                        | n/a                             | 38           | -28                             |
| P9            | n/a                    | n/a        | n/a                             | 8950         | 1637       | 7313    | n/a                        | n/a                             | 39           | -25                             |

# Characterization Survey Design Package

**Building:** Science Center                      **Survey Unit ID:** SU1                      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| P10           | n/a                    | n/a        | n/a                             | 10413        | 1637       | 8776    | n/a                        | n/a                             | 46           | 0                               |
| P11           | n/a                    | n/a        | n/a                             | 17749        | 1637       | 16112   | n/a                        | n/a                             | 48           | 7                               |
| N5D           | n/a                    | n/a        | n/a                             | 8874         | 1637       | 7237    | n/a                        | n/a                             | 53           | 25                              |
| N9D           | n/a                    | n/a        | n/a                             | 11142        | 1637       | 9505    | n/a                        | n/a                             | 49           | 11                              |
| N15D          | n/a                    | n/a        | n/a                             | 9074         | 1637       | 7437    | n/a                        | n/a                             | 37           | -32                             |
| N34D          | n/a                    | n/a        | n/a                             | 10881        | 1637       | 9244    | n/a                        | n/a                             | 38           | -28                             |
| S5D           | n/a                    | n/a        | n/a                             | 7865         | 1637       | 6228    | n/a                        | n/a                             | 51           | 18                              |
| S11D          | n/a                    | n/a        | n/a                             | 11733        | 1637       | 10096   | n/a                        | n/a                             | 45           | -4                              |
| S20D          | n/a                    | n/a        | n/a                             | 11078        | 1637       | 9441    | n/a                        | n/a                             | 43           | -11                             |
| S38D          | n/a                    | n/a        | n/a                             | 12002        | 1637       | 10365   | n/a                        | n/a                             | 49           | 11                              |
| W4D           | n/a                    | n/a        | n/a                             | 10526        | 1637       | 8889    | n/a                        | n/a                             | 43           | -11                             |
| W13D          | n/a                    | n/a        | n/a                             | 8397         | 1637       | 6760    | n/a                        | n/a                             | 38           | -28                             |
| E6D           | n/a                    | n/a        | n/a                             | 5980         | 1637       | 4343    | n/a                        | n/a                             | 54           | 28                              |
| E11D          | n/a                    | n/a        | n/a                             | 7180         | 1637       | 5543    | n/a                        | n/a                             | 50           | 14                              |
| C14D          | n/a                    | n/a        | n/a                             | 5032         | 1637       | 3395    | n/a                        | n/a                             | 41           | -18                             |
| C31D          | n/a                    | n/a        | n/a                             | 12225        | 1637       | 10588   | n/a                        | n/a                             | 44           | -7                              |
| C33D          | n/a                    | n/a        | n/a                             | 12127        | 1637       | 10490   | n/a                        | n/a                             | 45           | -4                              |
| C37D          | n/a                    | n/a        | n/a                             | 9491         | 1637       | 7854    | n/a                        | n/a                             | 33           | -46                             |
| C44D          | n/a                    | n/a        | n/a                             | 11512        | 1637       | 9875    | n/a                        | n/a                             | 51           | 18                              |
| C55D          | n/a                    | n/a        | n/a                             | 7379         | 1637       | 5742    | n/a                        | n/a                             | 54           | 28                              |
| C66D          | n/a                    | n/a        | n/a                             | 7574         | 1637       | 5937    | n/a                        | n/a                             | 51           | 18                              |
| C75D          | n/a                    | n/a        | n/a                             | 11434        | 1637       | 9797    | n/a                        | n/a                             | 48           | 7                               |
| C92D          | n/a                    | n/a        | n/a                             | 10028        | 1637       | 8391    | n/a                        | n/a                             | 36           | -35                             |
| C95D          | n/a                    | n/a        | n/a                             | 7743         | 1637       | 6106    | n/a                        | n/a                             | 49           | 11                              |
| F1D           | n/a                    | n/a        | n/a                             | 9983         | 1637       | 8346    | n/a                        | n/a                             | 44           | -7                              |

# Characterization Survey Design Package

**Building:** Science Center                      **Survey Unit ID:** SU1                      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

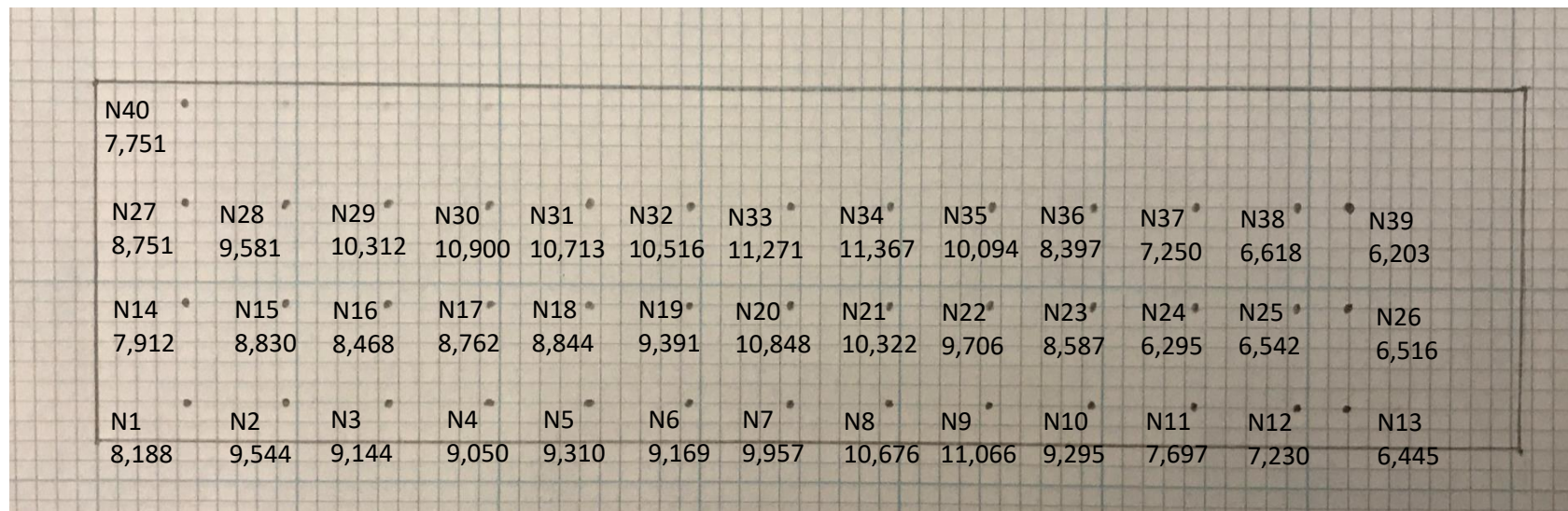
| Location Code | Total Activity Results |            |                                 |              |            |         | Removable Activity Results |                                 |              |                                 |
|---------------|------------------------|------------|---------------------------------|--------------|------------|---------|----------------------------|---------------------------------|--------------|---------------------------------|
|               | Alpha                  |            |                                 | Gamma        |            |         | Alpha                      |                                 | Beta-Gamma   |                                 |
|               | Gross Counts           | BKG Counts | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | BKG Counts | Net CPM | Gross Counts               | Net DPM/<br>100 cm <sup>2</sup> | Gross Counts | Net DPM/<br>100 cm <sup>2</sup> |
| F18D          | n/a                    | n/a        | n/a                             | 13790        | 1637       | 12153   | n/a                        | n/a                             | 43           | -11                             |
| F25D          | n/a                    | n/a        | n/a                             | 7764         | 1637       | 6127    | n/a                        | n/a                             | 58           | 42                              |
| F41D          | n/a                    | n/a        | n/a                             | 10024        | 1637       | 8387    | n/a                        | n/a                             | 43           | -11                             |
| F49D          | n/a                    | n/a        | n/a                             | 18278        | 1637       | 16641   | n/a                        | n/a                             | 37           | -32                             |
| F54D          | n/a                    | n/a        | n/a                             | 13029        | 1637       | 11392   | n/a                        | n/a                             | 43           | -11                             |
| F70D          | n/a                    | n/a        | n/a                             | 9050         | 1637       | 7413    | n/a                        | n/a                             | 42           | -14                             |
| F78D          | n/a                    | n/a        | n/a                             | 16454        | 1637       | 14817   | n/a                        | n/a                             | 45           | -4                              |
| F88D          | n/a                    | n/a        | n/a                             | 12285        | 1637       | 10648   | n/a                        | n/a                             | 61           | 53                              |
| F97D          | n/a                    | n/a        | n/a                             | 7524         | 1637       | 5887    | n/a                        | n/a                             | 48           | 7                               |
| P4D           | n/a                    | n/a        | n/a                             | 13312        | 1637       | 11675   | n/a                        | n/a                             | 40           | -21                             |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |
|               |                        |            |                                 |              |            |         |                            |                                 |              |                                 |

N/A

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

North Wall

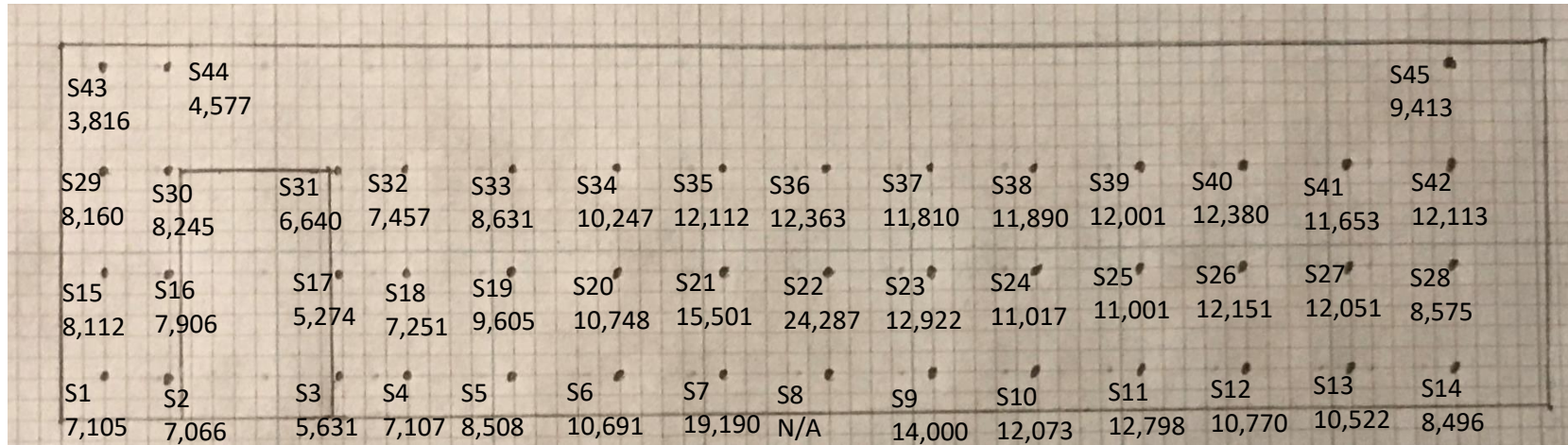


Comments: Locations determined using one meter grid. Location N23 was used as origin of the grid. Duplicate core sample taken at location N17 to satisfy QA requirements.

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

South Wall

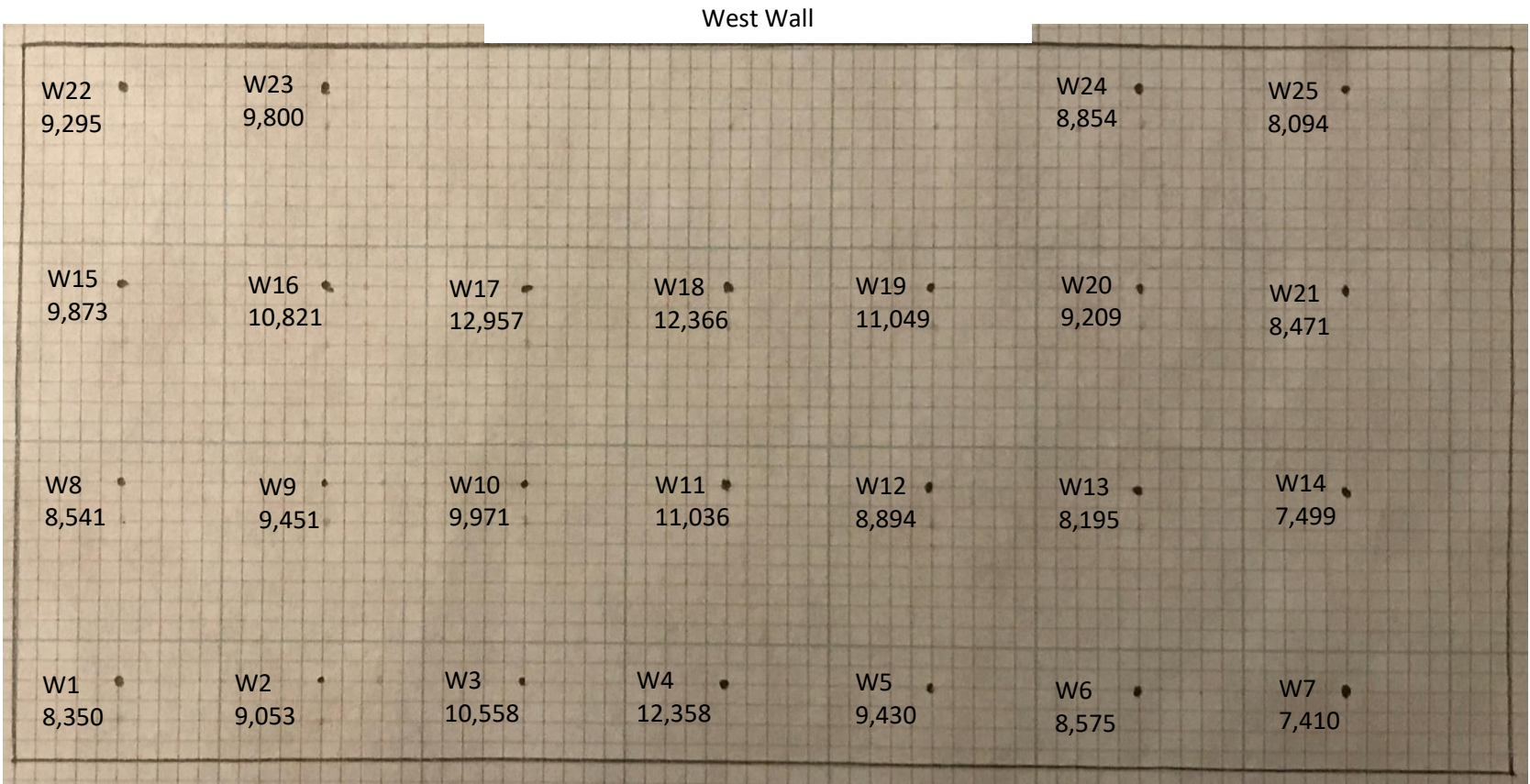


Comments: Locations determined using one meter grid. Location S19 was used as origin of the grid. Surface of wall was not accessible at location S8.



# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

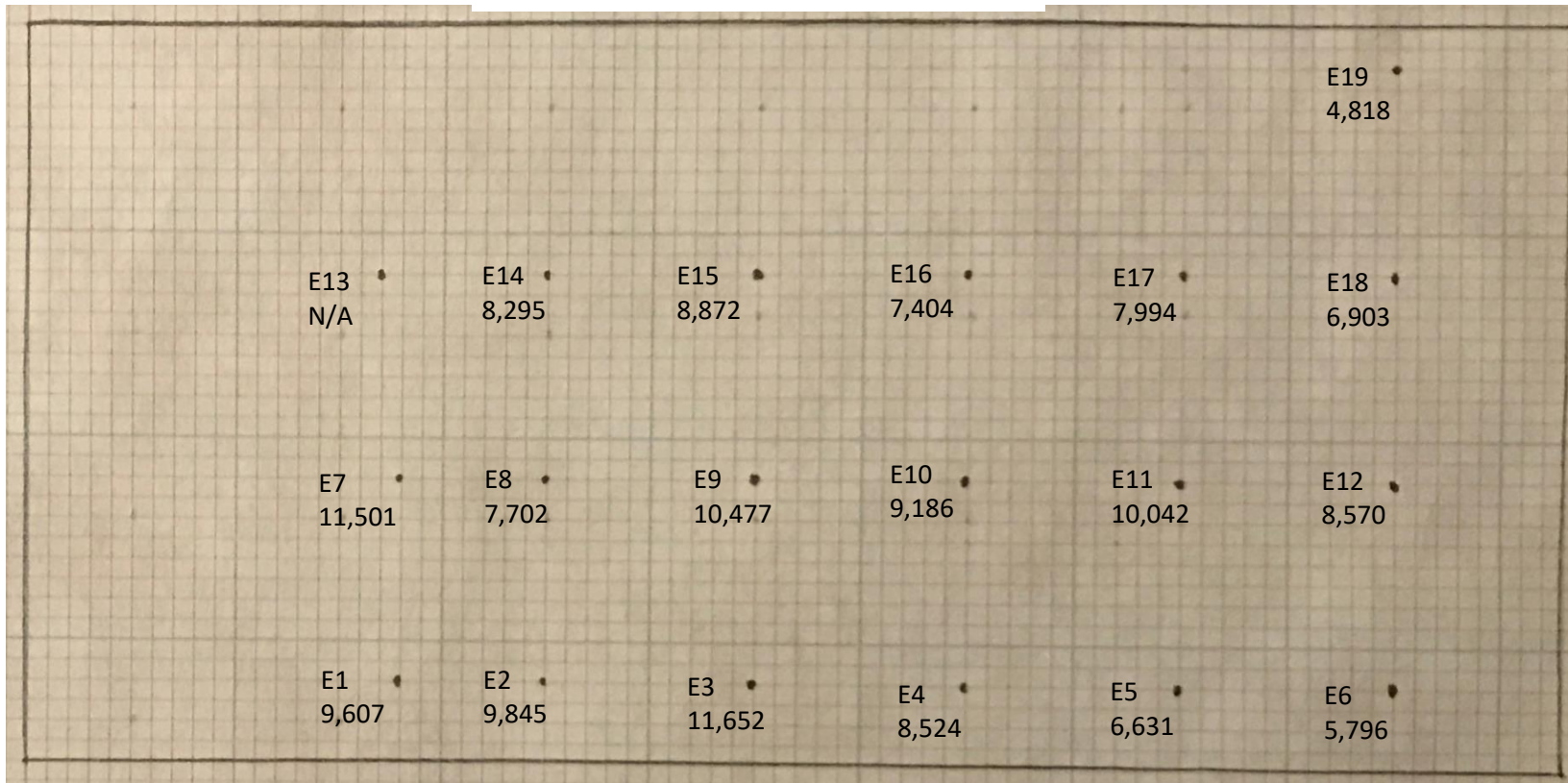


Comments: Locations determined using one meter grid. Location W11 was used as origin of the grid. Duplicate core samples taken at locations W5 and W11 to satisfy QA requirements.

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault

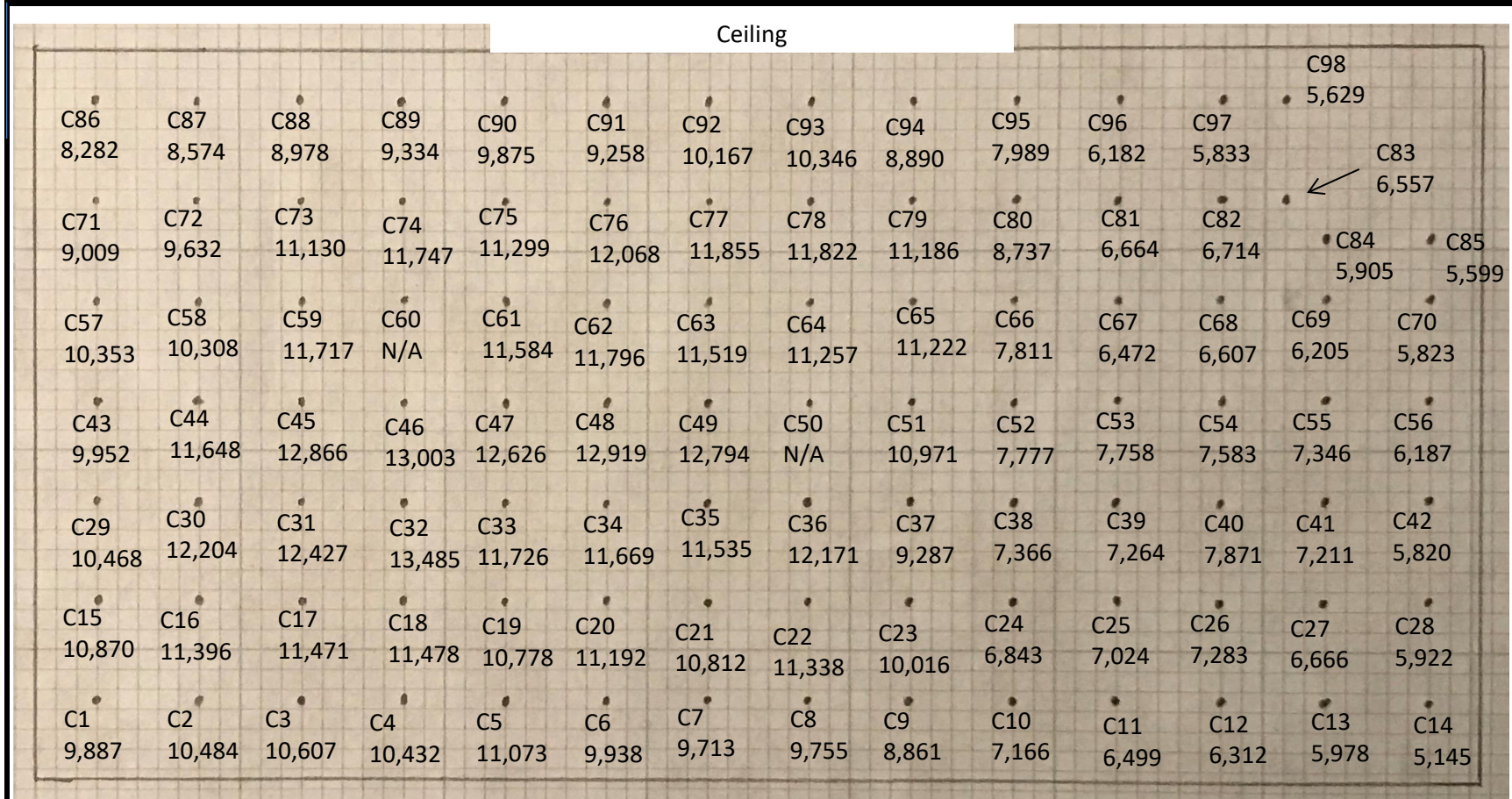
East Wall



Comments: Locations determined using one meter grid. Location E9 was used as origin of the grid.

# Characterization Survey Design Package

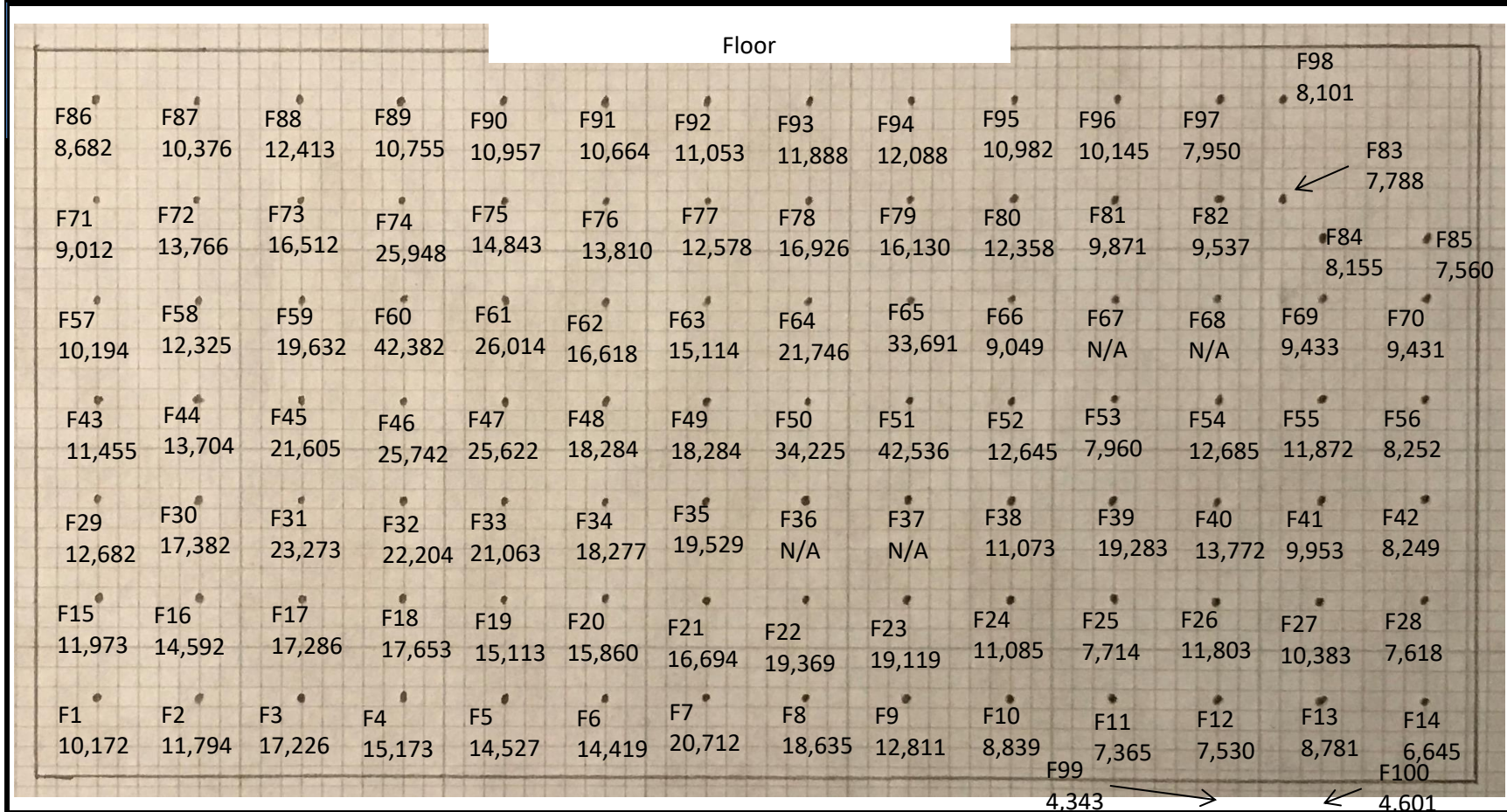
**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault



Comments: Locations for ceiling were approximated based on locations on floor grid. Location C52 was used as origin of the grid. Locations C50 and C60 were inaccessible and no static counts or smear were taken.

# Characterization Survey Design Package

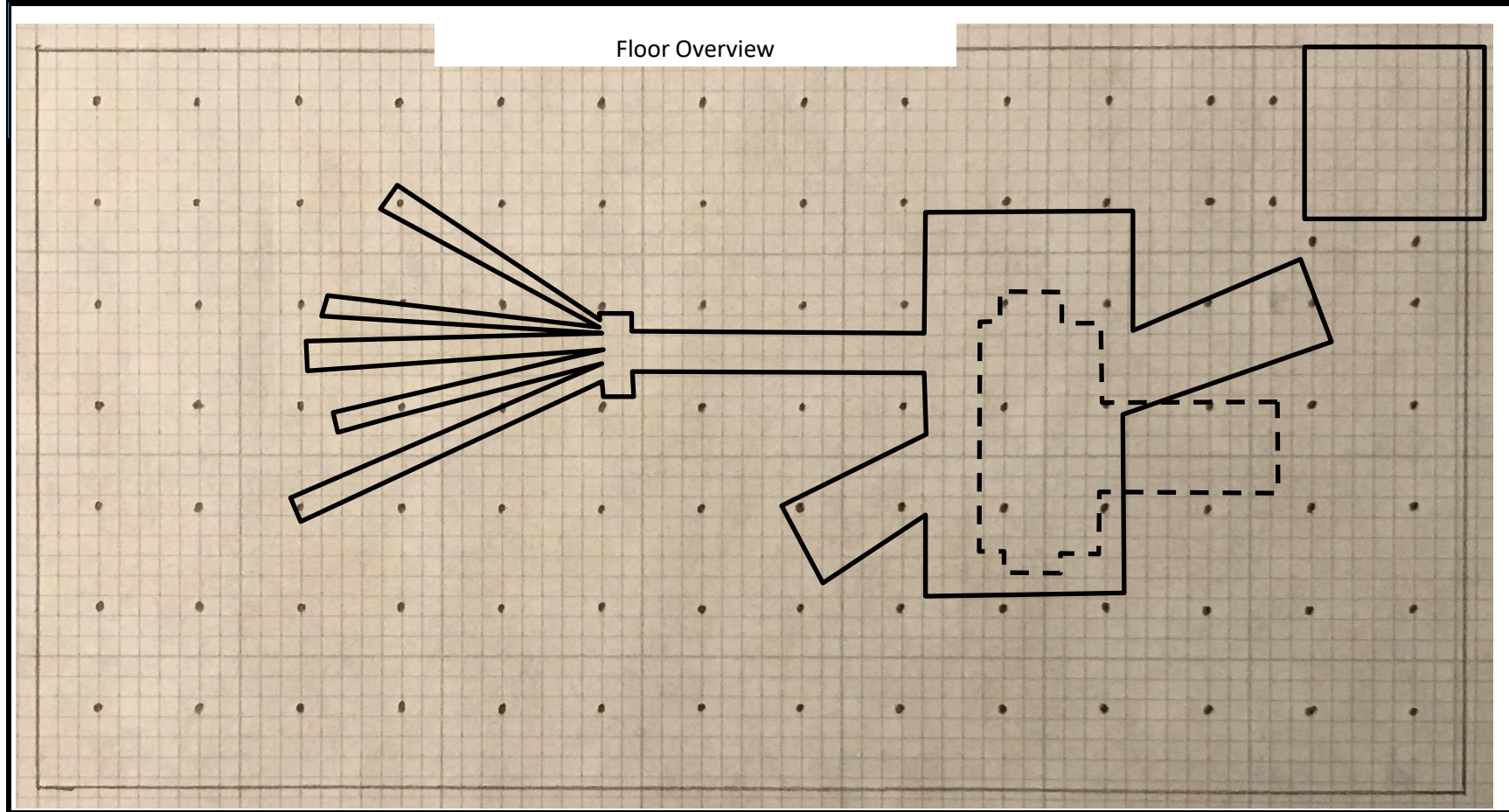
**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault



**Comments:** Locations determined using one meter grid. Location F52 was used as origin of the grid. Locations F36, F37, F67, and F68 were inaccessible and no static counts or smear were taken. Duplicate core sample taken at location F72 to satisfy QA requirements.

# Characterization Survey Design Package

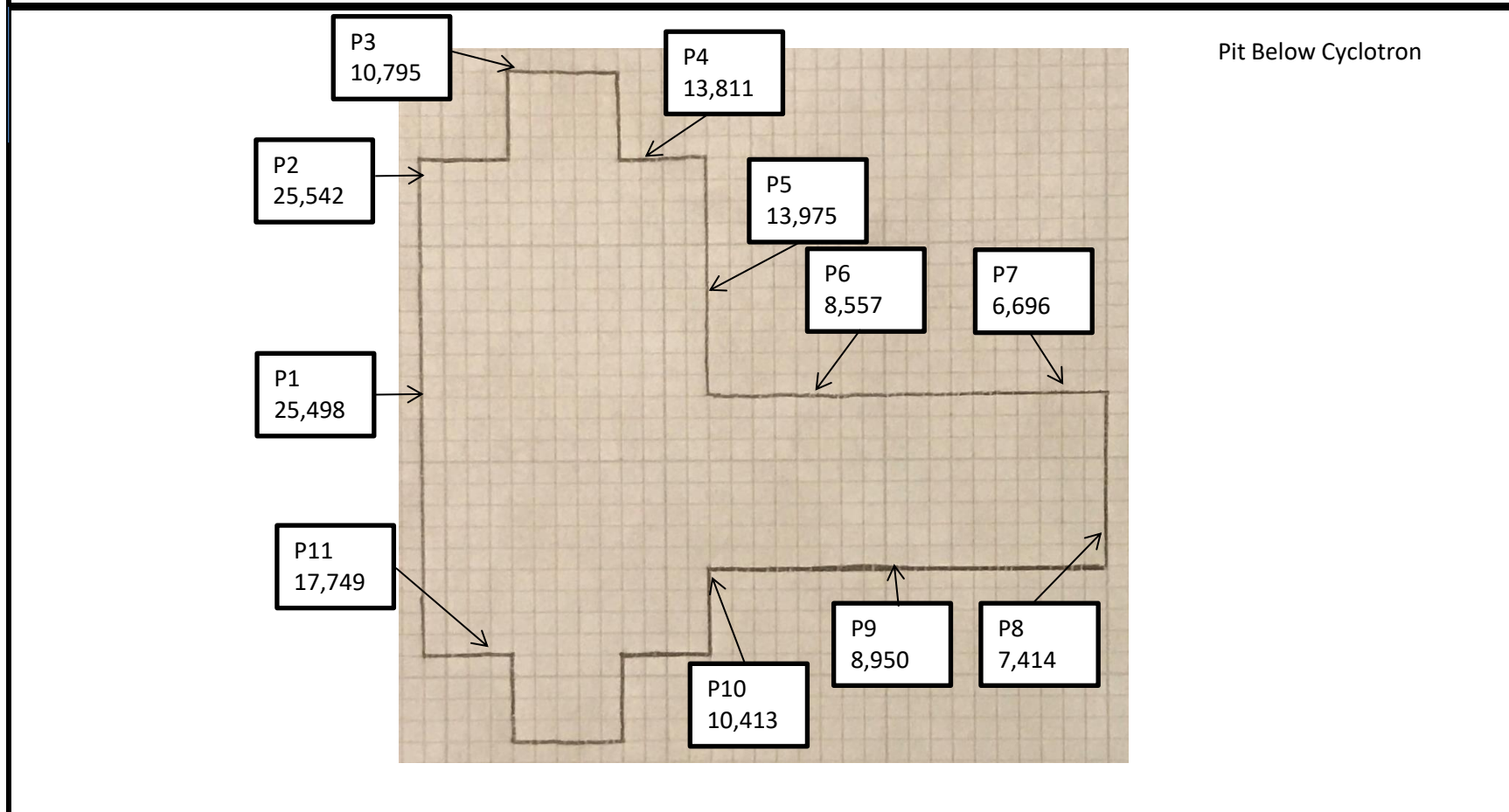
**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault



Comments: Area outlined in solid black line shows location of cyclotron. Area outlined in dashed black line shows location of the pit area. Square area located in Northeast corner was inaccessible for surveying.

# Characterization Survey Design Package

**Building:** Science Center      **Survey Unit ID:** SU1      Page \_\_\_\_\_ of \_\_\_\_\_  
**Marssim Classification:** N/A  
**Room Nos. Included in Survey Unit:** UT Health MC-40 Cyclotron Vault



Comments: Pit wall locations marked using one meter spacing measured from origin at P1. Wall height measured from Pit floor to vault floor is 1.1 meters and grid height is 0.9 meters from Pit floor.

# Characterization Survey Design Package

|                                                                                  |                                   |            |          |
|----------------------------------------------------------------------------------|-----------------------------------|------------|----------|
| <b>Building:</b> Science Center                                                  | <b>Survey Unit ID:</b> <u>SU1</u> | Page _____ | of _____ |
| <b>Marssim Classification:</b> N/A                                               |                                   |            |          |
| <b>Room Nos. Included in Survey Unit:</b> <u>UT Health MC-40 Cyclotron Vault</u> |                                   |            |          |

## Comments Section

| Date      | Comment                                                                                                                                                                                                     |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9/15/2017 | 100% of accessible surfaces scanned with NaI detector. Due to interference from cyclotron and remaining components, no elevated areas were marked. All walls and ceiling assumed to be uniformly activated. |
| 9/15/2017 | No removable activity was detected from beta-gamma smears or from LSC smears.                                                                                                                               |
|           |                                                                                                                                                                                                             |
|           |                                                                                                                                                                                                             |
|           |                                                                                                                                                                                                             |
|           |                                                                                                                                                                                                             |
|           |                                                                                                                                                                                                             |
|           |                                                                                                                                                                                                             |
|           |                                                                                                                                                                                                             |

**ATTACHMENT 2**

**Laboratory Reports for Concrete Volumetric Samples**







October 26, 2017

Mr. Paul Jones  
Ameriphysics, LLC  
911 Cross Park Dr.  
Knoxville, Tennessee 37923

Re: Ameriphysics, LLC  
Work Order: 433373

Dear Mr. Jones:

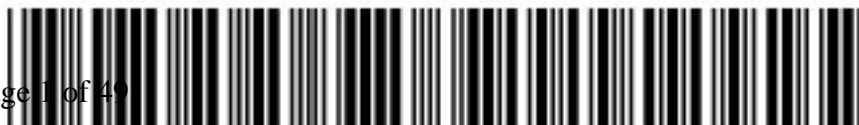
GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 21, 2017. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. The data package has been revised to correct the Gamma Spec data.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Edith Kent  
Project Manager

Purchase Order: 0316-001  
Enclosures



# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 – (843) 556-8171 – www.gel.com

## Certificate of Analysis Report for

AMPH002 Ameriphysics, LLC

Client SDG: 433373 GEL Work Order: 433373

**The Qualifiers in this report are defined as follows:**

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy—Uncertain identification

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.



Reviewed by \_\_\_\_\_

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F16 (1-6) Project: AMPH002  
Sample ID: 433373001 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 08:15  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date | Time     | Batch        | Method |
|--------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|------|----------|--------------|--------|
| Rad Gamma Spec Analysis                                      |           |          |             |        |    |       |    |    |         |      |          |              |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |      |          |              |        |
| Antimony-124                                                 | U         | -0.00626 | +/-0.0786   | 0.172  |    | pCi/g |    |    |         | MXR1 | 09/28/17 | 1354 1702974 | 1      |
| Cadmium-109                                                  | U         | -0.0642  | +/-0.962    | 1.84   |    | pCi/g |    |    |         |      |          |              |        |
| Cesium-134                                                   | U         | 0.0385   | +/-0.0683   | 0.130  |    | pCi/g |    |    |         |      |          |              |        |
| Chromium-51                                                  | U         | -0.0545  | +/-0.485    | 0.930  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-56                                                    | U         | 0.0278   | +/-0.0711   | 0.139  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-57                                                    | UI        | 0.00     | +/-0.136    | 0.264  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-58                                                    | U         | 0.00269  | +/-0.0647   | 0.125  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-60                                                    |           | 0.592    | +/-0.114    | 0.0889 |    | pCi/g |    |    |         |      |          |              |        |
| Europium-152                                                 |           | 8.91     | +/-0.555    | 0.230  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-154                                                 | UI        | 0.00     | +/-0.252    | 0.581  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-155                                                 | U         | -0.0601  | +/-0.141    | 0.261  |    | pCi/g |    |    |         |      |          |              |        |
| Iron-59                                                      | U         | 0.0341   | +/-0.146    | 0.273  |    | pCi/g |    |    |         |      |          |              |        |
| Manganese-54                                                 | U         | 0.0427   | +/-0.0611   | 0.123  |    | pCi/g |    |    |         |      |          |              |        |
| Niobium-95                                                   | U         | -0.0208  | +/-0.081    | 0.125  |    | pCi/g |    |    |         |      |          |              |        |
| Scandium-46                                                  | U         | -0.012   | +/-0.0688   | 0.128  |    | pCi/g |    |    |         |      |          |              |        |
| Silver-108m                                                  | U         | -0.0319  | +/-0.0374   | 0.0654 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-110m                                                  | U         | -0.0679  | +/-0.0868   | 0.153  |    | pCi/g |    |    |         |      |          |              |        |
| Sodium-22                                                    | UI        | 0.00     | +/-0.088    | 0.206  |    | pCi/g |    |    |         |      |          |              |        |
| Zinc-65                                                      | U         | -0.0664  | +/-0.160    | 0.246  |    | pCi/g |    |    |         |      |          |              |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F18 (1-6) Project: AMPH002  
Sample ID: 433373002 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 08:35  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.00521   | +/-0.068    | 0.148  |    | pCi/g |    |    | MXR1    | 09/28/17 | 1354 | 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.456     | +/-1.23     | 1.53   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | -0.0275   | +/-0.0542   | 0.0987 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.000865 | +/-0.385    | 0.732  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.0877    | +/-0.055    | 0.116  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | U         | 0.186     | +/-0.172    | 0.224  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | -0.0296   | +/-0.0544   | 0.0986 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.547     | +/-0.121    | 0.0753 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 8.49      | +/-0.487    | 0.217  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 |           | 0.523     | +/-0.202    | 0.222  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | -0.00594  | +/-0.132    | 0.240  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | 0.110     | +/-0.123    | 0.226  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.013     | +/-0.0529   | 0.101  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.0186    | +/-0.0591   | 0.107  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.00239   | +/-0.0549   | 0.104  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.00788  | +/-0.0328   | 0.0601 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.00134  | +/-0.0677   | 0.128  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | UI        | 0.00      | +/-0.0713   | 0.131  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | 0.153     | +/-0.152    | 0.224  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F20 (1-6) Project: AMPH002  
Sample ID: 433373003 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 09:00  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date | Time     | Batch        | Method |
|--------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|------|----------|--------------|--------|
| Rad Gamma Spec Analysis                                      |           |          |             |        |    |       |    |    |         |      |          |              |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |      |          |              |        |
| Antimony-124                                                 | U         | 7.70E-05 | +/-0.036    | 0.096  |    | pCi/g |    |    |         | MXR1 | 09/28/17 | 1354 1702974 | 1      |
| Cadmium-109                                                  | U         | -0.661   | +/-1.05     | 1.85   |    | pCi/g |    |    |         |      |          |              |        |
| Cesium-134                                                   | U         | 0.0201   | +/-0.0535   | 0.103  |    | pCi/g |    |    |         |      |          |              |        |
| Chromium-51                                                  | U         | 0.220    | +/-0.444    | 0.881  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-56                                                    | U         | 0.0491   | +/-0.109    | 0.107  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-57                                                    | UI        | 0.00     | +/-0.118    | 0.232  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-58                                                    | U         | 0.0352   | +/-0.0558   | 0.109  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-60                                                    |           | 0.603    | +/-0.119    | 0.0754 |    | pCi/g |    |    |         |      |          |              |        |
| Europium-152                                                 |           | 7.01     | +/-0.486    | 0.233  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-154                                                 | UI        | 0.00     | +/-0.220    | 0.423  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-155                                                 | U         | 0.0367   | +/-0.157    | 0.288  |    | pCi/g |    |    |         |      |          |              |        |
| Iron-59                                                      | U         | -0.0186  | +/-0.116    | 0.196  |    | pCi/g |    |    |         |      |          |              |        |
| Manganese-54                                                 | U         | 0.0116   | +/-0.0468   | 0.0887 |    | pCi/g |    |    |         |      |          |              |        |
| Niobium-95                                                   | U         | 0.0168   | +/-0.0557   | 0.105  |    | pCi/g |    |    |         |      |          |              |        |
| Scandium-46                                                  | U         | -0.0092  | +/-0.0603   | 0.108  |    | pCi/g |    |    |         |      |          |              |        |
| Silver-108m                                                  | U         | 0.0152   | +/-0.036    | 0.0708 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-110m                                                  | U         | -0.0503  | +/-0.0742   | 0.124  |    | pCi/g |    |    |         |      |          |              |        |
| Sodium-22                                                    | UI        | 0.00     | +/-0.0776   | 0.0756 |    | pCi/g |    |    |         |      |          |              |        |
| Zinc-65                                                      | U         | 0.0585   | +/-0.119    | 0.221  |    | pCi/g |    |    |         |      |          |              |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-F25 (1-6) | Project: AMPH002   |
| Sample ID: 433373004             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 09:25    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0247  | +/-0.0485   | 0.0635 |    | pCi/g |    |    | MXR1    | 09/28/17 | 1355 | 1702974 | 1      |
| Cadmium-109                                                          | U         | 1.55     | +/-1.62     | 1.67   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0705   | +/-0.0769   | 0.161  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.0547  | +/-0.410    | 0.741  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.052    | +/-0.0564   | 0.127  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.149    | 0.0591 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0123   | +/-0.0699   | 0.136  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.199    | +/-0.075    | 0.0976 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 3.27     | +/-0.417    | 0.222  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | UI        | 0.00     | +/-0.221    | 0.533  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | -0.0334  | +/-0.116    | 0.219  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.00995  | +/-0.133    | 0.272  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | -0.00114 | +/-0.0455   | 0.0894 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.0259   | +/-0.0735   | 0.145  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.0504   | +/-0.0609   | 0.133  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.00443 | +/-0.0388   | 0.0761 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0275  | +/-0.0829   | 0.149  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00     | +/-0.078    | 0.0873 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.0381   | +/-0.176    | 0.318  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F46 (1-6) Project: AMPH002  
Sample ID: 433373005 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 09:45  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date | Time     | Batch        | Method |
|--------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|------|----------|--------------|--------|
| Rad Gamma Spec Analysis                                      |           |           |             |        |    |       |    |    |         |      |          |              |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |           |             |        |    |       |    |    |         |      |          |              |        |
| Antimony-124                                                 | U         | -0.0312   | +/-0.0991   | 0.200  |    | pCi/g |    |    |         | MXR1 | 09/28/17 | 1355 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.133     | +/-0.803    | 1.47   |    | pCi/g |    |    |         |      |          |              |        |
| Cesium-134                                                   | U         | -0.0412   | +/-0.0717   | 0.129  |    | pCi/g |    |    |         |      |          |              |        |
| Chromium-51                                                  | U         | 0.431     | +/-0.518    | 0.963  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-56                                                    | U         | 0.043     | +/-0.0742   | 0.149  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-57                                                    | UI        | 0.00      | +/-0.186    | 0.252  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-58                                                    | U         | 0.0756    | +/-0.0798   | 0.161  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-60                                                    |           | 0.544     | +/-0.130    | 0.0909 |    | pCi/g |    |    |         |      |          |              |        |
| Europium-152                                                 |           | 7.20      | +/-0.492    | 0.273  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-154                                                 |           | 0.759     | +/-0.270    | 0.194  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-155                                                 | U         | 0.0513    | +/-0.130    | 0.240  |    | pCi/g |    |    |         |      |          |              |        |
| Iron-59                                                      | U         | 0.0218    | +/-0.158    | 0.304  |    | pCi/g |    |    |         |      |          |              |        |
| Manganese-54                                                 | U         | -1.52E-05 | +/-0.0671   | 0.128  |    | pCi/g |    |    |         |      |          |              |        |
| Niobium-95                                                   | U         | -0.0176   | +/-0.0844   | 0.157  |    | pCi/g |    |    |         |      |          |              |        |
| Scandium-46                                                  | U         | 0.0367    | +/-0.0686   | 0.139  |    | pCi/g |    |    |         |      |          |              |        |
| Silver-108m                                                  | U         | -0.0518   | +/-0.0419   | 0.0676 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-110m                                                  | U         | -0.0517   | +/-0.0972   | 0.174  |    | pCi/g |    |    |         |      |          |              |        |
| Sodium-22                                                    | UI        | 0.00      | +/-0.0954   | 0.206  |    | pCi/g |    |    |         |      |          |              |        |
| Zinc-65                                                      | U         | 0.0968    | +/-0.172    | 0.310  |    | pCi/g |    |    |         |      |          |              |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                   |                    |
|-----------------------------------|--------------------|
| Client Sample ID: 1132-F46 (7-12) | Project: AMPH002   |
| Sample ID: 433373006              | Client ID: AMPH002 |
| Matrix: Misc Solid                |                    |
| Collect Date: 14-SEP-17 09:55     |                    |
| Receive Date: 21-SEP-17           |                    |
| Collector: Client                 |                    |

| Parameter                                                            | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |           |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0158   | +/-0.0675   | 0.135  |    | pCi/g |    |    | MXR1    | 09/28/17 | 1414 | 1702974 | 1      |
| Cadmium-109                                                          | U         | 0.637     | +/-1.08     | 0.935  |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | -0.0195   | +/-0.0456   | 0.0798 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.022     | +/-0.362    | 0.650  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.0427    | +/-0.0479   | 0.0816 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00      | +/-0.0891   | 0.179  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | UI        | 0.00      | +/-0.0785   | 0.079  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.508     | +/-0.0996   | 0.0684 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 5.42      | +/-0.376    | 0.172  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         |           | 0.382     | +/-0.154    | 0.191  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0708    | +/-0.0884   | 0.176  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0273   | +/-0.110    | 0.205  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | -0.000374 | +/-0.044    | 0.0796 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.0209    | +/-0.0562   | 0.107  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.0273   | +/-0.0513   | 0.0871 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.0181   | +/-0.0302   | 0.0552 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.0609    | +/-0.0725   | 0.142  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00      | +/-0.0542   | 0.119  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.0653   | +/-0.170    | 0.185  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |



# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-F51 (1-6) | Project: AMPH002   |
| Sample ID: 433373007             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 10:10    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result  | Uncertainty | MDC   | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|---------|-------------|-------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |         |             |       |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |         |             |       |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.0227  | +/-0.107    | 0.239 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1152 | 1702974 | 1      |
| Cadmium-109                                                          | U         | -0.651  | +/-1.33     | 2.43  |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | -0.0144 | +/-0.0999   | 0.172 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.175  | +/-0.669    | 1.24  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.0202 | +/-0.0908   | 0.166 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00    | +/-0.183    | 0.375 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.152   | +/-0.175    | 0.168 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 1.22    | +/-0.174    | 0.117 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 16.3    | +/-0.759    | 0.308 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         |           | 0.847   | +/-0.413    | 0.373 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0659  | +/-0.196    | 0.368 |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.0384  | +/-0.158    | 0.305 |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.0782  | +/-0.0861   | 0.170 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0016 | +/-0.0969   | 0.170 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.0569 | +/-0.0961   | 0.170 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.0314  | +/-0.0546   | 0.105 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0167 | +/-0.117    | 0.216 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00    | +/-0.146    | 0.243 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.144   | +/-0.220    | 0.381 |    | pCi/g |    |    |         |          |      |         |        |

### Rad Liquid Scintillation Analysis

#### LSC, Tritium Dist, Solid "As Received"

|         |      |         |      |      |       |      |          |      |         |   |
|---------|------|---------|------|------|-------|------|----------|------|---------|---|
| Tritium | 5.19 | +/-2.74 | 4.39 | 6.00 | pCi/g | BXM4 | 09/29/17 | 0739 | 1703187 | 2 |
|---------|------|---------|------|------|-------|------|----------|------|---------|---|

#### Liquid Scint Fe55, Solid "Dry Weight Corrected"

|         |      |         |      |      |       |      |          |      |         |   |
|---------|------|---------|------|------|-------|------|----------|------|---------|---|
| Iron-55 | 5.50 | +/-7.21 | 11.3 | 20.0 | pCi/g | TXJ1 | 10/09/17 | 1257 | 1703166 | 3 |
|---------|------|---------|------|------|-------|------|----------|------|---------|---|

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |
| 2      | EPA 906.0 Modified            |                  |
| 3      | DOE RESL Fe-1, Modified       |                  |

| Surrogate/Tracer Recovery | Test | Result | Nominal | Recovery% | Acceptable Limits |
|---------------------------|------|--------|---------|-----------|-------------------|
|                           |      |        |         |           |                   |

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

---

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-F51 (1-6) | Project: AMPH002   |
| Sample ID: 433373007             | Client ID: AMPH002 |

| Parameter                 | Qualifier                                       | Result | Uncertainty | MDC | RL | Units  | PF      | DF        | Analyst Date      | Time Batch | Method |
|---------------------------|-------------------------------------------------|--------|-------------|-----|----|--------|---------|-----------|-------------------|------------|--------|
| Surrogate/Tracer Recovery | Test                                            |        |             |     |    | Result | Nominal | Recovery% | Acceptable Limits |            |        |
| Iron-59 Tracer            | Liquid Scint Fe55, Solid "Dry Weight Corrected" |        |             |     |    |        |         | 73.9      | (15%-125%)        |            |        |

**Notes:**  
 Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

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Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F51 (7-12) Project: AMPH002  
Sample ID: 433373008 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 10:20  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                     | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|---------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                       |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                  | U         | 0.060   | +/-0.114    | 0.281  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1152 | 1702974 | 1      |
| Cadmium-109                                                   | U         | -0.181  | +/-1.08     | 2.01   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                    | U         | 0.013   | +/-0.0984   | 0.180  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                   | U         | -0.0117 | +/-0.661    | 1.28   |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                     | U         | 0.0843  | +/-0.0927   | 0.186  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                     | UI        | 0.00    | +/-0.262    | 0.0852 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                     | U         | 0.0726  | +/-0.0966   | 0.189  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                     |           | 1.10    | +/-0.203    | 0.164  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                  |           | 13.8    | +/-0.792    | 0.338  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                  |           | 1.22    | +/-0.423    | 0.753  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                  | U         | 0.0284  | +/-0.170    | 0.320  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                       | U         | -0.0102 | +/-0.161    | 0.311  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                  | U         | -0.0378 | +/-0.100    | 0.151  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                    | U         | 0.0873  | +/-0.099    | 0.194  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                   | U         | -0.047  | +/-0.0956   | 0.175  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                   | U         | -0.0352 | +/-0.0616   | 0.0979 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                   | U         | -0.0424 | +/-0.129    | 0.239  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                     | U         | 0.0954  | +/-0.189    | 0.120  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                       | U         | 0.0451  | +/-0.185    | 0.327  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F51 (13-16) Project: AMPH002  
Sample ID: 433373009 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 10:25  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0332  | +/-0.0946   | 0.219  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1234 | 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.150   | +/-1.43     | 2.52   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0736  | +/-0.0687   | 0.139  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | 0.0848  | +/-0.534    | 1.01   |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | -0.0297 | +/-0.0776   | 0.134  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00    | +/-0.229    | 0.296  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.0371  | +/-0.0733   | 0.140  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.768   | +/-0.130    | 0.0782 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 9.67    | +/-0.593    | 0.265  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 |           | 0.783   | +/-0.283    | 0.575  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | -0.0532 | +/-0.199    | 0.341  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0986 | +/-0.141    | 0.230  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.0444  | +/-0.0663   | 0.128  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.00159 | +/-0.0768   | 0.139  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | -0.0668 | +/-0.0739   | 0.120  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | 0.00294 | +/-0.0439   | 0.0825 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0642 | +/-0.0969   | 0.163  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.041   | +/-0.143    | 0.0926 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | 0.0351  | +/-0.159    | 0.264  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F52 (1-6) Project: AMPH002  
Sample ID: 433373010 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 10:35  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0163  | +/-0.0641   | 0.161  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1235 | 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.414   | +/-1.01     | 1.91   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0528  | +/-0.0551   | 0.109  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.441  | +/-0.460    | 0.804  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.0128  | +/-0.0581   | 0.114  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00    | +/-0.169    | 0.0592 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.039   | +/-0.0546   | 0.113  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.268   | +/-0.0962   | 0.0962 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 4.56    | +/-0.439    | 0.188  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.161   | +/-0.177    | 0.372  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.0891  | +/-0.143    | 0.273  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | 0.00165 | +/-0.110    | 0.212  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.0107  | +/-0.050    | 0.0983 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.0776  | +/-0.0824   | 0.103  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | -0.016  | +/-0.0582   | 0.094  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | 0.0171  | +/-0.0364   | 0.0718 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0235 | +/-0.0664   | 0.123  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0538  | +/-0.0621   | 0.130  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.108  | +/-0.162    | 0.233  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration   SQL: Sample Quantitation Limit

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F56 (1-6) Project: AMPH002  
Sample ID: 433373011 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 10:55  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0356  | +/-0.0696   | 0.170  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1235 | 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.644   | +/-1.40     | 1.45   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0205  | +/-0.0553   | 0.0946 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.0253 | +/-0.329    | 0.633  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.023   | +/-0.0424   | 0.0881 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00    | +/-0.120    | 0.0465 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.014   | +/-0.0437   | 0.0883 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.192   | +/-0.113    | 0.0829 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 3.10    | +/-0.314    | 0.213  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.247   | +/-0.171    | 0.331  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.0549  | +/-0.100    | 0.193  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | 0.0491  | +/-0.0854   | 0.182  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.0406  | +/-0.0431   | 0.0912 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.0295  | +/-0.0537   | 0.0945 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.053   | +/-0.0443   | 0.0976 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.0114 | +/-0.0265   | 0.0483 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0142 | +/-0.0512   | 0.0971 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | UI        | 0.00    | +/-0.0604   | 0.0769 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.0588 | +/-0.126    | 0.192  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration   SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F72 (1-6) Project: AMPH002  
Sample ID: 433373012 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 11:15  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0245  | +/-0.0499   | 0.135  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1235 | 1702974 | 1      |
| Cadmium-109                                                  | U         | -0.0987 | +/-0.900    | 1.65   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0127  | +/-0.0578   | 0.107  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | 0.00504 | +/-0.363    | 0.706  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | -0.0167 | +/-0.0548   | 0.0957 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | U         | 0.0899  | +/-0.149    | 0.201  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.0352  | +/-0.0547   | 0.106  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.472   | +/-0.103    | 0.080  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 5.25    | +/-0.383    | 0.205  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | UI        | 0.00    | +/-0.232    | 0.407  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.0557  | +/-0.126    | 0.237  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | 0.0469  | +/-0.113    | 0.228  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.0203  | +/-0.0438   | 0.0849 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | -0.0274 | +/-0.0546   | 0.0948 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | -0.017  | +/-0.0483   | 0.0841 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.0252 | +/-0.0375   | 0.0583 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0112 | +/-0.0674   | 0.120  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0375  | +/-0.118    | 0.0743 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | 0.0309  | +/-0.153    | 0.201  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-F76 (1-6) Project: AMPH002  
Sample ID: 433373013 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 11:45  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0387   | +/-0.0525   | 0.142  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1236 | 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.472    | +/-0.751    | 1.41   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0222   | +/-0.0499   | 0.0947 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | UI        | 0.00     | +/-0.780    | 0.687  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.0114   | +/-0.0503   | 0.0929 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | U         | 0.00987  | +/-0.130    | 0.0522 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.00511  | +/-0.0526   | 0.0955 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.335    | +/-0.109    | 0.0663 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 5.02     | +/-0.398    | 0.180  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.222    | +/-0.145    | 0.322  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.0543   | +/-0.106    | 0.198  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0225  | +/-0.0961   | 0.177  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | -0.0265  | +/-0.0469   | 0.0788 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.0172   | +/-0.0449   | 0.0857 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | -0.0029  | +/-0.0509   | 0.0908 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.00269 | +/-0.0311   | 0.058  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0269  | +/-0.0635   | 0.108  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0808   | +/-0.0505   | 0.113  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | 0.0649   | +/-0.128    | 0.227  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit



# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-F80 (1-6) | Project: AMPH002   |
| Sample ID: 433373014             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 12:05    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.0366   | +/-0.113    | 0.277  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1236 | 1702974 | 1      |
| Cadmium-109                                                          | U         | -0.532   | +/-0.934    | 1.75   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | -0.00955 | +/-0.0694   | 0.129  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.131    | +/-0.520    | 0.965  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.00389 | +/-0.075    | 0.140  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.170    | 0.0684 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0231   | +/-0.0667   | 0.134  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.412    | +/-0.133    | 0.0822 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 4.65     | +/-0.462    | 0.237  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | U         | 0.252    | +/-0.235    | 0.524  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0705   | +/-0.137    | 0.270  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0435  | +/-0.129    | 0.249  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | -0.0456  | +/-0.0638   | 0.107  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.011   | +/-0.0779   | 0.143  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.0774   | +/-0.0736   | 0.159  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.0165  | +/-0.0395   | 0.0746 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.072    | +/-0.0886   | 0.188  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | U         | 0.089    | +/-0.0829   | 0.185  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | UI        | 0.00     | +/-0.158    | 0.207  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-C46 (1-6) | Project: AMPH002   |
| Sample ID: 433373015             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 12:30    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.00114  | +/-0.0468   | 0.128  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1236 | 1702974 | 1      |
| Cadmium-109                                                          | U         | 0.935    | +/-1.46     | 1.16   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | -0.00282 | +/-0.0573   | 0.111  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.165    | +/-0.410    | 0.818  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.0455   | +/-0.065    | 0.134  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | U         | 0.0248   | +/-0.153    | 0.0534 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | -0.00344 | +/-0.0616   | 0.119  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.484    | +/-0.112    | 0.0786 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 6.21     | +/-0.463    | 0.224  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | UI        | 0.00     | +/-0.269    | 0.504  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0176   | +/-0.117    | 0.216  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.0334   | +/-0.124    | 0.248  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.0951   | +/-0.0753   | 0.0998 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0232  | +/-0.065    | 0.121  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.0395   | +/-0.0701   | 0.142  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.0248   | +/-0.0731   | 0.0736 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0429  | +/-0.107    | 0.168  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00     | +/-0.0948   | 0.0964 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.175   | +/-0.159    | 0.204  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-C52 (1-6) | Project: AMPH002   |
| Sample ID: 433373016             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 12:40    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0114  | +/-0.0441   | 0.101  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1237 | 1702974 | 1      |
| Cadmium-109                                                          | U         | -0.354   | +/-0.979    | 1.54   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0132   | +/-0.0533   | 0.104  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.263   | +/-0.456    | 0.706  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.000214 | +/-0.0533   | 0.101  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.137    | 0.0537 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0149   | +/-0.0528   | 0.104  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.469    | +/-0.102    | 0.0713 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 3.71     | +/-0.343    | 0.200  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | U         | 0.239    | +/-0.219    | 0.362  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0633   | +/-0.131    | 0.237  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0562  | +/-0.0897   | 0.156  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.00393  | +/-0.0493   | 0.0845 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.0062   | +/-0.0542   | 0.104  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.0278   | +/-0.0522   | 0.105  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.0128  | +/-0.0367   | 0.0641 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0178  | +/-0.0655   | 0.121  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00     | +/-0.0774   | 0.0798 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.0251   | +/-0.146    | 0.188  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                 |                    |
|---------------------------------|--------------------|
| Client Sample ID: 1132-W3 (1-6) | Project: AMPH002   |
| Sample ID: 433373017            | Client ID: AMPH002 |
| Matrix: Misc Solid              |                    |
| Collect Date: 14-SEP-17 13:25   |                    |
| Receive Date: 21-SEP-17         |                    |
| Collector: Client               |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.023   | +/-0.0451   | 0.0798 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1240 | 1702974 | 1      |
| Cadmium-109                                                          | U         | 0.217    | +/-0.861    | 1.61   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.00512  | +/-0.0541   | 0.105  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.409   | +/-0.442    | 0.783  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.0156  | +/-0.0593   | 0.110  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.173    | 0.0566 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | -0.0181  | +/-0.054    | 0.101  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.750    | +/-0.127    | 0.0636 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 6.56     | +/-0.463    | 0.204  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | U         | 0.286    | +/-0.172    | 0.383  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.015    | +/-0.134    | 0.245  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0118  | +/-0.104    | 0.197  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | -0.0122  | +/-0.0459   | 0.0862 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.0176   | +/-0.057    | 0.106  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.00602  | +/-0.0564   | 0.109  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.00337 | +/-0.0289   | 0.0546 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0138  | +/-0.0771   | 0.144  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | U         | 0.103    | +/-0.061    | 0.136  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.237    | +/-0.130    | 0.284  |    | pCi/g |    |    |         |          |      |         |        |

### Rad Liquid Scintillation Analysis

#### LSC, Tritium Dist, Solid "As Received"

|         |   |      |         |      |      |       |  |      |          |      |         |   |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|
| Tritium | U | 4.25 | +/-2.73 | 4.45 | 6.00 | pCi/g |  | BXM4 | 09/29/17 | 0841 | 1703187 | 2 |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|

#### Liquid Scint Fe55, Solid "Dry Weight Corrected"

|         |   |      |         |      |      |       |  |      |          |      |         |   |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|
| Iron-55 | U | 7.13 | +/-7.17 | 11.1 | 20.0 | pCi/g |  | TXJ1 | 10/09/17 | 1328 | 1703166 | 3 |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |
| 2      | EPA 906.0 Modified            |                  |
| 3      | DOE RESL Fe-1, Modified       |                  |

| Surrogate/Tracer Recovery | Test | Result | Nominal | Recovery% | Acceptable Limits |
|---------------------------|------|--------|---------|-----------|-------------------|
|                           |      |        |         |           |                   |

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Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

---

Client Sample ID: 1132-W3 (1-6) Project: AMPH002  
Sample ID: 433373017 Client ID: AMPH002

---

| Parameter                 | Qualifier                                       | Result | Uncertainty | MDC | RL | Units  | PF      | DF        | Analyst | Date | Time Batch        | Method |
|---------------------------|-------------------------------------------------|--------|-------------|-----|----|--------|---------|-----------|---------|------|-------------------|--------|
| Surrogate/Tracer Recovery | Test                                            |        |             |     |    | Result | Nominal | Recovery% |         |      | Acceptable Limits |        |
| Iron-59 Tracer            | Liquid Scint Fe55, Solid "Dry Weight Corrected" |        |             |     |    |        |         | 73.6      |         |      | (15%-125%)        |        |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-W5 (1-6) Project: AMPH002  
Sample ID: 433373018 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 13:35  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.036     | +/-0.0572   | 0.148  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1240 | 1702974 | 1      |
| Cadmium-109                                                  | U         | 0.456     | +/-0.689    | 1.23   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | -0.000697 | +/-0.0393   | 0.0766 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.231    | +/-0.370    | 0.668  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.00217   | +/-0.048    | 0.0912 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | U         | 0.0987    | +/-0.123    | 0.161  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.0347    | +/-0.0474   | 0.0969 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.440     | +/-0.0827   | 0.0565 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 4.26      | +/-0.339    | 0.182  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.0936    | +/-0.222    | 0.199  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | -0.0474   | +/-0.0952   | 0.168  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | 0.0231    | +/-0.0962   | 0.184  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.0312    | +/-0.0707   | 0.0747 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | -0.0325   | +/-0.0516   | 0.0854 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.0126    | +/-0.047    | 0.0921 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | 0.012     | +/-0.027    | 0.0537 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | 0.00865   | +/-0.0599   | 0.116  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0331    | +/-0.0783   | 0.110  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.0116   | +/-0.111    | 0.180  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-W11 (1-6) | Project: AMPH002   |
| Sample ID: 433373019             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 14:05    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |         |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.031  | +/-0.043    | 0.0448 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1240 | 1702974 | 1      |
| Cadmium-109                                                          | U         | 0.182   | +/-1.08     | 1.96   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0153  | +/-0.0628   | 0.119  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.235   | +/-0.429    | 0.833  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.00824 | +/-0.0667   | 0.123  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00    | +/-0.105    | 0.220  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0207  | +/-0.0686   | 0.129  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.524   | +/-0.105    | 0.0843 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 5.34    | +/-0.466    | 0.242  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | UI        | 0.00    | +/-0.255    | 0.530  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.00646 | +/-0.148    | 0.264  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0225 | +/-0.128    | 0.240  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | -0.0763 | +/-0.0577   | 0.0878 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.00937 | +/-0.0644   | 0.120  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.00659 | +/-0.0642   | 0.119  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.0108  | +/-0.0385   | 0.0716 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.0213  | +/-0.0809   | 0.153  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00    | +/-0.090    | 0.0897 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.0568  | +/-0.145    | 0.257  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-W17 (1-6) | Project: AMPH002   |
| Sample ID: 433373020             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 14:25    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |         |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0479 | +/-0.0541   | 0.0427 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1323 | 1702974 | 1      |
| Cadmium-109                                                          | U         | -0.394  | +/-1.15     | 2.09   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0431  | +/-0.0637   | 0.126  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.117  | +/-0.459    | 0.875  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.00779 | +/-0.0651   | 0.109  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00    | +/-0.188    | 0.070  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.00584 | +/-0.0593   | 0.111  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.901   | +/-0.139    | 0.0823 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 6.90    | +/-0.526    | 0.234  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | UI        | 0.00    | +/-0.269    | 0.408  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0323  | +/-0.159    | 0.297  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.0288  | +/-0.133    | 0.240  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.0421  | +/-0.0601   | 0.110  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.035   | +/-0.0774   | 0.123  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.0136 | +/-0.0652   | 0.116  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.0297 | +/-0.0409   | 0.0732 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.0317  | +/-0.0803   | 0.154  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00    | +/-0.095    | 0.0905 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.0238 | +/-0.139    | 0.233  |    | pCi/g |    |    |         |          |      |         |        |

### Rad Liquid Scintillation Analysis

#### LSC, Tritium Dist, Solid "As Received"

|         |      |         |      |      |       |      |          |      |         |   |
|---------|------|---------|------|------|-------|------|----------|------|---------|---|
| Tritium | 5.28 | +/-2.73 | 4.36 | 6.00 | pCi/g | BXM4 | 09/29/17 | 0943 | 1703187 | 2 |
|---------|------|---------|------|------|-------|------|----------|------|---------|---|

#### Liquid Scint Fe55, Solid "Dry Weight Corrected"

|         |   |       |         |      |      |       |      |          |      |         |   |
|---------|---|-------|---------|------|------|-------|------|----------|------|---------|---|
| Iron-55 | U | 0.486 | +/-7.63 | 12.4 | 20.0 | pCi/g | TXJ1 | 10/09/17 | 1359 | 1703166 | 3 |
|---------|---|-------|---------|------|------|-------|------|----------|------|---------|---|

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0854 | 1702937    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |
| 2      | EPA 906.0 Modified            |                  |
| 3      | DOE RESL Fe-1, Modified       |                  |

| Surrogate/Tracer Recovery | Test | Result | Nominal | Recovery% | Acceptable Limits |
|---------------------------|------|--------|---------|-----------|-------------------|
|                           |      |        |         |           |                   |



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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

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|                   |                |            |         |
|-------------------|----------------|------------|---------|
| Client Sample ID: | 1132-W17 (1-6) | Project:   | AMPH002 |
| Sample ID:        | 433373020      | Client ID: | AMPH002 |

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| Parameter                 | Qualifier | Result                                          | Uncertainty | MDC | RL | Units  | PF      | DF        | Analyst Date | Time Batch        | Method |
|---------------------------|-----------|-------------------------------------------------|-------------|-----|----|--------|---------|-----------|--------------|-------------------|--------|
| Surrogate/Tracer Recovery | Test      |                                                 |             |     |    | Result | Nominal | Recovery% |              | Acceptable Limits |        |
| Iron-59 Tracer            |           | Liquid Scint Fe55, Solid "Dry Weight Corrected" |             |     |    |        |         | 70.8      |              | (15%-125%)        |        |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

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|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-W19 (1-6) | Project: AMPH002   |
| Sample ID: 433373021             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 14:35    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.0238   | +/-0.060    | 0.167  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1321 | 1702977 | 1      |
| Cadmium-109                                                          | U         | -0.785   | +/-0.773    | 1.38   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0642   | +/-0.052    | 0.113  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.218   | +/-0.365    | 0.674  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.0179  | +/-0.0568   | 0.106  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.0965   | 0.196  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0414   | +/-0.0563   | 0.118  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.766    | +/-0.137    | 0.0703 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 4.37     | +/-0.438    | 0.225  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | U         | 0.102    | +/-0.149    | 0.324  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.00664  | +/-0.117    | 0.222  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.0492   | +/-0.121    | 0.247  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.0197   | +/-0.0442   | 0.092  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0242  | +/-0.0681   | 0.118  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.0103  | +/-0.0597   | 0.113  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.00366 | +/-0.0327   | 0.0624 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.00734  | +/-0.0793   | 0.154  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | U         | 0.0292   | +/-0.0536   | 0.114  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.0788  | +/-0.158    | 0.238  |    | pCi/g |    |    |         |          |      |         |        |

### Rad Liquid Scintillation Analysis

#### LSC, Tritium Dist, Solid "As Received"

|         |   |      |         |      |      |       |  |      |          |      |         |   |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|
| Tritium | U | 3.97 | +/-2.66 | 4.35 | 6.00 | pCi/g |  | BXM4 | 09/28/17 | 1524 | 1703187 | 2 |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|

#### Liquid Scint Fe55, Solid "Dry Weight Corrected"

|         |   |      |         |      |      |       |  |      |          |      |         |   |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|
| Iron-55 | U | 4.11 | +/-7.46 | 11.7 | 20.0 | pCi/g |  | TXJ1 | 10/09/17 | 1430 | 1703166 | 3 |
|---------|---|------|---------|------|------|-------|--|------|----------|------|---------|---|

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |
| 2      | EPA 906.0 Modified            |                  |
| 3      | DOE RESL Fe-1, Modified       |                  |

| Surrogate/Tracer Recovery | Test | Result | Nominal | Recovery% | Acceptable Limits |
|---------------------------|------|--------|---------|-----------|-------------------|
|                           |      |        |         |           |                   |

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 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

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|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-W19 (1-6) | Project: AMPH002   |
| Sample ID: 433373021             | Client ID: AMPH002 |

| Parameter        | Qualifier | Result                                          | Uncertainty | MDC | RL | Units  | PF      | DF        | Analyst           | Date | Time Batch | Method |
|------------------|-----------|-------------------------------------------------|-------------|-----|----|--------|---------|-----------|-------------------|------|------------|--------|
| Surrogate/Tracer | Recovery  | Test                                            |             |     |    | Result | Nominal | Recovery% | Acceptable Limits |      |            |        |
| Iron-59 Tracer   |           | Liquid Scint Fe55, Solid "Dry Weight Corrected" |             |     |    |        |         | 75.9      | (15%-125%)        |      |            |        |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

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## QC Summary

Report Date: October 26, 2017

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Ameriphysics, LLC  
911 Cross Park Dr.  
Knoxville, Tennessee

Contact: Mr. Paul Jones

Workorder: 433373

| Parmname                   | NOM         | Sample    | Qual | QC        | Units | RPD% | REC% | Range       | Anlst | Date     | Time  |
|----------------------------|-------------|-----------|------|-----------|-------|------|------|-------------|-------|----------|-------|
| <b>Rad Gamma Spec</b>      |             |           |      |           |       |      |      |             |       |          |       |
| Batch                      | 1702974     |           |      |           |       |      |      |             |       |          |       |
| QC1203880734 433373001 DUP |             |           |      |           |       |      |      |             |       |          |       |
| Antimony-124               | U           | -0.00626  | U    | 0.00759   | pCi/g | N/A  |      | N/A         | MXR1  | 09/29/17 | 13:23 |
|                            | Uncertainty | +/-0.0786 |      | +/-0.0426 |       |      |      |             |       |          |       |
| Cadmium-109                | U           | -0.0642   | U    | 0.820     | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.962  |      | +/-1.74   |       |      |      |             |       |          |       |
| Cesium-134                 | U           | 0.0385    | U    | -0.0139   | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.0683 |      | +/-0.0511 |       |      |      |             |       |          |       |
| Chromium-51                | U           | -0.0545   | U    | -0.145    | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.485  |      | +/-0.430  |       |      |      |             |       |          |       |
| Cobalt-56                  | U           | 0.0278    | U    | 0.00348   | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.0711 |      | +/-0.0555 |       |      |      |             |       |          |       |
| Cobalt-57                  | UI          | 0.00      | U    | 0.0409    | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.136  |      | +/-0.175  |       |      |      |             |       |          |       |
| Cobalt-58                  | U           | 0.00269   | U    | -0.00399  | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.0647 |      | +/-0.0541 |       |      |      |             |       |          |       |
| Cobalt-60                  |             | 0.592     |      | 0.567     | pCi/g | 4.35 |      | (0%-20%)    |       |          |       |
|                            | Uncertainty | +/-0.114  |      | +/-0.141  |       |      |      |             |       |          |       |
| Europium-152               |             | 8.91      |      | 8.66      | pCi/g | 2.86 |      | (0%-20%)    |       |          |       |
|                            | Uncertainty | +/-0.555  |      | +/-0.438  |       |      |      |             |       |          |       |
| Europium-154               | UI          | 0.00      |      | 0.891     | pCi/g | 18.4 |      | (0% - 100%) |       |          |       |
|                            | Uncertainty | +/-0.252  |      | +/-0.215  |       |      |      |             |       |          |       |
| Europium-155               | U           | -0.0601   | U    | 0.0274    | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.141  |      | +/-0.150  |       |      |      |             |       |          |       |
| Iron-59                    | U           | 0.0341    | U    | -0.0692   | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.146  |      | +/-0.111  |       |      |      |             |       |          |       |
| Manganese-54               | U           | 0.0427    | U    | 0.0253    | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.0611 |      | +/-0.0479 |       |      |      |             |       |          |       |
| Niobium-95                 | U           | -0.0208   | U    | 0.00217   | pCi/g | N/A  |      | N/A         |       |          |       |
|                            | Uncertainty | +/-0.081  |      | +/-0.0551 |       |      |      |             |       |          |       |

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## QC Summary

Workorder: 433373

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| Parname               | NOM         | Sample    | Qual | QC        | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|-----------------------|-------------|-----------|------|-----------|-------|------|------|------------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |           |      |           |       |      |      |            |       |          |       |
| Batch                 | 1702974     |           |      |           |       |      |      |            |       |          |       |
| Scandium-46           | U           | -0.012    | U    | 0.0196    | pCi/g | N/A  |      | N/A        | MXR1  | 09/29/17 | 13:23 |
|                       | Uncertainty | +/-0.0688 |      | +/-0.0514 |       |      |      |            |       |          |       |
| Silver-108m           | U           | -0.0319   | U    | 0.00677   | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0374 |      | +/-0.0326 |       |      |      |            |       |          |       |
| Silver-110m           | U           | -0.0679   | U    | -0.00408  | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0868 |      | +/-0.0652 |       |      |      |            |       |          |       |
| Sodium-22             | UI          | 0.00      | UI   | 0.00      | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.088  |      | +/-0.108  |       |      |      |            |       |          |       |
| Zinc-65               | U           | -0.0664   | UI   | 0.00      | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.160  |      | +/-0.175  |       |      |      |            |       |          |       |
| QC1203880735          | LCS         |           |      |           |       |      |      |            |       |          |       |
| Americium-241         |             | 488       |      | 538       | pCi/g |      | 110  | (75%-125%) |       | 09/29/17 | 13:42 |
|                       | Uncertainty |           |      | +/-4.40   |       |      |      |            |       |          |       |
| Cesium-137            |             | 175       |      | 182       | pCi/g |      | 104  | (75%-125%) |       |          |       |
|                       | Uncertainty |           |      | +/-3.03   |       |      |      |            |       |          |       |
| Antimony-124          |             |           | U    | 0.552     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-1.01   |       |      |      |            |       |          |       |
| Cadmium-109           |             |           |      | 225       | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-15.5   |       |      |      |            |       |          |       |
| Cesium-134            |             |           | U    | 0.341     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.556  |       |      |      |            |       |          |       |
| Chromium-51           |             |           | U    | 0.0318    | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-3.41   |       |      |      |            |       |          |       |
| Cobalt-56             |             |           | U    | -0.129    | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.613  |       |      |      |            |       |          |       |
| Cobalt-57             |             |           |      | 0.451     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.383  |       |      |      |            |       |          |       |
| Cobalt-58             |             |           | U    | -0.0595   | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.528  |       |      |      |            |       |          |       |
| Cobalt-60             |             | 141       |      | 140       | pCi/g |      | 99.4 | (75%-125%) |       |          |       |
|                       | Uncertainty |           |      | +/-3.23   |       |      |      |            |       |          |       |

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## QC Summary

Workorder: 433373

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| Parmname              | NOM         | Sample | Qual | QC        | Units | RPD% | REC% | Range | Anlst | Date     | Time  |
|-----------------------|-------------|--------|------|-----------|-------|------|------|-------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |        |      |           |       |      |      |       |       |          |       |
| Batch                 | 1702974     |        |      |           |       |      |      |       |       |          |       |
| Europium-152          |             |        | U    | 0.295     | pCi/g |      |      |       | MXR1  | 09/29/17 | 13:42 |
|                       | Uncertainty |        |      | +/-1.19   |       |      |      |       |       |          |       |
| Europium-154          |             |        | U    | 0.861     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.853  |       |      |      |       |       |          |       |
| Europium-155          |             |        | U    | -0.0162   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.762  |       |      |      |       |       |          |       |
| Iron-59               |             |        | U    | 1.40      | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-1.28   |       |      |      |       |       |          |       |
| Manganese-54          |             |        | U    | -0.0552   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.583  |       |      |      |       |       |          |       |
| Niobium-95            |             |        | U    | 0.120     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.482  |       |      |      |       |       |          |       |
| Scandium-46           |             |        | U    | 0.549     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.639  |       |      |      |       |       |          |       |
| Silver-108m           |             |        | U    | 0.236     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.445  |       |      |      |       |       |          |       |
| Silver-110m           |             |        | U    | -0.0476   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.852  |       |      |      |       |       |          |       |
| Sodium-22             |             |        | U    | 0.306     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.300  |       |      |      |       |       |          |       |
| Zinc-65               |             |        | U    | 1.12      | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-1.35   |       |      |      |       |       |          |       |
| QC1203880733          | MB          |        |      |           |       |      |      |       |       |          |       |
| Antimony-124          |             |        | U    | 0.0497    | pCi/g |      |      |       |       | 09/29/17 | 13:25 |
|                       | Uncertainty |        |      | +/-0.0621 |       |      |      |       |       |          |       |
| Cadmium-109           |             |        | UI   | 0.00      | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.538  |       |      |      |       |       |          |       |
| Cesium-134            |             |        | U    | 0.0072    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0215 |       |      |      |       |       |          |       |
| Chromium-51           |             |        | U    | -0.0653   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.143  |       |      |      |       |       |          |       |

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| Parmname              | NOM         | Sample | Qual | QC        | Units | RPD% | REC% | Range | Anlst | Date     | Time  |
|-----------------------|-------------|--------|------|-----------|-------|------|------|-------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |        |      |           |       |      |      |       |       |          |       |
| Batch                 | 1702974     |        |      |           |       |      |      |       |       |          |       |
| Cobalt-56             |             |        | U    | -0.00046  | pCi/g |      |      |       | MXR1  | 09/29/17 | 13:25 |
|                       | Uncertainty |        |      | +/-0.0219 |       |      |      |       |       |          |       |
| Cobalt-57             |             |        | U    | 0.00264   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.012  |       |      |      |       |       |          |       |
| Cobalt-58             |             |        | U    | -0.02     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0233 |       |      |      |       |       |          |       |
| Cobalt-60             |             |        | U    | -9.98E-05 | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0189 |       |      |      |       |       |          |       |
| Europium-152          |             |        | U    | -0.0529   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0663 |       |      |      |       |       |          |       |
| Europium-154          |             |        | U    | -0.0131   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0447 |       |      |      |       |       |          |       |
| Europium-155          |             |        | U    | 0.0175    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0501 |       |      |      |       |       |          |       |
| Iron-59               |             |        | U    | 0.00115   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0359 |       |      |      |       |       |          |       |
| Manganese-54          |             |        | U    | 0.00139   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0224 |       |      |      |       |       |          |       |
| Niobium-95            |             |        | U    | -0.00571  | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0192 |       |      |      |       |       |          |       |
| Scandium-46           |             |        | U    | -0.0111   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0177 |       |      |      |       |       |          |       |
| Silver-108m           |             |        | U    | -0.00784  | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0184 |       |      |      |       |       |          |       |
| Silver-110m           |             |        | U    | -0.0156   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0286 |       |      |      |       |       |          |       |
| Sodium-22             |             |        | U    | -0.0046   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0157 |       |      |      |       |       |          |       |
| Zinc-65               |             |        | U    | -0.0154   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.049  |       |      |      |       |       |          |       |

# GEL LABORATORIES LLC

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## QC Summary

Workorder: 433373

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| Parmname                   | NOM         | Sample    | Qual | QC        | Units | RPD% | REC% | Range    | Anlst | Date     | Time  |
|----------------------------|-------------|-----------|------|-----------|-------|------|------|----------|-------|----------|-------|
| <b>Rad Gamma Spec</b>      |             |           |      |           |       |      |      |          |       |          |       |
| Batch 1702977              |             |           |      |           |       |      |      |          |       |          |       |
| QC1203880741 433373021 DUP |             |           |      |           |       |      |      |          |       |          |       |
| Antimony-124               | U           | 0.0238    | U    | -0.055    | pCi/g | N/A  |      | N/A MXR1 |       | 09/29/17 | 19:17 |
|                            | Uncertainty | +/-0.060  |      | +/-0.0623 |       |      |      |          |       |          |       |
| Cadmium-109                | U           | -0.785    | U    | 0.494     | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.773  |      | +/-0.762  |       |      |      |          |       |          |       |
| Cesium-134                 | U           | 0.0642    | U    | -0.0256   | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.052  |      | +/-0.0585 |       |      |      |          |       |          |       |
| Chromium-51                | U           | -0.218    | U    | -0.0966   | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.365  |      | +/-0.452  |       |      |      |          |       |          |       |
| Cobalt-56                  | U           | -0.0179   | U    | 0.0378    | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.0568 |      | +/-0.0725 |       |      |      |          |       |          |       |
| Cobalt-57                  | UI          | 0.00      | UI   | 0.00      | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.0965 |      | +/-0.155  |       |      |      |          |       |          |       |
| Cobalt-58                  | U           | 0.0414    | U    | 0.089     | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.0563 |      | +/-0.119  |       |      |      |          |       |          |       |
| Cobalt-60                  |             | 0.766     |      | 0.636     | pCi/g | 18.6 |      | (0%-20%) |       |          |       |
|                            | Uncertainty | +/-0.137  |      | +/-0.144  |       |      |      |          |       |          |       |
| Europium-152               |             | 4.37      |      | 4.78      | pCi/g | 8.83 |      | (0%-20%) |       |          |       |
|                            | Uncertainty | +/-0.438  |      | +/-0.411  |       |      |      |          |       |          |       |
| Europium-154               | U           | 0.102     | U    | 0.259     | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.149  |      | +/-0.283  |       |      |      |          |       |          |       |
| Europium-155               | U           | 0.00664   | U    | -0.0178   | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.117  |      | +/-0.113  |       |      |      |          |       |          |       |
| Iron-59                    | U           | 0.0492    | U    | 0.0201    | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.121  |      | +/-0.152  |       |      |      |          |       |          |       |
| Manganese-54               | U           | 0.0197    | U    | -0.0151   | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.0442 |      | +/-0.0671 |       |      |      |          |       |          |       |
| Niobium-95                 | U           | -0.0242   | U    | 0.0544    | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.0681 |      | +/-0.0588 |       |      |      |          |       |          |       |
| Scandium-46                | U           | -0.0103   | U    | -0.0727   | pCi/g | N/A  |      | N/A      |       |          |       |
|                            | Uncertainty | +/-0.0597 |      | +/-0.081  |       |      |      |          |       |          |       |



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## QC Summary

Workorder: 433373

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| Parname               | NOM         | Sample    | Qual | QC        | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|-----------------------|-------------|-----------|------|-----------|-------|------|------|------------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |           |      |           |       |      |      |            |       |          |       |
| Batch                 | 1702977     |           |      |           |       |      |      |            |       |          |       |
| Silver-108m           | U           | -0.00366  | U    | -0.0169   | pCi/g | N/A  |      | N/A        | MXR1  | 09/29/17 | 19:17 |
|                       | Uncertainty | +/-0.0327 |      | +/-0.0426 |       |      |      |            |       |          |       |
| Silver-110m           | U           | 0.00734   | U    | 0.0633    | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0793 |      | +/-0.162  |       |      |      |            |       |          |       |
| Sodium-22             | U           | 0.0292    | U    | 0.0913    | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0536 |      | +/-0.0999 |       |      |      |            |       |          |       |
| Zinc-65               | U           | -0.0788   | U    | -0.0295   | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.158  |      | +/-0.169  |       |      |      |            |       |          |       |
| QC1203880742          | LCS         |           |      |           |       |      |      |            |       |          |       |
| Americium-241         |             | 488       |      | 542       | pCi/g |      | 111  | (75%-125%) |       | 09/29/17 | 14:02 |
|                       | Uncertainty |           |      | +/-5.03   |       |      |      |            |       |          |       |
| Cesium-137            |             | 175       |      | 183       | pCi/g |      | 104  | (75%-125%) |       |          |       |
|                       | Uncertainty |           |      | +/-3.08   |       |      |      |            |       |          |       |
| Antimony-124          |             |           | U    | 0.185     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.558  |       |      |      |            |       |          |       |
| Cadmium-109           |             |           |      | 231       | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-14.7   |       |      |      |            |       |          |       |
| Cesium-134            |             |           | U    | 0.225     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.614  |       |      |      |            |       |          |       |
| Chromium-51           |             |           | U    | 0.731     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-3.54   |       |      |      |            |       |          |       |
| Cobalt-56             |             |           | U    | -0.219    | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.592  |       |      |      |            |       |          |       |
| Cobalt-57             |             |           |      | 0.586     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.291  |       |      |      |            |       |          |       |
| Cobalt-58             |             |           | U    | -0.238    | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.514  |       |      |      |            |       |          |       |
| Cobalt-60             |             | 141       |      | 140       | pCi/g |      | 99   | (75%-125%) |       |          |       |
|                       | Uncertainty |           |      | +/-3.24   |       |      |      |            |       |          |       |
| Europium-152          |             |           | U    | 0.762     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-1.20   |       |      |      |            |       |          |       |

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## QC Summary

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| Parmname              | NOM         | Sample | Qual | QC        | Units | RPD% | REC% | Range | Anlst | Date     | Time  |
|-----------------------|-------------|--------|------|-----------|-------|------|------|-------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |        |      |           |       |      |      |       |       |          |       |
| Batch                 | 1702977     |        |      |           |       |      |      |       |       |          |       |
| Europium-154          |             |        | U    | -0.108    | pCi/g |      |      |       | MXR1  | 09/29/17 | 14:02 |
|                       | Uncertainty |        |      | +/-0.937  |       |      |      |       |       |          |       |
| Europium-155          |             |        | U    | -0.0348   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.752  |       |      |      |       |       |          |       |
| Iron-59               |             |        | U    | 0.0971    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-1.27   |       |      |      |       |       |          |       |
| Manganese-54          |             |        | U    | 0.071     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.533  |       |      |      |       |       |          |       |
| Niobium-95            |             |        | U    | 0.103     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.461  |       |      |      |       |       |          |       |
| Scandium-46           |             |        | U    | -0.138    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.627  |       |      |      |       |       |          |       |
| Silver-108m           |             |        | U    | -0.00623  | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.442  |       |      |      |       |       |          |       |
| Silver-110m           |             |        | U    | 0.634     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.831  |       |      |      |       |       |          |       |
| Sodium-22             |             |        | U    | -0.0379   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.329  |       |      |      |       |       |          |       |
| Zinc-65               |             |        | U    | 2.17      | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-1.98   |       |      |      |       |       |          |       |
| QC1203880740          | MB          |        |      |           |       |      |      |       |       |          |       |
| Antimony-124          |             |        | U    | -0.00354  | pCi/g |      |      |       |       | 09/29/17 | 19:16 |
|                       | Uncertainty |        |      | +/-0.0593 |       |      |      |       |       |          |       |
| Cadmium-109           |             |        | U    | -0.469    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.394  |       |      |      |       |       |          |       |
| Cesium-134            |             |        | U    | 0.0041    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.016  |       |      |      |       |       |          |       |
| Chromium-51           |             |        | U    | 0.0847    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.167  |       |      |      |       |       |          |       |
| Cobalt-56             |             |        | U    | 0.00331   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.0203 |       |      |      |       |       |          |       |

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| Parmname              | NOM         | Sample | Qual | QC                    | Units | RPD% | REC% | Range | Anlst | Date     | Time  |
|-----------------------|-------------|--------|------|-----------------------|-------|------|------|-------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |        |      |                       |       |      |      |       |       |          |       |
| Batch                 | 1702977     |        |      |                       |       |      |      |       |       |          |       |
| Cobalt-57             | Uncertainty |        | U    | -0.00441<br>+/-0.0133 | pCi/g |      |      |       | MXR1  | 09/29/17 | 19:16 |
| Cobalt-58             | Uncertainty |        | U    | 0.0107<br>+/-0.0172   | pCi/g |      |      |       |       |          |       |
| Cobalt-60             | Uncertainty |        | U    | -0.00861<br>+/-0.0218 | pCi/g |      |      |       |       |          |       |
| Europium-152          | Uncertainty |        | U    | 0.0216<br>+/-0.0536   | pCi/g |      |      |       |       |          |       |
| Europium-154          | Uncertainty |        | U    | -0.0318<br>+/-0.044   | pCi/g |      |      |       |       |          |       |
| Europium-155          | Uncertainty |        | U    | -0.0252<br>+/-0.0528  | pCi/g |      |      |       |       |          |       |
| Iron-59               | Uncertainty |        | U    | -0.0384<br>+/-0.0335  | pCi/g |      |      |       |       |          |       |
| Manganese-54          | Uncertainty |        | U    | 0.0125<br>+/-0.0199   | pCi/g |      |      |       |       |          |       |
| Niobium-95            | Uncertainty |        | U    | 0.0158<br>+/-0.0181   | pCi/g |      |      |       |       |          |       |
| Scandium-46           | Uncertainty |        | U    | 0.00451<br>+/-0.0162  | pCi/g |      |      |       |       |          |       |
| Silver-108m           | Uncertainty |        | U    | 0.0286<br>+/-0.0144   | pCi/g |      |      |       |       |          |       |
| Silver-110m           | Uncertainty |        | U    | -0.0195<br>+/-0.0363  | pCi/g |      |      |       |       |          |       |
| Sodium-22             | Uncertainty |        | U    | -0.0121<br>+/-0.0149  | pCi/g |      |      |       |       |          |       |
| Zinc-65               | Uncertainty |        | U    | 0.00266<br>+/-0.042   | pCi/g |      |      |       |       |          |       |

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## QC Summary

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| Parmname                        | NOM         | Sample  | Qual | QC      | Units | RPD% | REC% | Range       | Anlst | Date     | Time  |
|---------------------------------|-------------|---------|------|---------|-------|------|------|-------------|-------|----------|-------|
| <b>Rad Liquid Scintillation</b> |             |         |      |         |       |      |      |             |       |          |       |
| Batch 1703166                   |             |         |      |         |       |      |      |             |       |          |       |
| QC1203881234 433373007 DUP      |             |         |      |         |       |      |      |             |       |          |       |
| Iron-55                         | U           | 5.50    | U    | 3.76    | pCi/g | N/A  |      | N/A         | TXJ1  | 10/09/17 | 15:33 |
|                                 | Uncertainty | +/-7.21 |      | +/-6.58 |       |      |      |             |       |          |       |
| QC1203881235 LCS                |             |         |      |         |       |      |      |             |       |          |       |
| Iron-55                         | 231         |         |      | 234     | pCi/g |      | 101  | (75%-125%)  |       | 10/09/17 | 16:04 |
|                                 | Uncertainty |         |      | +/-12.8 |       |      |      |             |       |          |       |
| QC1203881233 MB                 |             |         |      |         |       |      |      |             |       |          |       |
| Iron-55                         |             |         | U    | 2.46    | pCi/g |      |      |             |       | 10/09/17 | 15:01 |
|                                 | Uncertainty |         |      | +/-6.08 |       |      |      |             |       |          |       |
| Batch 1703187                   |             |         |      |         |       |      |      |             |       |          |       |
| QC1203881266 433373007 DUP      |             |         |      |         |       |      |      |             |       |          |       |
| Tritium                         |             | 5.19    |      | 5.09    | pCi/g | 1.97 |      | (0% - 100%) | BXM4  | 09/29/17 | 10:46 |
|                                 | Uncertainty | +/-2.74 |      | +/-2.76 |       |      |      |             |       |          |       |
| QC1203881268 LCS                |             |         |      |         |       |      |      |             |       |          |       |
| Tritium                         | 33.8        |         |      | 28.2    | pCi/g |      | 83.6 | (75%-125%)  |       | 09/28/17 | 19:33 |
|                                 | Uncertainty |         |      | +/-3.52 |       |      |      |             |       |          |       |
| QC1203881265 MB                 |             |         |      |         |       |      |      |             |       |          |       |
| Tritium                         |             |         | U    | 1.47    | pCi/g |      |      |             |       | 09/28/17 | 16:26 |
|                                 | Uncertainty |         |      | +/-2.59 |       |      |      |             |       |          |       |
| QC1203881267 433373007 MS       |             |         |      |         |       |      |      |             |       |          |       |
| Tritium                         | 72.0        | 5.19    |      | 66.8    | pCi/g |      | 85.6 | (75%-125%)  |       | 09/28/17 | 18:31 |
|                                 | Uncertainty | +/-2.74 |      | +/-7.96 |       |      |      |             |       |          |       |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a Tracer compound
- < Result is less than value reported
- > Result is greater than value reported
- BD Results are either below the MDC or tracer recovery is low
- FA Failed analysis.
- H Analytical holding time was exceeded
- J Value is estimated
- K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- M M if above MDC and less than LLD

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| Parname | NOM                                                                                                                            | Sample | Qual | QC | Units | RPD% | REC% | Range | Anlst | Date | Time |
|---------|--------------------------------------------------------------------------------------------------------------------------------|--------|------|----|-------|------|------|-------|-------|------|------|
| M       | REMP Result > MDC/CL and < RDL                                                                                                 |        |      |    |       |      |      |       |       |      |      |
| N/A     | RPD or %Recovery limits do not apply.                                                                                          |        |      |    |       |      |      |       |       |      |      |
| NI      | See case narrative                                                                                                             |        |      |    |       |      |      |       |       |      |      |
| ND      | Analyte concentration is not detected above the detection limit                                                                |        |      |    |       |      |      |       |       |      |      |
| NJ      | Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier                                     |        |      |    |       |      |      |       |       |      |      |
| Q       | One or more quality control criteria have not been met. Refer to the applicable narrative or DER.                              |        |      |    |       |      |      |       |       |      |      |
| R       | Sample results are rejected                                                                                                    |        |      |    |       |      |      |       |       |      |      |
| U       | Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.                                                     |        |      |    |       |      |      |       |       |      |      |
| UI      | Gamma Spectroscopy--Uncertain identification                                                                                   |        |      |    |       |      |      |       |       |      |      |
| UJ      | Gamma Spectroscopy--Uncertain identification                                                                                   |        |      |    |       |      |      |       |       |      |      |
| UL      | Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.       |        |      |    |       |      |      |       |       |      |      |
| X       | Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier                                     |        |      |    |       |      |      |       |       |      |      |
| Y       | Other specific qualifiers were required to properly define the results. Consult case narrative.                                |        |      |    |       |      |      |       |       |      |      |
| ^       | RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry. |        |      |    |       |      |      |       |       |      |      |
| h       | Preparation or preservation holding time was exceeded                                                                          |        |      |    |       |      |      |       |       |      |      |

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**Section 1**

Project Number: **1132** Project Name: **UT Health**

Send Report To: **Ameriphysics, LLC**

Address: **9111 Cross Park Drive, Suite D200, Knoxville, TN 37923**

Phone: **(865)705-1136** Fax:

Sampler Name: **Robbie Hansen**

Shipment Method: **FedEx** Airbill Number:

Laboratory Receiving: **GEL Laboratories**

Page 1 of 2  
 Purchase Order #: N/A  
 Batch #: 1132-001

**Section 2**

| Sample ID       | Sample Description | Sample Date | Sample Time | Sample Matrix | Sample Volume | Cont. Type | Cont. Quantity | Analysis Requested                                                                                                                                                                               | QA/QC level | Comments, Special Instructions, etc. | Lab Sample ID (to be completed by lab) |
|-----------------|--------------------|-------------|-------------|---------------|---------------|------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------|----------------------------------------|
| 1132-F16 (1-6)  | Concrete Sample    | 9/14/17     | 8:15        | S             | 0.5 L         | P          | 1              | Gamm Spec (Na-22, Sc-46, Cr-51, Mn-54, Fe-59, Co-56, Co-57, Co-58, Co-60, Zn-65, Nb-95, Ag-108m, Ag-110M, Cd-109, Sb-124, Cs-134, Eu-152, Eu-154, and Eu-155)<br>All True Positives<br>H3 & Fe55 | Level I     |                                      |                                        |
| 1132-F18 (1-6)  | Concrete Sample    | 9/14/17     | 8:35        | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  | Level II    |                                      |                                        |
| 1132-F20 (1-6)  | Concrete Sample    | 9/14/17     | 9:00        | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  | Level III   |                                      |                                        |
| 1132-F25 (1-6)  | Concrete Sample    | 9/14/17     | 9:25        | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  | Other       |                                      |                                        |
| 1132-F46 (1-6)  | Concrete Sample    | 9/14/17     | 9:45        | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  |             |                                      |                                        |
| 1132-F46 (7-12) | Concrete Sample    | 9/14/17     | 9:55        | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  |             |                                      |                                        |
| 1132-F51 (1-6)  | Concrete Sample    | 9/14/17     | 10:10       | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  |             |                                      |                                        |
| 1132-F51 (7-12) | Concrete Sample    | 9/14/17     | 10:20       | S             | 0.5 L         | P          | 1              |                                                                                                                                                                                                  |             |                                      |                                        |

**Section 3**

**Section 4**

**Relinquished by: (Signature)** *[Signature]* **Date:** 9/21/17 **Time:** 9:55

**Received by: (Signature)** *[Signature]*

**Relinquished by: (Signature)** *[Signature]* **Date:** 9/21/17 **Time:** 9:55

**Received by: (Signature)** *[Signature]*

**Relinquished by: (Signature)** *[Signature]* **Date:** 9/21/17 **Time:** 9:55

**Received by: (Signature)** *[Signature]*

**Sample Custodian Remarks (Completed By laboratory):**

|             |                |                              |
|-------------|----------------|------------------------------|
| QA/QC level | Turnaround     | Sample Receipt               |
| Level I     | <u>Routine</u> | Total # Containers Received? |
| Level II    | 24 Hour        | COC Seals Present?           |
| Level III   | 1 Week         | COC Seals Intact?            |
| Other       | Other: _____   | Received Containers Intact?  |
|             |                | Temperature?                 |

|                          |  |                               |               |
|--------------------------|--|-------------------------------|---------------|
| <b>Ameriphysics, LLC</b> |  | <b>Chain of Custody (COC)</b> |               |
| <b>QA Program Form</b>   |  | <b>Doc</b>                    | <b>Rev #</b>  |
|                          |  | 2/10/2015                     | 1             |
|                          |  | <b>Date</b>                   | <b>Form #</b> |
|                          |  | 2                             | 1             |

| Sample ID        | Sample Description | Sample Date | Sample Time | Sample Matrix | Sample Volume | Cont. Type | Cont. Quantity | Refer to Page 1 for Analysis Requested |   |   |   | Comments, Special Instructions, etc. | Lab Sample ID (to be completed by lab) |
|------------------|--------------------|-------------|-------------|---------------|---------------|------------|----------------|----------------------------------------|---|---|---|--------------------------------------|----------------------------------------|
|                  |                    |             |             |               |               |            |                | X                                      | X | X | X |                                      |                                        |
| 1132-F51 (13-16) | Concrete Sample    | 9/14/17     | 10:25       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-F52 (1-6)   | Concrete Sample    | 9/14/17     | 10:35       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-F56 (1-6)   | Concrete Sample    | 9/14/17     | 10:55       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-F72 (1-6)   | Concrete Sample    | 9/14/17     | 11:15       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-F76 (1-6)   | Concrete Sample    | 9/14/17     | 11:45       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-F80 (1-6)   | Concrete Sample    | 9/14/17     | 12:05       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-C46 (1-6)   | Concrete Sample    | 9/14/17     | 12:30       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-C52 (1-6)   | Concrete Sample    | 9/14/17     | 12:40       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-W3 (1-6)    | Concrete Sample    | 9/14/17     | 13:25       | S             | 0.5 L         | P          | 1              | X                                      | X | X |   |                                      |                                        |
| 1132-W5 (1-6)    | Concrete Sample    | 9/14/17     | 13:35       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-W11 (1-6)   | Concrete Sample    | 9/14/17     | 14:05       | S             | 0.5 L         | P          | 1              | X                                      | X |   |   |                                      |                                        |
| 1132-W17 (1-6)   | Concrete Sample    | 9/14/17     | 14:25       | S             | 0.5 L         | P          | 1              | X                                      | X | X |   |                                      |                                        |
| 1132-W19 (1-6)   | Concrete Sample    | 9/14/17     | 14:35       | S             | 0.5 L         | P          | 1              | X                                      | X | X |   |                                      |                                        |
|                  |                    |             |             |               |               |            |                |                                        |   |   |   |                                      |                                        |
|                  |                    |             |             |               |               |            |                |                                        |   |   |   |                                      |                                        |

Section 2





**Subject:** Re: Questions on detected radionuclides  
**From:** Edie Kent <emk@gel.com>  
**Date:** 10/26/2017 1:19 PM  
**To:** Tim Pratt <tpratt@ameriphysics.com>  
**CC:** Nancy Mattern <Nancy.Mattern@gel.com>

Tim:

The Na-22 and Cd-109 results were intended to be rejected but were not qualified properly. The Co-57 was a false positive and should have been reported as rejected. We are in the process of correcting this and will issue a revised report.

Edie

On 10/25/2017 2:54 PM, Tim Pratt wrote:

Edie,

The ones I question are Sample 1132-F20 (1-6) with the Na-22; Sample 1132-W5D (1-6) with the Cd-109; and Samples 1132-F52 (1-6), 1132-F56 (1-6), 1132-C52 (1-6), 1132-W3 (1-6), and 1132-W17 (1-6) with the Co-57.

As I mentioned, with the short relatively short half-lives of these radionuclides and the time that has elapsed since this place was operational (2001), there is very little chance that these are really there.

Thanks,

Tim

Timothy J. Pratt  
Corporate Radiation Safety Officer  
Ameriphysics LLC  
9111 Cross Park Drive, Suite D200  
Knoxville, TN 37923  
Office: 865-470-4171  
Cell: 865-386-8066  
Fax: 865-470-4179

--

**Edith M. Kent**  
**Project Manager**



2040 Savage Road, Charleston, SC 29407 | PO Box 30712, Charleston, SC 29417  
Office Direct: 843.769.7385 | Office Main: 843.556.8171 | Fax: 843.766.1178  
E-Mail: [emk@gel.com](mailto:emk@gel.com) | Website: [www.gel.com](http://www.gel.com)

**Environmental | Engineering | Surveying | Analytical Testing**

**List of current GEL Certifications as of 10 October 2017**

| <b>State</b>             | <b>Certification</b>         |
|--------------------------|------------------------------|
| Alaska                   | UST-0110                     |
| Arkansas                 | 88-0651                      |
| CLIA                     | 42D0904046                   |
| California               | 2940                         |
| Colorado                 | SC00012                      |
| Connecticut              | PH-0169                      |
| Delaware                 | SC00012                      |
| DoD ELAP/ ISO17025 A2LA  | 2567.01                      |
| Florida NELAP            | E87156                       |
| Foreign Soils Permit     | P330-15-00283, P330-15-00253 |
| Georgia                  | SC00012                      |
| Georgia SDWA             | 967                          |
| Hawaii                   | SC00012                      |
| Idaho Chemistry          | SC00012                      |
| Idaho Radiochemistry     | SC00012                      |
| Illinois NELAP           | 200029                       |
| Indiana                  | C-SC-01                      |
| Kansas NELAP             | E-10332                      |
| Kentucky SDWA            | 90129                        |
| Kentucky Wastewater      | 90129                        |
| Louisiana NELAP          | 03046 (AI33904)              |
| Louisiana SDWA           | LA170010                     |
| Maryland                 | 270                          |
| Massachusetts            | M-SC012                      |
| Michigan                 | 9976                         |
| Mississippi              | SC00012                      |
| Nebraska                 | NE-OS-26-13                  |
| Nevada                   | SC000122018-1                |
| New Hampshire NELAP      | 205415                       |
| New Jersey NELAP         | SC002                        |
| New Mexico               | SC00012                      |
| New York NELAP           | 11501                        |
| North Carolina           | 233                          |
| North Carolina SDWA      | 45709                        |
| North Dakota             | R-158                        |
| Oklahoma                 | 9904                         |
| Pennsylvania NELAP       | 68-00485                     |
| Puerto Rico              | SC00012                      |
| S.Carolina Radchem       | 10120002                     |
| South Carolina Chemistry | 10120001                     |
| Tennessee                | TN 02934                     |
| Texas NELAP              | T104704235-17-12             |
| Utah NELAP               | SC000122017-23               |
| Vermont                  | VT87156                      |
| Virginia NELAP           | 460202                       |
| Washington               | C780                         |
| West Virginia            | 997404                       |

**Radiochemistry**  
**Technical Case Narrative**  
**Ameriphysics, LLC (AMPH)**  
**SDG #: 433373**

**Product:** Dry Weight

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 21

**Preparation Batch:** 1702937

The following samples were analyzed using the above methods and analytical procedure(s).

| <b><u>GEL Sample ID#</u></b> | <b><u>Client Sample Identification</u></b> |
|------------------------------|--------------------------------------------|
| 433373001                    | 1132-F16 (1-6)                             |
| 433373002                    | 1132-F18 (1-6)                             |
| 433373003                    | 1132-F20 (1-6)                             |
| 433373004                    | 1132-F25 (1-6)                             |
| 433373005                    | 1132-F46 (1-6)                             |
| 433373006                    | 1132-F46 (7-12)                            |
| 433373007                    | 1132-F51 (1-6)                             |
| 433373008                    | 1132-F51 (7-12)                            |
| 433373009                    | 1132-F51 (13-16)                           |
| 433373010                    | 1132-F52 (1-6)                             |
| 433373011                    | 1132-F56 (1-6)                             |
| 433373012                    | 1132-F72 (1-6)                             |
| 433373013                    | 1132-F76 (1-6)                             |
| 433373014                    | 1132-F80 (1-6)                             |
| 433373015                    | 1132-C46 (1-6)                             |
| 433373016                    | 1132-C52 (1-6)                             |
| 433373017                    | 1132-W3 (1-6)                              |
| 433373018                    | 1132-W5 (1-6)                              |
| 433373019                    | 1132-W11 (1-6)                             |
| 433373020                    | 1132-W17 (1-6)                             |

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** Dry Weight

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 21

**Preparation Batch:** 1702947

The following samples were analyzed using the above methods and analytical procedure(s).

| <u>GEL Sample ID#</u> | <u>Client Sample Identification</u> |
|-----------------------|-------------------------------------|
| 433373021             | 1132-W19 (1-6)                      |

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** Gammaspec, Gamma, Solid - Client List  
**Analytical Method:** DOE HASL 300, 4.5.2.3/Ga-01-R  
**Analytical Procedure:** GL-RAD-A-013 REV# 27  
**Analytical Batch:** 1702974

**Preparation Method:** Dry Soil Prep  
**Preparation Procedure:** GL-RAD-A-021 REV# 21  
**Preparation Batch:** 1702937

The following samples were analyzed using the above methods and analytical procedure(s).

| <u>GEL Sample ID#</u> | <u>Client Sample Identification</u>              |
|-----------------------|--------------------------------------------------|
| 433373001             | 1132-F16 (1-6)                                   |
| 433373002             | 1132-F18 (1-6)                                   |
| 433373003             | 1132-F20 (1-6)                                   |
| 433373004             | 1132-F25 (1-6)                                   |
| 433373005             | 1132-F46 (1-6)                                   |
| 433373006             | 1132-F46 (7-12)                                  |
| 433373007             | 1132-F51 (1-6)                                   |
| 433373008             | 1132-F51 (7-12)                                  |
| 433373009             | 1132-F51 (13-16)                                 |
| 433373010             | 1132-F52 (1-6)                                   |
| 433373011             | 1132-F56 (1-6)                                   |
| 433373012             | 1132-F72 (1-6)                                   |
| 433373013             | 1132-F76 (1-6)                                   |
| 433373014             | 1132-F80 (1-6)                                   |
| 433373015             | 1132-C46 (1-6)                                   |
| 433373016             | 1132-C52 (1-6)                                   |
| 433373017             | 1132-W3 (1-6)                                    |
| 433373018             | 1132-W5 (1-6)                                    |
| 433373019             | 1132-W11 (1-6)                                   |
| 433373020             | 1132-W17 (1-6)                                   |
| 1203880733            | Method Blank (MB)                                |
| 1203880734            | 433373001(1132-F16 (1-6)) Sample Duplicate (DUP) |
| 1203880735            | Laboratory Control Sample (LCS)                  |

The samples in this SDG were analyzed on a "dry weight" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Qualifier Information**

| Qualifier | Reason                                                                    | Analyte      | Sample                          | Client Sample   |
|-----------|---------------------------------------------------------------------------|--------------|---------------------------------|-----------------|
| UI        | Results are considered a false positive due to high counting uncertainty. | Chromium-51  | 433373013                       | 1132-F76 (1-6)  |
|           |                                                                           | Cobalt-57    | 433373004                       | 1132-F25 (1-6)  |
|           |                                                                           |              | 433373010                       | 1132-F52 (1-6)  |
|           |                                                                           |              | 433373011                       | 1132-F56 (1-6)  |
|           |                                                                           |              | 433373016                       | 1132-C52 (1-6)  |
|           |                                                                           |              | 433373017                       | 1132-W3 (1-6)   |
|           |                                                                           |              | 433373020                       | 1132-W17 (1-6)  |
|           |                                                                           | Cobalt-58    | 433373006                       | 1132-F46 (7-12) |
|           |                                                                           | Europium-154 | 433373012                       | 1132-F72 (1-6)  |
|           |                                                                           | Sodium-22    | 433373011                       | 1132-F56 (1-6)  |
| UI        | Results are considered a false positive due to high peak-width.           |              | 433373016                       | 1132-C52 (1-6)  |
|           |                                                                           |              | 433373020                       | 1132-W17 (1-6)  |
| UI        | Results are considered a false positive due to interference.              | Cobalt-57    | 433373008                       | 1132-F51 (7-12) |
|           |                                                                           |              | 433373014                       | 1132-F80 (1-6)  |
|           |                                                                           | Sodium-22    | 433373003                       | 1132-F20 (1-6)  |
|           |                                                                           |              | 433373004                       | 1132-F25 (1-6)  |
|           |                                                                           |              | 433373015                       | 1132-C46 (1-6)  |
|           |                                                                           |              | 433373019                       | 1132-W11 (1-6)  |
|           |                                                                           | 1203880734   | 1132-F16<br>(1-6)(433373001DUP) |                 |
| UI        | Results are considered a false positive due to low abundance.             | Cobalt-57    | 433373001                       | 1132-F16 (1-6)  |

|    |                                                               |             |                                 |
|----|---------------------------------------------------------------|-------------|---------------------------------|
|    |                                                               | 433373003   | 1132-F20 (1-6)                  |
|    |                                                               | 433373005   | 1132-F46 (1-6)                  |
|    |                                                               | 433373006   | 1132-F46 (7-12)                 |
|    |                                                               | 433373007   | 1132-F51 (1-6)                  |
|    |                                                               | 433373009   | 1132-F51 (13-16)                |
|    |                                                               | 433373019   | 1132-W11 (1-6)                  |
|    | Europium-154                                                  | 433373001   | 1132-F16 (1-6)                  |
|    |                                                               | 433373003   | 1132-F20 (1-6)                  |
|    |                                                               | 433373004   | 1132-F25 (1-6)                  |
|    |                                                               | 433373015   | 1132-C46 (1-6)                  |
|    |                                                               | 433373019   | 1132-W11 (1-6)                  |
|    |                                                               | 433373020   | 1132-W17 (1-6)                  |
|    | Sodium-22                                                     | 433373001   | 1132-F16 (1-6)                  |
|    |                                                               | 433373002   | 1132-F18 (1-6)                  |
|    |                                                               | 433373005   | 1132-F46 (1-6)                  |
|    |                                                               | 433373006   | 1132-F46 (7-12)                 |
|    |                                                               | 433373007   | 1132-F51 (1-6)                  |
|    | Zinc-65                                                       | 1203880734  | 1132-F16<br>(1-6)(433373001DUP) |
| UI | Results are considered a false positive due to no valid peak. | Cadmium-109 | 1203880733 MB for batch 1702974 |
|    |                                                               | Zinc-65     | 433373014 1132-F80 (1-6)        |

**Product: Gammaspec, Gamma, Solid - Client List**

**Analytical Method:** DOE HASL 300, 4.5.2.3/Ga-01-R

**Analytical Procedure:** GL-RAD-A-013 REV# 27

**Analytical Batch:** 1702977

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 21

**Preparation Batch:** 1702947

The following samples were analyzed using the above methods and analytical procedure(s).

| <b><u>GEL Sample ID#</u></b> | <b><u>Client Sample Identification</u></b>       |
|------------------------------|--------------------------------------------------|
| 433373021                    | 1132-W19 (1-6)                                   |
| 1203880740                   | Method Blank (MB)                                |
| 1203880741                   | 433373021(1132-W19 (1-6)) Sample Duplicate (DUP) |
| 1203880742                   | Laboratory Control Sample (LCS)                  |

The samples in this SDG were analyzed on a "dry weight" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Qualifier Information**

| <b>Qualifier</b> | <b>Reason</b>                                                             | <b>Analyte</b> | <b>Sample</b> | <b>Client Sample</b>            |
|------------------|---------------------------------------------------------------------------|----------------|---------------|---------------------------------|
| UI               | Results are considered a false positive due to high counting uncertainty. | Cobalt-57      | 1203880741    | 1132-W19<br>(1-6)(433373021DUP) |
| UI               | Results are considered a false positive due to low abundance.             |                | 433373021     | 1132-W19 (1-6)                  |

**Product: Liquid Scint Fe55, Solid**

**Analytical Method:** DOE RESL Fe-1, Modified

**Analytical Procedure:** GL-RAD-A-040 REV# 13

**Analytical Batch:** 1703166

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 21

**Preparation Batches:** 1702937 and 1702947

The following samples were analyzed using the above methods and analytical procedure(s).

| <b><u>GEL Sample ID#</u></b> | <b><u>Client Sample Identification</u></b>       |
|------------------------------|--------------------------------------------------|
| 433373007                    | 1132-F51 (1-6)                                   |
| 433373017                    | 1132-W3 (1-6)                                    |
| 433373020                    | 1132-W17 (1-6)                                   |
| 433373021                    | 1132-W19 (1-6)                                   |
| 1203881233                   | Method Blank (MB)                                |
| 1203881234                   | 433373007(1132-F51 (1-6)) Sample Duplicate (DUP) |
| 1203881235                   | Laboratory Control Sample (LCS)                  |

The samples in this SDG were analyzed on a "dry weight" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.



**Product:** LSC, Tritium Dist, Solid

**Analytical Method:** EPA 906.0 Modified

**Analytical Procedure:** GL-RAD-A-002 REV# 22

**Analytical Batch:** 1703187

The following samples were analyzed using the above methods and analytical procedure(s).

| <b><u>GEL Sample ID#</u></b> | <b><u>Client Sample Identification</u></b>       |
|------------------------------|--------------------------------------------------|
| 433373007                    | 1132-F51 (1-6)                                   |
| 433373017                    | 1132-W3 (1-6)                                    |
| 433373020                    | 1132-W17 (1-6)                                   |
| 433373021                    | 1132-W19 (1-6)                                   |
| 1203881265                   | Method Blank (MB)                                |
| 1203881266                   | 433373007(1132-F51 (1-6)) Sample Duplicate (DUP) |
| 1203881267                   | 433373007(1132-F51 (1-6)) Matrix Spike (MS)      |
| 1203881268                   | Laboratory Control Sample (LCS)                  |

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information**

**Recounts**

Samples 1203881266 (1132-F51 (1-6)DUP), 433373007 (1132-F51 (1-6)), 433373017 (1132-W3 (1-6)) and 433373020 (1132-W17 (1-6)) were recounted to verify sample results. Recounts are reported.

**Miscellaneous Information**

**Additional Comments**

The matrix spike, 1203881267 (1132-F51 (1-6)MS), aliquot was reduced to conserve sample volume.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.



October 26, 2017

Mr. Paul Jones  
Ameriphysics, LLC  
911 Cross Park Dr.  
Knoxville, Tennessee 37923

Re: Ameriphysics, LLC  
Work Order: 433374

Dear Mr. Jones:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 21, 2017. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. The data package has been revised to correct the Gamma Spec data.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4453.

Sincerely,

Edith Kent  
Project Manager

Purchase Order: 0316-001  
Enclosures



# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 – (843) 556-8171 – www.gel.com

## Certificate of Analysis Report for

AMPH002 Ameriphysics, LLC

Client SDG: 433374 GEL Work Order: 433374

**The Qualifiers in this report are defined as follows:**

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy—Uncertain identification

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Edith Kent.



Reviewed by \_\_\_\_\_

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-E2 (1-6) Project: AMPH002  
Sample ID: 433374001 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 15:35  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | -0.012  | +/-0.0578   | 0.125  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1324 | 1702977 | 1      |
| Cadmium-109                                                  | U         | 0.0108  | +/-0.469    | 0.829  |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.00779 | +/-0.0386   | 0.0783 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | 0.140   | +/-0.326    | 0.654  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.0156  | +/-0.0464   | 0.093  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00    | +/-0.061    | 0.121  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | -0.0532 | +/-0.0407   | 0.0653 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.421   | +/-0.106    | 0.0732 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 2.83    | +/-0.293    | 0.158  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.191   | +/-0.109    | 0.275  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.00771 | +/-0.0704   | 0.134  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0143 | +/-0.0932   | 0.175  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.00255 | +/-0.0322   | 0.0648 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.013   | +/-0.0467   | 0.0922 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.0162  | +/-0.0413   | 0.0847 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.0172 | +/-0.025    | 0.044  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | 0.00243 | +/-0.0576   | 0.112  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0664  | +/-0.0384   | 0.0964 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.0559 | +/-0.112    | 0.197  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration   SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-E4 (1-6) Project: AMPH002  
Sample ID: 433374002 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 15:15  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | -0.0705 | +/-0.0983   | 0.153  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1324 | 1702977 | 1      |
| Cadmium-109                                                  | U         | 0.472   | +/-0.691    | 1.31   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0669  | +/-0.0582   | 0.131  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.0927 | +/-0.424    | 0.831  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | -0.0174 | +/-0.0647   | 0.117  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00    | +/-0.121    | 0.0527 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | -0.0349 | +/-0.0559   | 0.0944 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.373   | +/-0.122    | 0.0834 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 2.48    | +/-0.374    | 0.231  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.0938  | +/-0.133    | 0.316  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.0274  | +/-0.103    | 0.202  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0286 | +/-0.113    | 0.221  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | -0.0134 | +/-0.0586   | 0.0848 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | -0.0358 | +/-0.0588   | 0.100  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.0395  | +/-0.0507   | 0.116  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.0286 | +/-0.0361   | 0.0639 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0209 | +/-0.0658   | 0.128  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0331  | +/-0.0468   | 0.112  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.015  | +/-0.159    | 0.269  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration   SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-E9 (1-6) Project: AMPH002  
Sample ID: 433374003 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 15:25  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0335   | +/-0.0708   | 0.167  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1415 | 1702977 | 1      |
| Cadmium-109                                                  | U         | -0.066   | +/-0.597    | 1.06   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.00749  | +/-0.044    | 0.0831 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.0969  | +/-0.292    | 0.503  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | -0.0164  | +/-0.0434   | 0.0762 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00     | +/-0.100    | 0.0388 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | -0.0026  | +/-0.0377   | 0.0701 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.310    | +/-0.0662   | 0.060  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 3.09     | +/-0.246    | 0.116  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.132    | +/-0.161    | 0.279  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | -0.064   | +/-0.0825   | 0.146  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.00566 | +/-0.0699   | 0.139  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | -0.0186  | +/-0.0373   | 0.0645 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.0103   | +/-0.0443   | 0.0841 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.0165   | +/-0.0416   | 0.0811 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.0018  | +/-0.0218   | 0.0425 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | 0.034    | +/-0.053    | 0.106  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0465   | +/-0.0567   | 0.0659 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | 0.0624   | +/-0.0856   | 0.146  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-E17 (1-6) | Project: AMPH002   |
| Sample ID: 433374004             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 15:50    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |           |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.0264    | +/-0.0442   | 0.112  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1428 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 0.921     | +/-0.687    | 1.27   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0395    | +/-0.0292   | 0.063  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.148    | +/-0.272    | 0.500  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.00632  | +/-0.0322   | 0.0575 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | U         | 0.0269    | +/-0.0893   | 0.0368 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | -0.00479  | +/-0.0324   | 0.0585 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.313     | +/-0.0751   | 0.0501 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 2.51      | +/-0.264    | 0.137  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | UI        | 0.00      | +/-0.136    | 0.225  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | -0.0202   | +/-0.0893   | 0.160  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.00466  | +/-0.0658   | 0.128  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.00253   | +/-0.0285   | 0.053  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0234   | +/-0.0351   | 0.0594 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -9.66E-05 | +/-0.0345   | 0.0627 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.00512  | +/-0.024    | 0.0435 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0166   | +/-0.0449   | 0.0758 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00      | +/-0.0479   | 0.0399 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.0239    | +/-0.0788   | 0.140  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-N17 (1-6) Project: AMPH002  
Sample ID: 433374005 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 16:00  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                     | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|---------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                  | U         | -0.0301  | +/-0.0629   | 0.110  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1429 | 1702977 | 1      |
| Cadmium-109                                                   | U         | 0.707    | +/-0.809    | 1.11   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                    | U         | 0.00601  | +/-0.0379   | 0.069  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                   | U         | 0.0611   | +/-0.289    | 0.557  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                     | U         | -0.00448 | +/-0.0394   | 0.0691 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                     | U         | 8.85E-05 | +/-0.105    | 0.132  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                     | U         | 0.00773  | +/-0.0382   | 0.0697 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                     |           | 0.659    | +/-0.0856   | 0.0548 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                  |           | 4.21     | +/-0.281    | 0.147  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                  | UI        | 0.00     | +/-0.177    | 0.286  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                  | U         | -0.0242  | +/-0.0833   | 0.151  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                       | U         | -0.00553 | +/-0.0749   | 0.141  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                  | U         | 0.0119   | +/-0.0328   | 0.0611 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                    | U         | 0.00889  | +/-0.0394   | 0.0719 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                   | U         | -0.00982 | +/-0.0374   | 0.0696 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                   | U         | 0.0079   | +/-0.0235   | 0.0415 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                   | U         | -0.00982 | +/-0.0498   | 0.0927 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                     | U         | 0.046    | +/-0.0799   | 0.0607 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                       | U         | 0.0637   | +/-0.0768   | 0.156  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit



# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-N20 (1-6) Project: AMPH002  
Sample ID: 433374006 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 16:20  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | -0.0383   | +/-0.0485   | 0.0783 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1438 | 1702977 | 1      |
| Cadmium-109                                                  | U         | 0.397     | +/-0.810    | 1.49   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.016     | +/-0.0354   | 0.0695 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.0755   | +/-0.306    | 0.549  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | -0.000423 | +/-0.0374   | 0.0704 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00      | +/-0.111    | 0.0453 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | 0.0222    | +/-0.0357   | 0.0708 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.616     | +/-0.0867   | 0.0539 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 4.63      | +/-0.280    | 0.124  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 | U         | 0.189     | +/-0.0999   | 0.224  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | -0.0658   | +/-0.107    | 0.192  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0221   | +/-0.0683   | 0.125  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | -0.0167   | +/-0.0357   | 0.0628 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | -0.0411   | +/-0.0445   | 0.0715 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | -0.00119  | +/-0.0397   | 0.0743 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | -0.0115   | +/-0.0258   | 0.045  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0056   | +/-0.0473   | 0.0882 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0654    | +/-0.0351   | 0.0784 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.0256   | +/-0.110    | 0.124  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration   SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-N23 (1-6) Project: AMPH002  
Sample ID: 433374007 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 16:30  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |           |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.00736   | +/-0.0364   | 0.0863 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1430 | 1702977 | 1      |
| Cadmium-109                                                  | U         | 1.07      | +/-1.16     | 1.19   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | -0.000345 | +/-0.0308   | 0.0561 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.123    | +/-0.285    | 0.507  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.0208    | +/-0.0328   | 0.0666 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | U         | 0.0247    | +/-0.0823   | 0.0354 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | -0.0162   | +/-0.033    | 0.0559 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.436     | +/-0.0826   | 0.0556 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 2.78      | +/-0.260    | 0.145  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 |           | 0.222     | +/-0.156    | 0.147  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | -0.0319   | +/-0.0843   | 0.150  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0156   | +/-0.0667   | 0.124  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.0386    | +/-0.0332   | 0.0663 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | U         | 0.00798   | +/-0.0372   | 0.068  |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | -0.00897  | +/-0.0309   | 0.0578 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | 0.0016    | +/-0.0205   | 0.0389 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | 0.00292   | +/-0.0407   | 0.0788 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | U         | 0.0784    | +/-0.0549   | 0.0877 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | -0.0511   | +/-0.0916   | 0.138  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

Client Sample ID: 1132-N23 ~~(4-6)~~ (6-12) <sup>78P</sup> <sub>10/26/17</sub>      Project: AMPH002  
 Sample ID: 433374008      Client ID: AMPH002  
 Matrix: Misc Solid  
 Collect Date: 14-SEP-17 16:40  
 Receive Date: 21-SEP-17  
 Collector: Client

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date | Time | Batch | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|------|------|-------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |      |      |       |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |      |      |       |        |
| Antimony-124                                                         | U         | 0.00945  | +/-0.0405   | 0.0814 |    | pCi/g |    |    |         |      |      |       |        |
| Cadmium-109                                                          | U         | 0.376    | +/-0.911    | 0.675  |    | pCi/g |    |    |         |      |      |       |        |
| Cesium-134                                                           | U         | 0.0199   | +/-0.0206   | 0.0418 |    | pCi/g |    |    |         |      |      |       |        |
| Chromium-51                                                          | U         | 0.0769   | +/-0.188    | 0.349  |    | pCi/g |    |    |         |      |      |       |        |
| Cobalt-56                                                            | U         | 0.00306  | +/-0.0205   | 0.039  |    | pCi/g |    |    |         |      |      |       |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.0523   | 0.0242 |    | pCi/g |    |    |         |      |      |       |        |
| Cobalt-58                                                            | U         | -0.0083  | +/-0.0182   | 0.033  |    | pCi/g |    |    |         |      |      |       |        |
| Cobalt-60                                                            |           | 0.106    | +/-0.0403   | 0.0344 |    | pCi/g |    |    |         |      |      |       |        |
| Europium-152                                                         |           | 1.12     | +/-0.121    | 0.0887 |    | pCi/g |    |    |         |      |      |       |        |
| Europium-154                                                         | U         | 0.041    | +/-0.0511   | 0.129  |    | pCi/g |    |    |         |      |      |       |        |
| Europium-155                                                         | U         | 0.0267   | +/-0.0583   | 0.107  |    | pCi/g |    |    |         |      |      |       |        |
| Iron-59                                                              | U         | -0.0168  | +/-0.0391   | 0.0691 |    | pCi/g |    |    |         |      |      |       |        |
| Manganese-54                                                         | U         | -0.00332 | +/-0.017    | 0.0315 |    | pCi/g |    |    |         |      |      |       |        |
| Niobium-95                                                           | U         | 0.00697  | +/-0.0248   | 0.0399 |    | pCi/g |    |    |         |      |      |       |        |
| Scandium-46                                                          | U         | -0.00729 | +/-0.0176   | 0.0319 |    | pCi/g |    |    |         |      |      |       |        |
| Silver-108m                                                          | U         | -0.00641 | +/-0.0141   | 0.0257 |    | pCi/g |    |    |         |      |      |       |        |
| Silver-110m                                                          | U         | 0.00257  | +/-0.0255   | 0.0426 |    | pCi/g |    |    |         |      |      |       |        |
| Sodium-22                                                            | U         | 0.0145   | +/-0.018    | 0.0286 |    | pCi/g |    |    |         |      |      |       |        |
| Zinc-65                                                              | U         | 0.0437   | +/-0.078    | 0.0936 |    | pCi/g |    |    |         |      |      |       |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor      Lc/LC: Critical Level  
 DL: Detection Limit      PF: Prep Factor  
 MDA: Minimum Detectable Activity      RL: Reporting Limit  
 MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-N30 (1-6) | Project: AMPH002   |
| Sample ID: 433374009             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 14-SEP-17 16:50    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0329  | +/-0.0405   | 0.0677 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1430 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 0.252    | +/-0.873    | 0.995  |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.025    | +/-0.036    | 0.0608 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.0583   | +/-0.242    | 0.477  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.0158   | +/-0.0345   | 0.068  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.0869   | 0.0323 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0292   | +/-0.0323   | 0.0666 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.291    | +/-0.0891   | 0.0551 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 3.48     | +/-0.273    | 0.131  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | UI        | 0.00     | +/-0.158    | 0.240  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | -0.0215  | +/-0.0709   | 0.134  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0287  | +/-0.0745   | 0.116  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.00678  | +/-0.0299   | 0.0582 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0134  | +/-0.0362   | 0.0623 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.0166   | +/-0.0294   | 0.0597 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | -0.00176 | +/-0.0202   | 0.0381 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.00838  | +/-0.0365   | 0.072  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00     | +/-0.0558   | 0.0486 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.0475   | +/-0.0785   | 0.115  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-S19 (1-6) | Project: AMPH002   |
| Sample ID: 433374010             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 15-SEP-17 08:30    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0269  | +/-0.0388   | 0.0673 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1430 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 0.174    | +/-0.551    | 0.556  |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.0521   | +/-0.0508   | 0.0628 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.00911  | +/-0.216    | 0.412  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.0245  | +/-0.0275   | 0.0476 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.0744   | 0.0239 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | -0.00729 | +/-0.0271   | 0.0504 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.407    | +/-0.0713   | 0.0509 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 3.03     | +/-0.216    | 0.114  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | U         | 0.140    | +/-0.115    | 0.203  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0407   | +/-0.0515   | 0.0994 |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0211  | +/-0.0578   | 0.104  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.000597 | +/-0.0251   | 0.0477 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.0108   | +/-0.0302   | 0.0571 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.00203  | +/-0.0319   | 0.060  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.00304  | +/-0.0189   | 0.0357 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0146  | +/-0.0412   | 0.0747 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | U         | 0.0494   | +/-0.0405   | 0.0618 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.00288 | +/-0.0811   | 0.129  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-S21 (1-6) | Project: AMPH002   |
| Sample ID: 433374011             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 15-SEP-17 08:50    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |          |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.0228   | +/-0.0316   | 0.106  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1913 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 0.289    | +/-0.941    | 0.860  |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.017    | +/-0.044    | 0.0855 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | 0.0352   | +/-0.304    | 0.559  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.0179   | +/-0.0454   | 0.0876 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00     | +/-0.0745   | 0.151  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0241   | +/-0.0425   | 0.0843 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.655    | +/-0.102    | 0.0592 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 4.72     | +/-0.325    | 0.154  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         | U         | 0.247    | +/-0.185    | 0.291  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0364   | +/-0.0703   | 0.142  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0744  | +/-0.0779   | 0.133  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.00012  | +/-0.0413   | 0.0753 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0111  | +/-0.0439   | 0.0805 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.00872 | +/-0.0384   | 0.0695 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.00474  | +/-0.0254   | 0.0508 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.00797 | +/-0.0515   | 0.0937 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00     | +/-0.0651   | 0.052  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.0424  | +/-0.125    | 0.139  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-S26 (1-6) Project: AMPH002  
Sample ID: 433374012 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 15-SEP-17 09:00  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                     | Qualifier | Result    | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date | Time     | Batch        | Method |
|---------------------------------------------------------------|-----------|-----------|-------------|--------|----|-------|----|----|---------|------|----------|--------------|--------|
| Rad Gamma Spec Analysis                                       |           |           |             |        |    |       |    |    |         |      |          |              |        |
| Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected" |           |           |             |        |    |       |    |    |         |      |          |              |        |
| Antimony-124                                                  | U         | -0.00597  | +/-0.0369   | 0.0749 |    | pCi/g |    |    |         | MXR1 | 09/29/17 | 1431 1702977 | 1      |
| Cadmium-109                                                   | U         | 0.172     | +/-0.510    | 0.894  |    | pCi/g |    |    |         |      |          |              |        |
| Cesium-134                                                    | U         | 0.0149    | +/-0.0331   | 0.0621 |    | pCi/g |    |    |         |      |          |              |        |
| Chromium-51                                                   | U         | -0.0507   | +/-0.232    | 0.440  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-56                                                     | U         | 0.0113    | +/-0.0305   | 0.0571 |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-57                                                     | U         | 0.089     | +/-0.0912   | 0.120  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-58                                                     | U         | 0.0208    | +/-0.0304   | 0.0586 |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-60                                                     |           | 0.536     | +/-0.0729   | 0.0357 |    | pCi/g |    |    |         |      |          |              |        |
| Europium-152                                                  |           | 4.64      | +/-0.244    | 0.100  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-154                                                  |           | 0.393     | +/-0.156    | 0.230  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-155                                                  | U         | 0.0236    | +/-0.0715   | 0.134  |    | pCi/g |    |    |         |      |          |              |        |
| Iron-59                                                       | U         | 0.0756    | +/-0.0607   | 0.125  |    | pCi/g |    |    |         |      |          |              |        |
| Manganese-54                                                  | U         | -7.12E-05 | +/-0.0279   | 0.0505 |    | pCi/g |    |    |         |      |          |              |        |
| Niobium-95                                                    | U         | 0.00734   | +/-0.0305   | 0.0566 |    | pCi/g |    |    |         |      |          |              |        |
| Scandium-46                                                   | U         | 0.013     | +/-0.0307   | 0.0577 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-108m                                                   | U         | 0.00429   | +/-0.0179   | 0.0348 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-110m                                                   | U         | -0.00419  | +/-0.0397   | 0.071  |    | pCi/g |    |    |         |      |          |              |        |
| Sodium-22                                                     | U         | 0.0346    | +/-0.0745   | 0.0457 |    | pCi/g |    |    |         |      |          |              |        |
| Zinc-65                                                       | U         | 0.093     | +/-0.0905   | 0.136  |    | pCi/g |    |    |         |      |          |              |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                                  |                    |
|----------------------------------|--------------------|
| Client Sample ID: 1132-S40 (1-6) | Project: AMPH002   |
| Sample ID: 433374013             | Client ID: AMPH002 |
| Matrix: Misc Solid               |                    |
| Collect Date: 15-SEP-17 09:20    |                    |
| Receive Date: 21-SEP-17          |                    |
| Collector: Client                |                    |

| Parameter                                                            | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |         |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0432 | +/-0.0895   | 0.157  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1431 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 0.547   | +/-0.947    | 1.05   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | -0.014  | +/-0.0564   | 0.0982 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.0938 | +/-0.354    | 0.665  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.0125 | +/-0.0601   | 0.103  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00    | +/-0.121    | 0.0431 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0517  | +/-0.0559   | 0.109  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.765   | +/-0.113    | 0.0549 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 5.40    | +/-0.371    | 0.194  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         |           | 0.473   | +/-0.156    | 0.355  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0159  | +/-0.0905   | 0.168  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.0086  | +/-0.113    | 0.192  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | -0.035  | +/-0.0514   | 0.081  |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0261 | +/-0.0569   | 0.0971 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | 0.0384  | +/-0.0525   | 0.106  |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.00587 | +/-0.0326   | 0.0621 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0706 | +/-0.0655   | 0.113  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | U         | 0.0157  | +/-0.0792   | 0.0521 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | -0.0717 | +/-0.152    | 0.191  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |



# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

---

|                               |                    |
|-------------------------------|--------------------|
| Client Sample ID: 1132-F72D   | Project: AMPH002   |
| Sample ID: 433374014          | Client ID: AMPH002 |
| Matrix: Misc Solid            |                    |
| Collect Date: 14-SEP-17 11:35 |                    |
| Receive Date: 21-SEP-17       |                    |
| Collector: Client             |                    |

| Parameter                                                            | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |         |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | -0.0684 | +/-0.0465   | 0.0507 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1431 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 0.379   | +/-1.33     | 1.38   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | 0.00848 | +/-0.0402   | 0.073  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.0697 | +/-0.316    | 0.586  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | -0.0113 | +/-0.0412   | 0.0716 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | UI        | 0.00    | +/-0.0789   | 0.158  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | 0.0119  | +/-0.0627   | 0.0675 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.531   | +/-0.0773   | 0.0565 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 6.46    | +/-0.333    | 0.146  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         |           | 0.432   | +/-0.152    | 0.171  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0515  | +/-0.109    | 0.197  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | -0.0388 | +/-0.0823   | 0.149  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.00339 | +/-0.0366   | 0.0656 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | 0.00558 | +/-0.0407   | 0.0734 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.0142 | +/-0.0409   | 0.0703 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.00263 | +/-0.024    | 0.0449 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | 0.00107 | +/-0.0484   | 0.0865 |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | UI        | 0.00    | +/-0.0535   | 0.105  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.0722  | +/-0.101    | 0.178  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-W5D Project: AMPH002  
Sample ID: 433374015 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 13:55  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|--------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| Rad Gamma Spec Analysis                                      |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                 | U         | 0.0354   | +/-0.0695   | 0.179  |    | pCi/g |    |    | MXR1    | 09/29/17 | 1913 | 1702977 | 1      |
| Cadmium-109                                                  | UI        | 0.00     | +/-1.44     | 1.49   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                   | U         | 0.0231   | +/-0.0516   | 0.100  |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                  | U         | -0.154   | +/-0.355    | 0.679  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                    | U         | 0.0321   | +/-0.0484   | 0.102  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                    | UI        | 0.00     | +/-0.0923   | 0.179  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                    | U         | -0.00286 | +/-0.0493   | 0.0963 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                    |           | 0.717    | +/-0.152    | 0.0787 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                 |           | 3.83     | +/-0.398    | 0.188  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                 |           | 0.439    | +/-0.198    | 0.355  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                 | U         | 0.0586   | +/-0.106    | 0.213  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                      | U         | -0.0373  | +/-0.109    | 0.201  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                 | U         | 0.00923  | +/-0.0488   | 0.0873 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                   | UI        | 0.00     | +/-0.170    | 0.0982 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                  | U         | 0.0101   | +/-0.0444   | 0.0904 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                  | U         | 0.00545  | +/-0.0309   | 0.0612 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                  | U         | -0.0216  | +/-0.0604   | 0.114  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                    | UI        | 0.00     | +/-0.0698   | 0.0816 |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                      | U         | 0.108    | +/-0.116    | 0.245  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration      SQL: Sample Quantitation Limit

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
 Address : 911 Cross Park Dr.  
 Knoxville, Tennessee 37923  
 Contact: Mr. Paul Jones  
 Project: Ameriphysics, LLC

|                               |                    |
|-------------------------------|--------------------|
| Client Sample ID: 1132-W11D   | Project: AMPH002   |
| Sample ID: 433374016          | Client ID: AMPH002 |
| Matrix: Misc Solid            |                    |
| Collect Date: 14-SEP-17 13:45 |                    |
| Receive Date: 21-SEP-17       |                    |
| Collector: Client             |                    |

| Parameter                                                            | Qualifier | Result  | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date     | Time | Batch   | Method |
|----------------------------------------------------------------------|-----------|---------|-------------|--------|----|-------|----|----|---------|----------|------|---------|--------|
| <b>Rad Gamma Spec Analysis</b>                                       |           |         |             |        |    |       |    |    |         |          |      |         |        |
| <b>Gammascpec, Gamma, Solid - Client List "Dry Weight Corrected"</b> |           |         |             |        |    |       |    |    |         |          |      |         |        |
| Antimony-124                                                         | U         | 0.00368 | +/-0.0344   | 0.0951 |    | pCi/g |    |    | MXR1    | 09/29/17 | 1914 | 1702977 | 1      |
| Cadmium-109                                                          | U         | 1.11    | +/-1.02     | 1.36   |    | pCi/g |    |    |         |          |      |         |        |
| Cesium-134                                                           | U         | -0.0101 | +/-0.0435   | 0.0793 |    | pCi/g |    |    |         |          |      |         |        |
| Chromium-51                                                          | U         | -0.0618 | +/-0.384    | 0.732  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-56                                                            | U         | 0.00635 | +/-0.0401   | 0.0774 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-57                                                            | U         | 0.0204  | +/-0.143    | 0.184  |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-58                                                            | U         | -0.0134 | +/-0.0523   | 0.0938 |    | pCi/g |    |    |         |          |      |         |        |
| Cobalt-60                                                            |           | 0.713   | +/-0.107    | 0.0463 |    | pCi/g |    |    |         |          |      |         |        |
| Europium-152                                                         |           | 5.13    | +/-0.390    | 0.176  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-154                                                         |           | 0.244   | +/-0.214    | 0.177  |    | pCi/g |    |    |         |          |      |         |        |
| Europium-155                                                         | U         | 0.0505  | +/-0.120    | 0.223  |    | pCi/g |    |    |         |          |      |         |        |
| Iron-59                                                              | U         | 0.0649  | +/-0.0884   | 0.174  |    | pCi/g |    |    |         |          |      |         |        |
| Manganese-54                                                         | U         | 0.0626  | +/-0.103    | 0.0742 |    | pCi/g |    |    |         |          |      |         |        |
| Niobium-95                                                           | U         | -0.0305 | +/-0.0502   | 0.0855 |    | pCi/g |    |    |         |          |      |         |        |
| Scandium-46                                                          | U         | -0.0447 | +/-0.0504   | 0.0829 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-108m                                                          | U         | 0.00181 | +/-0.0292   | 0.0566 |    | pCi/g |    |    |         |          |      |         |        |
| Silver-110m                                                          | U         | -0.0225 | +/-0.059    | 0.104  |    | pCi/g |    |    |         |          |      |         |        |
| Sodium-22                                                            | U         | 0.0862  | +/-0.0754   | 0.111  |    | pCi/g |    |    |         |          |      |         |        |
| Zinc-65                                                              | U         | 0.022   | +/-0.109    | 0.185  |    | pCi/g |    |    |         |          |      |         |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

**Notes:**

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

|                                       |                                |
|---------------------------------------|--------------------------------|
| DF: Dilution Factor                   | Lc/LC: Critical Level          |
| DL: Detection Limit                   | PF: Prep Factor                |
| MDA: Minimum Detectable Activity      | RL: Reporting Limit            |
| MDC: Minimum Detectable Concentration | SQL: Sample Quantitation Limit |

# GEL LABORATORIES LLC

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## Certificate of Analysis

Report Date: October 26, 2017

Company : Ameriphysics, LLC  
Address : 911 Cross Park Dr.  
  
Knoxville, Tennessee 37923  
Contact: Mr. Paul Jones  
Project: Ameriphysics, LLC

Client Sample ID: 1132-N17D Project: AMPH002  
Sample ID: 433374017 Client ID: AMPH002  
Matrix: Misc Solid  
Collect Date: 14-SEP-17 16:10  
Receive Date: 21-SEP-17  
Collector: Client

| Parameter                                                    | Qualifier | Result   | Uncertainty | MDC    | RL | Units | PF | DF | Analyst | Date | Time     | Batch        | Method |
|--------------------------------------------------------------|-----------|----------|-------------|--------|----|-------|----|----|---------|------|----------|--------------|--------|
| Rad Gamma Spec Analysis                                      |           |          |             |        |    |       |    |    |         |      |          |              |        |
| Gammaspec, Gamma, Solid - Client List "Dry Weight Corrected" |           |          |             |        |    |       |    |    |         |      |          |              |        |
| Antimony-124                                                 | U         | -0.0222  | +/-0.0549   | 0.108  |    | pCi/g |    |    |         | MXR1 | 09/29/17 | 1915 1702977 | 1      |
| Cadmium-109                                                  | U         | 0.360    | +/-1.36     | 1.21   |    | pCi/g |    |    |         |      |          |              |        |
| Cesium-134                                                   | U         | -0.0186  | +/-0.0362   | 0.0639 |    | pCi/g |    |    |         |      |          |              |        |
| Chromium-51                                                  | U         | -0.0742  | +/-0.317    | 0.614  |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-56                                                    | U         | -0.00317 | +/-0.0434   | 0.0803 |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-57                                                    | UI        | 0.00     | +/-0.127    | 0.0416 |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-58                                                    | U         | -0.00926 | +/-0.0377   | 0.0692 |    | pCi/g |    |    |         |      |          |              |        |
| Cobalt-60                                                    |           | 0.478    | +/-0.0882   | 0.0281 |    | pCi/g |    |    |         |      |          |              |        |
| Europium-152                                                 |           | 3.92     | +/-0.323    | 0.146  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-154                                                 |           | 0.334    | +/-0.116    | 0.289  |    | pCi/g |    |    |         |      |          |              |        |
| Europium-155                                                 | U         | 0.0486   | +/-0.0954   | 0.185  |    | pCi/g |    |    |         |      |          |              |        |
| Iron-59                                                      | U         | -0.0202  | +/-0.0899   | 0.161  |    | pCi/g |    |    |         |      |          |              |        |
| Manganese-54                                                 | U         | 0.0131   | +/-0.0335   | 0.0671 |    | pCi/g |    |    |         |      |          |              |        |
| Niobium-95                                                   | U         | 0.0323   | +/-0.0408   | 0.084  |    | pCi/g |    |    |         |      |          |              |        |
| Scandium-46                                                  | U         | 0.0177   | +/-0.0397   | 0.0794 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-108m                                                  | U         | 0.00228  | +/-0.0225   | 0.0452 |    | pCi/g |    |    |         |      |          |              |        |
| Silver-110m                                                  | U         | 0.00932  | +/-0.0506   | 0.0977 |    | pCi/g |    |    |         |      |          |              |        |
| Sodium-22                                                    | UI        | 0.00     | +/-0.0408   | 0.066  |    | pCi/g |    |    |         |      |          |              |        |
| Zinc-65                                                      | U         | 0.106    | +/-0.0851   | 0.186  |    | pCi/g |    |    |         |      |          |              |        |

The following Prep Methods were performed:

| Method        | Description                | Analyst | Date     | Time | Prep Batch |
|---------------|----------------------------|---------|----------|------|------------|
| Dry Soil Prep | Dry Soil Prep GL-RAD-A-021 | LYT1    | 09/22/17 | 0914 | 1702947    |

The following Analytical Methods were performed:

| Method | Description                   | Analyst Comments |
|--------|-------------------------------|------------------|
| 1      | DOE HASL 300, 4.5.2.3/Ga-01-R |                  |

### Notes:

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor                      Lc/LC: Critical Level  
DL: Detection Limit                      PF: Prep Factor  
MDA: Minimum Detectable Activity      RL: Reporting Limit  
MDC: Minimum Detectable Concentration   SQL: Sample Quantitation Limit

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## QC Summary

Report Date: October 26, 2017

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Ameriphysics, LLC  
911 Cross Park Dr.  
Knoxville, Tennessee

Contact: Mr. Paul Jones

Workorder: 433374

| Parmname              | NOM         | Sample    | Qual | QC        | Units | RPD% | REC% | Range    | Anlst | Date     | Time  |
|-----------------------|-------------|-----------|------|-----------|-------|------|------|----------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |           |      |           |       |      |      |          |       |          |       |
| Batch                 | 1702977     |           |      |           |       |      |      |          |       |          |       |
| QC1203880741          | 433373021   | DUP       |      |           |       |      |      |          |       |          |       |
| Antimony-124          | U           | 0.0238    | U    | -0.055    | pCi/g | N/A  |      | N/A      | MXR1  | 09/29/17 | 19:17 |
|                       | Uncertainty | +/-0.060  |      | +/-0.0623 |       |      |      |          |       |          |       |
| Cadmium-109           | U           | -0.785    | U    | 0.494     | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.773  |      | +/-0.762  |       |      |      |          |       |          |       |
| Cesium-134            | U           | 0.0642    | U    | -0.0256   | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.052  |      | +/-0.0585 |       |      |      |          |       |          |       |
| Chromium-51           | U           | -0.218    | U    | -0.0966   | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.365  |      | +/-0.452  |       |      |      |          |       |          |       |
| Cobalt-56             | U           | -0.0179   | U    | 0.0378    | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.0568 |      | +/-0.0725 |       |      |      |          |       |          |       |
| Cobalt-57             | UI          | 0.00      | UI   | 0.00      | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.0965 |      | +/-0.155  |       |      |      |          |       |          |       |
| Cobalt-58             | U           | 0.0414    | U    | 0.089     | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.0563 |      | +/-0.119  |       |      |      |          |       |          |       |
| Cobalt-60             |             | 0.766     |      | 0.636     | pCi/g | 18.6 |      | (0%-20%) |       |          |       |
|                       | Uncertainty | +/-0.137  |      | +/-0.144  |       |      |      |          |       |          |       |
| Europium-152          |             | 4.37      |      | 4.78      | pCi/g | 8.83 |      | (0%-20%) |       |          |       |
|                       | Uncertainty | +/-0.438  |      | +/-0.411  |       |      |      |          |       |          |       |
| Europium-154          | U           | 0.102     | U    | 0.259     | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.149  |      | +/-0.283  |       |      |      |          |       |          |       |
| Europium-155          | U           | 0.00664   | U    | -0.0178   | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.117  |      | +/-0.113  |       |      |      |          |       |          |       |
| Iron-59               | U           | 0.0492    | U    | 0.0201    | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.121  |      | +/-0.152  |       |      |      |          |       |          |       |
| Manganese-54          | U           | 0.0197    | U    | -0.0151   | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.0442 |      | +/-0.0671 |       |      |      |          |       |          |       |
| Niobium-95            | U           | -0.0242   | U    | 0.0544    | pCi/g | N/A  |      | N/A      |       |          |       |
|                       | Uncertainty | +/-0.0681 |      | +/-0.0588 |       |      |      |          |       |          |       |

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## QC Summary

Workorder: 433374

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| Parmname              | NOM         | Sample    | Qual | QC        | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|-----------------------|-------------|-----------|------|-----------|-------|------|------|------------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |           |      |           |       |      |      |            |       |          |       |
| Batch                 | 1702977     |           |      |           |       |      |      |            |       |          |       |
| Scandium-46           | U           | -0.0103   | U    | -0.0727   | pCi/g | N/A  |      | N/A        | MXR1  | 09/29/17 | 19:17 |
|                       | Uncertainty | +/-0.0597 |      | +/-0.081  |       |      |      |            |       |          |       |
| Silver-108m           | U           | -0.00366  | U    | -0.0169   | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0327 |      | +/-0.0426 |       |      |      |            |       |          |       |
| Silver-110m           | U           | 0.00734   | U    | 0.0633    | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0793 |      | +/-0.162  |       |      |      |            |       |          |       |
| Sodium-22             | U           | 0.0292    | U    | 0.0913    | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.0536 |      | +/-0.0999 |       |      |      |            |       |          |       |
| Zinc-65               | U           | -0.0788   | U    | -0.0295   | pCi/g | N/A  |      | N/A        |       |          |       |
|                       | Uncertainty | +/-0.158  |      | +/-0.169  |       |      |      |            |       |          |       |
| QC1203880742          | LCS         |           |      |           |       |      |      |            |       |          |       |
| Americium-241         |             | 488       |      | 542       | pCi/g |      | 111  | (75%-125%) |       | 09/29/17 | 14:02 |
|                       | Uncertainty |           |      | +/-5.03   |       |      |      |            |       |          |       |
| Cesium-137            |             | 175       |      | 183       | pCi/g |      | 104  | (75%-125%) |       |          |       |
|                       | Uncertainty |           |      | +/-3.08   |       |      |      |            |       |          |       |
| Antimony-124          |             |           | U    | 0.185     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.558  |       |      |      |            |       |          |       |
| Cadmium-109           |             |           |      | 231       | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-14.7   |       |      |      |            |       |          |       |
| Cesium-134            |             |           | U    | 0.225     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.614  |       |      |      |            |       |          |       |
| Chromium-51           |             |           | U    | 0.731     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-3.54   |       |      |      |            |       |          |       |
| Cobalt-56             |             |           | U    | -0.219    | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.592  |       |      |      |            |       |          |       |
| Cobalt-57             |             |           |      | 0.586     | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.291  |       |      |      |            |       |          |       |
| Cobalt-58             |             |           | U    | -0.238    | pCi/g |      |      |            |       |          |       |
|                       | Uncertainty |           |      | +/-0.514  |       |      |      |            |       |          |       |
| Cobalt-60             |             | 141       |      | 140       | pCi/g |      | 99   | (75%-125%) |       |          |       |
|                       | Uncertainty |           |      | +/-3.24   |       |      |      |            |       |          |       |

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## QC Summary

Workorder: 433374

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| Parmname              | NOM         | Sample | Qual | QC        | Units | RPD% | REC% | Range | Anlst | Date     | Time  |
|-----------------------|-------------|--------|------|-----------|-------|------|------|-------|-------|----------|-------|
| <b>Rad Gamma Spec</b> |             |        |      |           |       |      |      |       |       |          |       |
| Batch                 | 1702977     |        |      |           |       |      |      |       |       |          |       |
| Europium-152          |             |        | U    | 0.762     | pCi/g |      |      |       | MXR1  | 09/29/17 | 14:02 |
|                       | Uncertainty |        |      | +/-1.20   |       |      |      |       |       |          |       |
| Europium-154          |             |        | U    | -0.108    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.937  |       |      |      |       |       |          |       |
| Europium-155          |             |        | U    | -0.0348   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.752  |       |      |      |       |       |          |       |
| Iron-59               |             |        | U    | 0.0971    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-1.27   |       |      |      |       |       |          |       |
| Manganese-54          |             |        | U    | 0.071     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.533  |       |      |      |       |       |          |       |
| Niobium-95            |             |        | U    | 0.103     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.461  |       |      |      |       |       |          |       |
| Scandium-46           |             |        | U    | -0.138    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.627  |       |      |      |       |       |          |       |
| Silver-108m           |             |        | U    | -0.00623  | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.442  |       |      |      |       |       |          |       |
| Silver-110m           |             |        | U    | 0.634     | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.831  |       |      |      |       |       |          |       |
| Sodium-22             |             |        | U    | -0.0379   | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.329  |       |      |      |       |       |          |       |
| Zinc-65               |             |        | U    | 2.17      | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-1.98   |       |      |      |       |       |          |       |
| QC1203880740          | MB          |        |      |           |       |      |      |       |       |          |       |
| Antimony-124          |             |        | U    | -0.00354  | pCi/g |      |      |       |       | 09/29/17 | 19:16 |
|                       | Uncertainty |        |      | +/-0.0593 |       |      |      |       |       |          |       |
| Cadmium-109           |             |        | U    | -0.469    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.394  |       |      |      |       |       |          |       |
| Cesium-134            |             |        | U    | 0.0041    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.016  |       |      |      |       |       |          |       |
| Chromium-51           |             |        | U    | 0.0847    | pCi/g |      |      |       |       |          |       |
|                       | Uncertainty |        |      | +/-0.167  |       |      |      |       |       |          |       |

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## QC Summary

Workorder: 433374

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| Parmname       | NOM         | Sample  | Qual | QC        | Units | RPD% | REC% | Range | Anlst | Date     | Time  |
|----------------|-------------|---------|------|-----------|-------|------|------|-------|-------|----------|-------|
| Rad Gamma Spec |             |         |      |           |       |      |      |       |       |          |       |
| Batch          |             | 1702977 |      |           |       |      |      |       |       |          |       |
| Cobalt-56      |             |         | U    | 0.00331   | pCi/g |      |      |       | MXR1  | 09/29/17 | 19:16 |
|                | Uncertainty |         |      | +/-0.0203 |       |      |      |       |       |          |       |
| Cobalt-57      |             |         | U    | -0.00441  | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0133 |       |      |      |       |       |          |       |
| Cobalt-58      |             |         | U    | 0.0107    | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0172 |       |      |      |       |       |          |       |
| Cobalt-60      |             |         | U    | -0.00861  | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0218 |       |      |      |       |       |          |       |
| Europium-152   |             |         | U    | 0.0216    | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0536 |       |      |      |       |       |          |       |
| Europium-154   |             |         | U    | -0.0318   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.044  |       |      |      |       |       |          |       |
| Europium-155   |             |         | U    | -0.0252   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0528 |       |      |      |       |       |          |       |
| Iron-59        |             |         | U    | -0.0384   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0335 |       |      |      |       |       |          |       |
| Manganese-54   |             |         | U    | 0.0125    | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0199 |       |      |      |       |       |          |       |
| Niobium-95     |             |         | U    | 0.0158    | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0181 |       |      |      |       |       |          |       |
| Scandium-46    |             |         | U    | 0.00451   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0162 |       |      |      |       |       |          |       |
| Silver-108m    |             |         | U    | 0.0286    | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0144 |       |      |      |       |       |          |       |
| Silver-110m    |             |         | U    | -0.0195   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0363 |       |      |      |       |       |          |       |
| Sodium-22      |             |         | U    | -0.0121   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.0149 |       |      |      |       |       |          |       |
| Zinc-65        |             |         | U    | 0.00266   | pCi/g |      |      |       |       |          |       |
|                | Uncertainty |         |      | +/-0.042  |       |      |      |       |       |          |       |

Notes:



# GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

## QC Summary

Workorder: 433374

Page 5 of 5

| Parmname | NOM | Sample | Qual | QC | Units | RPD% | REC% | Range | Anlst | Date | Time |
|----------|-----|--------|------|----|-------|------|------|-------|-------|------|------|
|----------|-----|--------|------|----|-------|------|------|-------|-------|------|------|

Counting Uncertainty is calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a Tracer compound
- < Result is less than value reported
- > Result is greater than value reported
- BD Results are either below the MDC or tracer recovery is low
- FA Failed analysis.
- H Analytical holding time was exceeded
- J Value is estimated
- K Analyte present. Reported value may be biased high. Actual value is expected to be lower.
- L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
- M M if above MDC and less than LLD
- M REMP Result > MDC/CL and < RDL
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UI Gamma Spectroscopy--Uncertain identification
- UJ Gamma Spectroscopy--Uncertain identification
- UL Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Other specific qualifiers were required to properly define the results. Consult case narrative.
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

**Section 1**

Project Number: **1132** Project Name: **UT Health**

Send Report To: **Ameriphysics, LLC**

Address: **9111 Cross Park Drive, Suite D200, Knoxville, TN 37923**

Phone: **(865)705-1136** Fax:

Sampler Name: **(Print) Robbie Hansen**

Shipment Method: **FedEx** Airbill Number:

Laboratory Receiving: **GEL Laboratories**

Page **1** of **2**  
 Purchase Order #: **N/A**  
 Batch #: **1132-002**

**Section 2**

| Sample ID      | Sample Description | Sample Date | Sample Time | Sample Matrix | Sample Volume | Cont. Type | Cont. Quantity | Analysis Requested                                                                                                                                            | QA/QC level | Comments, Special Instructions, etc. | Lab Sample ID (to be completed by lab) |
|----------------|--------------------|-------------|-------------|---------------|---------------|------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------|----------------------------------------|
| 1132-E2 (1-6)  | Concrete Sample    | 9/14/17     | 15:35       | S             | 0.5 L         | P          | 1              | Gamm Spec (Na-22, Sc-46, Cr-51, Mn-54, Fe-59, Co-56, Co-57, Co-58, Co-60, Zn-65, Nb-95, Ag-108m, Ag-110m, Cd-109, Sb-124, Cs-134, Eu-152, Eu-154, and Eu-155) | N/A         |                                      |                                        |
| 1132-E4 (1-6)  | Concrete Sample    | 9/14/17     | 15:15       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |
| 1132-E9 (1-6)  | Concrete Sample    | 9/14/17     | 15:25       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |
| 1132-E17 (1-6) | Concrete Sample    | 9/14/17     | 15:50       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |
| 1132-N17 (1-6) | Concrete Sample    | 9/14/17     | 16:00       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |
| 1132-N20 (1-6) | Concrete Sample    | 9/14/17     | 16:20       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |
| 1132-N23 (1-6) | Concrete Sample    | 9/14/17     | 16:30       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |
| 1132-N23 (1-6) | Concrete Sample    | 9/14/17     | 16:40       | S             | 0.5 L         | P          | 1              |                                                                                                                                                               | N/A         |                                      |                                        |

**Section 3**

Relinquished by: (Signature) *[Signature]* Date: **9/21/17** Time: **9:05**

Received by: (Signature) *[Signature]* Date: \_\_\_\_\_ Time: \_\_\_\_\_

Relinquished by: (Signature) \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Received by: (Signature) \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Relinquished by: (Signature) \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Received by: (Signature) \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

**Section 4**

QA/QC level: Level I, Level II, Level III, Other \_\_\_\_\_

Turnaround: Routine, 24 Hour, 1 Week, Other: \_\_\_\_\_

Sample Receipt: Total # Containers Received?, COC Seals Present?, COC Seals Intact?, Received Containers Intact?, Temperature?

433374

|                   |  |                        |        |
|-------------------|--|------------------------|--------|
| Ameriphysics, LLC |  | Chain of Custody (COC) |        |
| QA Program Form   |  | Doc                    | Rev #  |
|                   |  | Date                   | Form # |
|                   |  | 2/10/2015              | 1      |
|                   |  |                        | 1      |

| Sample ID      | Sample Description | Sample Date | Sample Time | Sample Matrix | Sample Volume | Cont. Type | Cont. Quantity | Refer to Page 1 for Analysis Requested |   |  |  | Comments, Special Instructions, etc. | Lab Sample ID (to be completed by lab) |
|----------------|--------------------|-------------|-------------|---------------|---------------|------------|----------------|----------------------------------------|---|--|--|--------------------------------------|----------------------------------------|
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
| 1132-N30 (1-6) | Concrete Sample    | 9/14/17     | 16:50       | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-S19 (1-6) | Concrete Sample    | 9/15/17     | 8:30        | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-S21 (1-6) | Concrete Sample    | 9/15/17     | 8:50        | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-S26 (1-6) | Concrete Sample    | 9/15/17     | 9:00        | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-S40 (1-6) | Concrete Sample    | 9/15/17     | 9:20        | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-F72D      | Concrete Sample    | 9/14/17     | 11:35       | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-W5D       | Concrete Sample    | 9/14/17     | 13:55       | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-W11D      | Concrete Sample    | 9/14/17     | 13:45       | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
| 1132-N17D      | Concrete Sample    | 9/14/17     | 16:10       | S             | 0.5 L         | P          | 1              | X                                      | X |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |
|                |                    |             |             |               |               |            |                |                                        |   |  |  |                                      |                                        |



SAMPLE RECEIPT & REVIEW FORM

Client: SDG/AR/COC/Work Order:

Received By: Stacy Boone Date Received: 21-SEPT-17

Carrier and Tracking Number: FedEx Express 7877 8470 3300 - 210, 7877 8470 3310 - 210

Suspected Hazard Information: \*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.

Shipped as a DOT Hazardous?: Hazard Class Shipped: UN#:

COC/Samples marked or classified as radioactive?: Maximum Net Counts Observed\* (Observed Counts - Area Background Counts): 0 CPM / mR/Hr

Is package, COC, and/or Samples marked HAZ?: If yes, select Hazards below, and contact the GEL Safety Group. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:

Table with 4 columns: Sample Receipt Criteria, Yes, NA, No, and Comments/Qualifiers (Required for Non-Conforming Items). Rows 1-13 detailing various criteria like container integrity, documentation, preservation methods, and temperature control.

Comments (Use Continuation Form if needed):

PM (or PMA) review Initials: [Signature] Date: 9/21/17 Page 1 of 1

**Subject:** Re: Questions on detected radionuclides  
**From:** Edie Kent <emk@gel.com>  
**Date:** 10/26/2017 1:19 PM  
**To:** Tim Pratt <tpratt@ameriphysics.com>  
**CC:** Nancy Mattern <Nancy.Mattern@gel.com>

Tim:

The Na-22 and Cd-109 results were intended to be rejected but were not qualified properly. The Co-57 was a false positive and should have been reported as rejected. We are in the process of correcting this and will issue a revised report.

Edie

On 10/25/2017 2:54 PM, Tim Pratt wrote:

Edie,

The ones I question are Sample 1132-F20 (1-6) with the Na-22; Sample 1132-W5D (1-6) with the Cd-109; and Samples 1132-F52 (1-6), 1132-F56 (1-6), 1132-C52 (1-6), 1132-W3 (1-6), and 1132-W17 (1-6) with the Co-57.

As I mentioned, with the short relatively short half-lives of these radionuclides and the time that has elapsed since this place was operational (2001), there is very little chance that these are really there.

Thanks,

Tim

Timothy J. Pratt  
Corporate Radiation Safety Officer  
Ameriphysics LLC  
9111 Cross Park Drive, Suite D200  
Knoxville, TN 37923  
Office: 865-470-4171  
Cell: 865-386-8066  
Fax: 865-470-4179

--

**Edith M. Kent**  
**Project Manager**



2040 Savage Road, Charleston, SC 29407 | PO Box 30712, Charleston, SC 29417  
Office Direct: 843.769.7385 | Office Main: 843.556.8171 | Fax: 843.766.1178  
E-Mail: [emk@gel.com](mailto:emk@gel.com) | Website: [www.gel.com](http://www.gel.com)

**Environmental | Engineering | Surveying | Analytical Testing**

**List of current GEL Certifications as of 02 October 2017**

| <b>State</b>             | <b>Certification</b>         |
|--------------------------|------------------------------|
| Alaska                   | UST-0110                     |
| Arkansas                 | 88-0651                      |
| CLIA                     | 42D0904046                   |
| California               | 2940                         |
| Colorado                 | SC00012                      |
| Connecticut              | PH-0169                      |
| Delaware                 | SC00012                      |
| DoD ELAP/ ISO17025 A2LA  | 2567.01                      |
| Florida NELAP            | E87156                       |
| Foreign Soils Permit     | P330-15-00283, P330-15-00253 |
| Georgia                  | SC00012                      |
| Georgia SDWA             | 967                          |
| Hawaii                   | SC00012                      |
| Idaho Chemistry          | SC00012                      |
| Idaho Radiochemistry     | SC00012                      |
| Illinois NELAP           | 200029                       |
| Indiana                  | C-SC-01                      |
| Kansas NELAP             | E-10332                      |
| Kentucky SDWA            | 90129                        |
| Kentucky Wastewater      | 90129                        |
| Louisiana NELAP          | 03046 (AI33904)              |
| Louisiana SDWA           | LA170010                     |
| Maryland                 | 270                          |
| Massachusetts            | M-SC012                      |
| Michigan                 | 9976                         |
| Mississippi              | SC00012                      |
| Nebraska                 | NE-OS-26-13                  |
| Nevada                   | SC000122018-1                |
| New Hampshire NELAP      | 205415                       |
| New Jersey NELAP         | SC002                        |
| New Mexico               | SC00012                      |
| New York NELAP           | 11501                        |
| North Carolina           | 233                          |
| North Carolina SDWA      | 45709                        |
| North Dakota             | R-158                        |
| Oklahoma                 | 9904                         |
| Pennsylvania NELAP       | 68-00485                     |
| Puerto Rico              | SC00012                      |
| S.Carolina Radchem       | 10120002                     |
| South Carolina Chemistry | 10120001                     |
| Tennessee                | TN 02934                     |
| Texas NELAP              | T104704235-17-12             |
| Utah NELAP               | SC000122017-23               |
| Vermont                  | VT87156                      |
| Virginia NELAP           | 460202                       |
| Washington               | C780                         |
| West Virginia            | 997404                       |

**Radiochemistry  
Technical Case Narrative  
Ameriphysics, LLC (AMPH)  
SDG #: 433374**

**Product:** Dry Weight

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 21

**Preparation Batch:** 1702947

The following samples were analyzed using the above methods and analytical procedure(s).

| <b><u>GEL Sample ID#</u></b> | <b><u>Client Sample Identification</u></b> |
|------------------------------|--------------------------------------------|
| 433374001                    | 1132-E2 (1-6)                              |
| 433374002                    | 1132-E4 (1-6)                              |
| 433374003                    | 1132-E9 (1-6)                              |
| 433374004                    | 1132-E17 (1-6)                             |
| 433374005                    | 1132-N17 (1-6)                             |
| 433374006                    | 1132-N20 (1-6)                             |
| 433374007                    | 1132-N23 (1-6)                             |
| 433374008                    | 1132-N23 (1-6)                             |
| 433374009                    | 1132-N30 (1-6)                             |
| 433374010                    | 1132-S19 (1-6)                             |
| 433374011                    | 1132-S21 (1-6)                             |
| 433374012                    | 1132-S26 (1-6)                             |
| 433374013                    | 1132-S40 (1-6)                             |
| 433374014                    | 1132-F72D                                  |
| 433374015                    | 1132-W5D                                   |
| 433374016                    | 1132-W11D                                  |
| 433374017                    | 1132-N17D                                  |

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** Gammascpec, Gamma, Solid - Client List

**Analytical Method:** DOE HASL 300, 4.5.2.3/Ga-01-R

**Analytical Procedure:** GL-RAD-A-013 REV# 27

**Analytical Batch:** 1702977

**Preparation Method:** Dry Soil Prep

**Preparation Procedure:** GL-RAD-A-021 REV# 21

**Preparation Batch:** 1702947



The following samples were analyzed using the above methods and analytical procedure(s).

| <u>GEL Sample ID#</u> | <u>Client Sample Identification</u>              |
|-----------------------|--------------------------------------------------|
| 433374001             | 1132-E2 (1-6)                                    |
| 433374002             | 1132-E4 (1-6)                                    |
| 433374003             | 1132-E9 (1-6)                                    |
| 433374004             | 1132-E17 (1-6)                                   |
| 433374005             | 1132-N17 (1-6)                                   |
| 433374006             | 1132-N20 (1-6)                                   |
| 433374007             | 1132-N23 (1-6)                                   |
| 433374008             | 1132-N23 (1-6)                                   |
| 433374009             | 1132-N30 (1-6)                                   |
| 433374010             | 1132-S19 (1-6)                                   |
| 433374011             | 1132-S21 (1-6)                                   |
| 433374012             | 1132-S26 (1-6)                                   |
| 433374013             | 1132-S40 (1-6)                                   |
| 433374014             | 1132-F72D                                        |
| 433374015             | 1132-W5D                                         |
| 433374016             | 1132-W11D                                        |
| 433374017             | 1132-N17D                                        |
| 1203880740            | Method Blank (MB)                                |
| 1203880741            | 433373021(1132-W19 (1-6)) Sample Duplicate (DUP) |
| 1203880742            | Laboratory Control Sample (LCS)                  |

The samples in this SDG were analyzed on a "dry weight" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Qualifier Information**

| <b>Qualifier</b> | <b>Reason</b>                                                             | <b>Analyte</b> | <b>Sample</b> | <b>Client Sample</b> |
|------------------|---------------------------------------------------------------------------|----------------|---------------|----------------------|
| UI               | Results are considered a false positive due to high counting uncertainty. | Cadmium-109    | 433374015     | 1132-W5D             |
|                  |                                                                           |                | 433374002     | 1132-E4 (1-6)        |
|                  |                                                                           |                | 433374003     | 1132-E9 (1-6)        |
|                  |                                                                           |                | 433374006     | 1132-N20 (1-6)       |
|                  |                                                                           |                | 433374008     | 1132-N23 (1-6)       |
|                  |                                                                           |                | 433374009     | 1132-N30 (1-6)       |
|                  |                                                                           |                | 433374013     | 1132-S40 (1-6)       |
|                  |                                                                           |                | 433374017     | 1132-N17D            |
|                  |                                                                           |                |               |                      |

|    |                                                                 |              |            |                                 |
|----|-----------------------------------------------------------------|--------------|------------|---------------------------------|
|    |                                                                 |              | 1203880741 | 1132-W19<br>(1-6)(433373021DUP) |
|    |                                                                 | Europium-154 | 433374005  | 1132-N17 (1-6)                  |
| UI | Results are considered a false positive due to high peak-width. | Niobium-95   | 433374015  | 1132-W5D                        |
| UI | Results are considered a false positive due to interference.    | Cobalt-57    | 433374010  | 1132-S19 (1-6)                  |
|    |                                                                 | Sodium-22    | 433374004  | 1132-E17 (1-6)                  |
|    |                                                                 |              | 433374009  | 1132-N30 (1-6)                  |
|    |                                                                 |              | 433374011  | 1132-S21 (1-6)                  |
|    |                                                                 |              | 433374015  | 1132-W5D                        |
|    |                                                                 |              | 433374017  | 1132-N17D                       |
| UI | Results are considered a false positive due to low abundance.   | Cobalt-57    | 433374001  | 1132-E2 (1-6)                   |
|    |                                                                 |              | 433374011  | 1132-S21 (1-6)                  |
|    |                                                                 |              | 433374014  | 1132-F72D                       |
|    |                                                                 |              | 433374015  | 1132-W5D                        |
|    |                                                                 | Europium-154 | 433374004  | 1132-E17 (1-6)                  |
|    |                                                                 |              | 433374009  | 1132-N30 (1-6)                  |
|    |                                                                 | Sodium-22    | 433374014  | 1132-F72D                       |

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

**ATTACHMENT 3**  
**REDRAD-BUILD Reports**

---

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

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RESRAD-BUILD Table of Contents

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Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

=====

=====

=====

RESRAD-BUILD Input Parameters

=====

=====

Number of Sources : 1  
Number of Receptors: 1  
Total Time : 3.650000E+02 days  
Fraction Inside : 5.000000E-01

===== Receptor Information =====

| Receptor | Room | x     | y     | z     | FracTime | Inhalation | Ingestion(Dust) |
|----------|------|-------|-------|-------|----------|------------|-----------------|
|          |      | [m]   | [m]   | [m]   |          | [m3/day]   | [m2/hr]         |
| 1        | 1    | 1.000 | 1.000 | 1.000 | 1.000    | 1.80E+01   | 1.00E-04        |

===== Receptor-Source Shielding Relationship =====

| Receptor | Source | Density  | Thickness | Material |
|----------|--------|----------|-----------|----------|
|          |        | [g/cm3]  | [cm]      |          |
| 1        | 1      | 2.40E+00 | 0.00E+00  | Concrete |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

==== Building Information ====

Building Air Exchange Rate: 8.00E-01 1/hr

| Height [m]  | Area [m2] | Air Exchanges [m3/hr]     |
|-------------|-----------|---------------------------|
|             |           | *****                     |
|             |           | * * *                     |
|             |           | * * *                     |
|             |           | * * * <=Q01: 7.20E+01     |
| H1: 2.500   |           | * Room 1 * Q10 : 7.20E+01 |
|             |           | * LAMBDA: 8.00E-01 * *    |
| Area 36.000 |           | * * *                     |
|             |           | * * *                     |
|             |           | *****                     |

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

==== Source Information ====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00[m]  
 Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x  
 Pathway ::  
 Direct Ingestion Rate: 0.000E+00 [gm/hr]  
 Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1  
 Thickness [cm] :1.50E+01  
 Density [g/cm3] :2.40E+00  
 Material :Concrete  
 Erosion Rate [cm/day] :2.40E-08

Contamination::

Nuclide Concentration Dose Conversion Factor (Library: FGR 13 Morbidity)

|        |           | Ingestion  | Inhalation | Submersion             |
|--------|-----------|------------|------------|------------------------|
|        | [pCi/g]   | [mrem/pCi] | [mrem/pCi] | [mrem/yr/<br>(pCi/m3)] |
| GD-152 | 0.000E+00 | 1.610E-04  | 2.430E-01  | 0.000E+00              |
| EU-154 | 7.830E-01 | 9.550E-06  | 2.860E-04  | 7.172E-03              |
| EU-152 | 1.630E+01 | 6.480E-06  | 2.210E-04  | 6.599E-03              |
| CO-60  | 1.220E+00 | 2.690E-05  | 2.190E-04  | 1.472E-02              |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.00000000E+00 years

```
=====
=====
=====
Assessment for Time: 1
Time =0.00E+00 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 0.000E+00                |
|                 | EU-154  | 7.830E-01                |
|                 | EU-152  | 1.630E+01                |
|                 | CO-60   | 1.220E+00                |



Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.00000000E+00 years

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RESRAD-BUILD Dose Tables

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---

Source Contributions to Receptor Doses

---

[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 4.19E+01 | 4.19E+01 |
| Total      | 4.19E+01 | 4.19E+01 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.00000000E+00 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 4.19E+01 | 6.64E-06   | 7.12E-08  | 1.47E-05   | 0.00E+00 | 1.37E-06  |
| Total    | 4.19E+01 | 6.64E-06   | 7.12E-08  | 1.47E-05   | 0.00E+00 | 1.37E-06  |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.0000000E+00 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 1.78E+00 | 1.78E+00 |
| GD-152  | 4.93E-17 | 4.93E-17 |
| EU-152  | 3.45E+01 | 3.45E+01 |
| CO-60   | 5.63E+00 | 5.63E+00 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

```
=====
=====
=====
Assessment for Time: 2
Time =1.00E+00 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 1.019E-13                |
|                 | EU-154  | 7.237E-01                |
|                 | EU-152  | 1.547E+01                |
|                 | CO-60   | 1.070E+00                |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

---

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

---

[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 3.93E+01 | 3.93E+01 |
| Total      | 3.93E+01 | 3.93E+01 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 3.93E+01 | 6.24E-06   | 6.69E-08  | 1.39E-05   | 0.00E+00 | 1.27E-06  |
| Total    | 3.93E+01 | 6.24E-06   | 6.69E-08  | 1.39E-05   | 0.00E+00 | 1.27E-06  |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 1.65E+00 | 1.65E+00 |
| GD-152  | 1.45E-16 | 1.45E-16 |
| EU-152  | 3.27E+01 | 3.27E+01 |
| CO-60   | 4.94E+00 | 4.94E+00 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.0000000 years

```
=====
=====
=====
Assessment for Time: 3
Time =1.00E+01 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1  
Thickness [cm] :1.50E+01  
Fraction Contaminated :1.00E+00  
Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 8.153E-13                |
|                 | EU-154  | 3.562E-01                |
|                 | EU-152  | 9.679E+00                |
|                 | CO-60   | 3.275E-01                |



Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.0000000 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

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[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 2.28E+01 | 2.28E+01 |
| Total      | 2.28E+01 | 2.28E+01 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.000000 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 2.28E+01 | 3.66E-06   | 3.90E-08  | 8.34E-06   | 0.00E+00 | 7.11E-07  |
| Total    | 2.28E+01 | 3.66E-06   | 3.90E-08  | 8.34E-06   | 0.00E+00 | 7.11E-07  |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 8.12E-01 | 8.12E-01 |
| GD-152  | 8.12E-16 | 8.12E-16 |
| EU-152  | 2.05E+01 | 2.05E+01 |
| CO-60   | 1.51E+00 | 1.51E+00 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

```
=====
=====
=====
Assessment for Time: 4
Time =1.00E+02 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 1.996E-12                |
|                 | EU-154  | 2.971E-04                |
|                 | EU-152  | 8.888E-02                |
|                 | CO-60   | 2.367E-06                |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

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[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 1.89E-01 | 1.89E-01 |
| Total      | 1.89E-01 | 1.89E-01 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 1.89E-01 | 3.06E-08   | 3.25E-10  | 7.15E-08   | 0.00E+00 | 5.58E-09  |
| Total    | 1.89E-01 | 3.06E-08   | 3.25E-10  | 7.15E-08   | 0.00E+00 | 5.58E-09  |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 6.77E-04 | 6.77E-04 |
| GD-152  | 1.92E-15 | 1.92E-15 |
| EU-152  | 1.88E-01 | 1.88E-01 |
| CO-60   | 1.09E-05 | 1.09E-05 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

```
=====
=====
=====
Assessment for Time: 5
Time =1.00E+03 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1  
Thickness [cm] :1.50E+01  
Fraction Contaminated :1.00E+00  
Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 2.007E-12                |
|                 | EU-154  | 4.851E-35                |
|                 | EU-152  | 3.788E-22                |
|                 | CO-60   | 0.000E+00                |



Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

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[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 1.93E-15 | 1.93E-15 |
| Total      | 1.93E-15 | 1.93E-15 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 8.01E-22 | 1.30E-28   | 1.38E-30  | 1.92E-15   | 0.00E+00 | 3.40E-18  |
| Total    | 8.01E-22 | 1.30E-28   | 1.38E-30  | 1.92E-15   | 0.00E+00 | 3.40E-18  |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 0.00E+00 | 0.00E+00 |
| GD-152  | 1.93E-15 | 1.93E-15 |
| EU-152  | 8.01E-22 | 8.01E-22 |

Title : Sample F51 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Full Summary

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RESRAD-BUILD Dose (Time) Tables

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Receptor Dose Received for the Exposure Duration

---

---

(mrem)

Evaluation Time [yr]

0.00E+00 1.00E+00 1.00E+01 1.00E+02 1.00E+03

---

1 4.19E+01 3.93E+01 2.28E+01 1.89E-01 1.93E-15

Receptor Dose/Yr Averaged Over Exposure Duration

---

---

(mrem/yr)

Evaluation Time [yr]

0.00E+00 1.00E+00 1.00E+01 1.00E+02 1.00E+03

---

1 4.19E+01 3.93E+01 2.28E+01 1.89E-01 1.93E-15

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

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| For time = 1.00E+02 yr             |    |
| Time Specific Parameters.....      | 17 |
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| For time = 1.00E+03 yr             |    |
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Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

=====

=====

=====

RESRAD-BUILD Input Parameters

=====

=====

Number of Sources : 1  
Number of Receptors: 1  
Total Time : 3.650000E+02 days  
Fraction Inside : 5.000000E-01

===== Receptor Information =====

| Receptor | Room | x     | y     | z     | FracTime | Inhalation | Ingestion(Dust) |
|----------|------|-------|-------|-------|----------|------------|-----------------|
|          |      | [m]   | [m]   | [m]   |          | [m3/day]   | [m2/hr]         |
| 1        | 1    | 1.000 | 1.000 | 1.000 | 1.000    | 1.80E+01   | 1.00E-04        |

===== Receptor-Source Shielding Relationship =====

| Receptor | Source | Density  | Thickness | Material |
|----------|--------|----------|-----------|----------|
|          |        | [g/cm3]  | [cm]      |          |
| 1        | 1      | 2.40E+00 | 0.00E+00  | Concrete |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

==== Building Information ====

Building Air Exchange Rate: 8.00E-01 1/hr

| Height [m]  | Air Exchanges [m3/hr] |                  |
|-------------|-----------------------|------------------|
| Area [m2]   | *****                 |                  |
|             | *                     | *                |
|             | *                     | *                |
|             | *                     | <=Q01: 7.20E+01  |
| H1: 2.500   | * Room 1              | * Q10 : 7.20E+01 |
|             | * LAMBDA: 8.00E-01    | *                |
| Area 36.000 | *                     | *                |
|             | *                     | *                |
|             | *****                 |                  |

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

==== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00[m]  
 Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x  
 Pathway ::  
 Direct Ingestion Rate: 0.000E+00 [gm/hr]  
 Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1  
 Thickness [cm] :1.50E+01  
 Density [g/cm3] :2.40E+00  
 Material :Concrete  
 Erosion Rate [cm/day] :2.40E-08

Contamination::

Nuclide Concentration Dose Conversion Factor (Library: FGR 13 Morbidity)

|        |           | Ingestion  | Inhalation | Submersion             |
|--------|-----------|------------|------------|------------------------|
|        | [pCi/g]   | [mrem/pCi] | [mrem/pCi] | [mrem/yr/<br>(pCi/m3)] |
| GD-152 | 0.000E+00 | 1.610E-04  | 2.430E-01  | 0.000E+00              |
| EU-154 | 5.230E-01 | 9.550E-06  | 2.860E-04  | 7.172E-03              |
| EU-152 | 8.490E+00 | 6.480E-06  | 2.210E-04  | 6.599E-03              |
| CO-60  | 5.470E-01 | 2.690E-05  | 2.190E-04  | 1.472E-02              |



Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.00000000E+00 years

```
=====
=====
=====
Assessment for Time: 1
Time =0.00E+00 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 0.000E+00                |
|                 | EU-154  | 5.230E-01                |
|                 | EU-152  | 8.490E+00                |
|                 | CO-60   | 5.470E-01                |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.00000000E+00 years

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RESRAD-BUILD Dose Tables

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---

Source Contributions to Receptor Doses

---

[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 2.17E+01 | 2.17E+01 |
| Total      | 2.17E+01 | 2.17E+01 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.0000000E+00 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 2.17E+01 | 3.45E-06   | 3.69E-08  | 7.71E-06   | 0.00E+00 | 7.01E-07  |
| Total    | 2.17E+01 | 3.45E-06   | 3.69E-08  | 7.71E-06   | 0.00E+00 | 7.01E-07  |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 0.0000000E+00 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 1.19E+00 | 1.19E+00 |
| GD-152  | 2.57E-17 | 2.57E-17 |
| EU-152  | 1.80E+01 | 1.80E+01 |
| CO-60   | 2.52E+00 | 2.52E+00 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

```
=====
=====
=====
Assessment for Time: 2
Time =1.00E+00 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]  
Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x  
Pathway ::  
Direct Ingestion Rate : 0.000E+00 [gm/hr]  
Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1  
Thickness [cm] :1.50E+01  
Fraction Contaminated :1.00E+00  
Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 5.309E-14                |
|                 | EU-154  | 4.834E-01                |
|                 | EU-152  | 8.059E+00                |
|                 | CO-60   | 4.796E-01                |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

---

[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 2.04E+01 | 2.04E+01 |
| Total      | 2.04E+01 | 2.04E+01 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 2.04E+01 | 3.24E-06   | 3.47E-08  | 7.28E-06   | 0.00E+00 | 6.56E-07  |
| Total    | 2.04E+01 | 3.24E-06   | 3.47E-08  | 7.28E-06   | 0.00E+00 | 6.56E-07  |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1.00000000 years

Nuclide Detail of Doses

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[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 1.10E+00 | 1.10E+00 |
| GD-152  | 7.53E-17 | 7.53E-17 |
| EU-152  | 1.71E+01 | 1.71E+01 |
| CO-60   | 2.21E+00 | 2.21E+00 |



Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.0000000 years

```
=====
=====
=====
Assessment for Time: 3
Time =1.00E+01 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 4.247E-13                |
|                 | EU-154  | 2.379E-01                |
|                 | EU-152  | 5.042E+00                |
|                 | CO-60   | 1.468E-01                |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.0000000 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

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[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 1.19E+01 | 1.19E+01 |
| Total      | 1.19E+01 | 1.19E+01 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.000000 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 1.19E+01 | 1.91E-06   | 2.03E-08  | 4.38E-06   | 0.00E+00 | 3.69E-07  |
| Total    | 1.19E+01 | 1.91E-06   | 2.03E-08  | 4.38E-06   | 0.00E+00 | 3.69E-07  |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 10.000000 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 5.42E-01 | 5.42E-01 |
| GD-152  | 4.23E-16 | 4.23E-16 |
| EU-152  | 1.07E+01 | 1.07E+01 |
| CO-60   | 6.78E-01 | 6.78E-01 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

```
=====
=====
=====
Assessment for Time: 4
Time =1.00E+02 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 1.040E-12                |
|                 | EU-154  | 1.985E-04                |
|                 | EU-152  | 4.629E-02                |
|                 | CO-60   | 1.061E-06                |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

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[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 9.84E-02 | 9.84E-02 |
| Total      | 9.84E-02 | 9.84E-02 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 9.84E-02 | 1.60E-08   | 1.70E-10  | 3.73E-08   | 0.00E+00 | 2.91E-09  |
| Total    | 9.84E-02 | 1.60E-08   | 1.70E-10  | 3.73E-08   | 0.00E+00 | 2.91E-09  |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 100.000008 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 4.52E-04 | 4.52E-04 |
| GD-152  | 9.98E-16 | 9.98E-16 |
| EU-152  | 9.79E-02 | 9.79E-02 |
| CO-60   | 4.90E-06 | 4.90E-06 |



Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

```
=====
=====
=====
Assessment for Time: 5
Time =1.00E+03 yr
=====
=====
```

===== Source Information =====

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]

Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: x

Pathway ::

Direct Ingestion Rate : 0.000E+00 [gm/hr]

Fraction released to air: 1.000E-01

Containment :: Number of Regions: 1 Contaminated Region: 1

Region : 1

Thickness [cm] :1.50E+01

Fraction Contaminated :1.00E+00

Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | GD-152  | 1.046E-12                |
|                 | EU-154  | 3.240E-35                |
|                 | EU-152  | 1.973E-22                |
|                 | CO-60   | 0.000E+00                |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

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RESRAD-BUILD Dose Tables

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Source Contributions to Receptor Doses

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[mrem]

|            | Source   | Total    |
|------------|----------|----------|
|            | 1        |          |
| Receptor 1 | 1.00E-15 | 1.00E-15 |
| Total      | 1.00E-15 | 1.00E-15 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

Pathway Detail of Doses

[mrem]

Source: 1

| Receptor | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
|----------|----------|------------|-----------|------------|----------|-----------|
| 1        | 4.17E-22 | 6.78E-29   | 7.19E-31  | 1.00E-15   | 0.00E+00 | 1.77E-18  |
| Total    | 4.17E-22 | 6.78E-29   | 7.19E-31  | 1.00E-15   | 0.00E+00 | 1.77E-18  |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Evaluation Time: 1000.00000 years

Nuclide Detail of Doses

[mrem]

Source: 1

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| EU-154  | 0.00E+00 | 0.00E+00 |
| GD-152  | 1.00E-15 | 1.00E-15 |
| EU-152  | 4.17E-22 | 4.17E-22 |

Title : Sample F18 0-6 inches

Input File : C:\RESRAD\_Family\BUILD\3.5\UTHealth.bld

Full Summary

=====

=====

=====

=====

RESRAD-BUILD Dose (Time) Tables

=====

=====

=====

Receptor Dose Received for the Exposure Duration

(mrem)

Evaluation Time [yr]

0.00E+00 1.00E+00 1.00E+01 1.00E+02 1.00E+03

1 2.17E+01 2.04E+01 1.19E+01 9.84E-02 1.00E-15

Receptor Dose/Yr Averaged Over Exposure Duration

(mrem/yr)

Evaluation Time [yr]

0.00E+00 1.00E+00 1.00E+01 1.00E+02 1.00E+03

1 2.17E+01 2.04E+01 1.19E+01 9.85E-02 1.00E-15

**ATTACHMENT 4**

**Liquid Scintillation Counting Results**



vault floor

Assay Definition

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170912\_1701

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170912\_1701\20170912\_1701.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170912\_1701\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

Count Conditions

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Number of Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

Background = 23 cpm

MDA = 41 dpm

with H-3 efficiency = 62%

Detection Level = 48 cpm

All wipes are < MDA

unless otherwise marked.

Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Count Corrections

Static Controller: On

Colored Samples: n/a

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: n/a

Delay Before Burst (nsec): 75

GCT: n/a

PAC: n/a

PAC Strength: n/a

Instrument Block Data

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

Cycle 1 Results

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC   | SIS       | DATE    | TIME |
|-----|----|----|-------|------|------|------|--------|-----------|---------|------|
| 10  | 10 | 1  | 1.00  | 15   | 11   | 26   | 58.21  | 9/12/2017 | 5:02:19 | PM   |
| 10  | 10 | 2  | 1.00  | 13   | 9    | 22   | 50.10  | 9/12/2017 | 5:03:37 | PM   |
| 10  | 10 | 3  | 1.00  | 26   | 6    | 33   | 53.57  | 9/12/2017 | 5:04:54 | PM   |
| 10  | 10 | 4  | 1.00  | 19   | 7    | 27   | 102.29 | 9/12/2017 | 5:06:12 | PM   |
| 10  | 10 | 5  | 1.00  | 17   | 4    | 21   | 39.40  | 9/12/2017 | 5:07:30 | PM   |
| 10  | 10 | 6  | 1.00  | 17   | 6    | 23   | 53.28  | 9/12/2017 | 5:08:48 | PM   |
| 10  | 10 | 7  | 1.00  | 14   | 12   | 26   | 63.40  | 9/12/2017 | 5:10:06 | PM   |

Protocol# 10 - Wipe Test.lsa

User: Sai Yan

## vault floor

|                                        |    |    |      |    |    |    |        |           |         |    |
|----------------------------------------|----|----|------|----|----|----|--------|-----------|---------|----|
| 10                                     | 10 | 8  | 1.00 | 16 | 6  | 23 | 82.73  | 9/12/2017 | 5:11:23 | PM |
| 10                                     | 10 | 9  | 1.00 | 13 | 13 | 26 | 74.69  | 9/12/2017 | 5:12:42 | PM |
| 10                                     | 10 | 10 | 1.00 | 21 | 5  | 27 | 78.85  | 9/12/2017 | 5:13:59 | PM |
| 10                                     | 10 | 11 | 1.00 | 15 | 6  | 22 | 94.18  | 9/12/2017 | 5:15:17 | PM |
| 10                                     | 10 | 12 | 1.00 | 20 | 9  | 29 | 50.32  | 9/12/2017 | 5:16:35 | PM |
| 2                                      | 10 | 13 | 1.00 | 24 | 12 | 37 | 77.26  | 9/12/2017 | 5:17:59 | PM |
| 2                                      | 10 | 14 | 1.00 | 19 | 6  | 26 | 68.15  | 9/12/2017 | 5:19:17 | PM |
| 2                                      | 10 | 15 | 1.00 | 17 | 5  | 25 | 144.16 | 9/12/2017 | 5:20:35 | PM |
| 2                                      | 10 | 16 | 1.00 | 21 | 13 | 34 | 87.18  | 9/12/2017 | 5:21:53 | PM |
| 2                                      | 10 | 17 | 1.00 | 19 | 12 | 31 | 95.86  | 9/12/2017 | 5:23:10 | PM |
| 2                                      | 10 | 18 | 1.00 | 16 | 8  | 24 | 61.02  | 9/12/2017 | 5:24:28 | PM |
| 2                                      | 10 | 19 | 1.00 | 19 | 13 | 34 | 135.22 | 9/12/2017 | 5:25:46 | PM |
| 2                                      | 10 | 20 | 1.00 | 11 | 7  | 19 | 91.48  | 9/12/2017 | 5:27:04 | PM |
| 2                                      | 10 | 21 | 1.00 | 14 | 8  | 22 | 55.37  | 9/12/2017 | 5:28:22 | PM |
| 2                                      | 10 | 22 | 1.00 | 18 | 12 | 31 | 102.95 | 9/12/2017 | 5:29:40 | PM |
| 2                                      | 10 | 23 | 1.00 | 10 | 13 | 24 | 138.70 | 9/12/2017 | 5:30:57 | PM |
| 2                                      | 10 | 24 | 1.00 | 12 | 11 | 23 | 79.10  | 9/12/2017 | 5:32:16 | PM |
| 9                                      | 10 | 25 | 1.00 | 11 | 4  | 17 | 117.87 | 9/12/2017 | 5:33:39 | PM |
| 9                                      | 10 | 26 | 1.00 | 17 | 9  | 27 | 64.53  | 9/12/2017 | 5:34:57 | PM |
| 9                                      | 10 | 27 | 1.00 | 22 | 2  | 24 | 32.03  | 9/12/2017 | 5:36:15 | PM |
| 9                                      | 10 | 28 | 1.00 | 13 | 10 | 24 | 98.93  | 9/12/2017 | 5:37:33 | PM |
| 9                                      | 10 | 29 | 1.00 | 10 | 4  | 14 | 66.85  | 9/12/2017 | 5:38:51 | PM |
| 9                                      | 10 | 30 | 1.00 | 13 | 8  | 21 | 74.79  | 9/12/2017 | 5:40:09 | PM |
| 9                                      | 10 | 31 | 1.00 | 18 | 10 | 28 | 79.80  | 9/12/2017 | 5:41:27 | PM |
| 9                                      | 10 | 32 | 1.00 | 13 | 8  | 21 | 79.45  | 9/12/2017 | 5:42:45 | PM |
| 9                                      | 10 | 33 | 1.00 | 19 | 11 | 31 | 98.87  | 9/12/2017 | 5:44:03 | PM |
| 9                                      | 10 | 34 | 1.00 | 16 | 8  | 25 | 109.47 | 9/12/2017 | 5:45:21 | PM |
| 9                                      | 10 | 35 | 1.00 | 15 | 7  | 22 | 60.77  | 9/12/2017 | 5:46:39 | PM |
| 9                                      | 10 | 36 | 1.00 | 18 | 7  | 26 | 89.14  | 9/12/2017 | 5:47:57 | PM |
| 21                                     | 10 | 37 | 1.00 | 16 | 11 | 27 | 110.14 | 9/12/2017 | 5:49:21 | PM |
| 21                                     | 10 | 38 | 1.00 | 9  | 11 | 21 | 114.38 | 9/12/2017 | 5:50:39 | PM |
| 21                                     | 10 | 39 | 1.00 | 13 | 8  | 21 | 59.30  | 9/12/2017 | 5:51:57 | PM |
| 21                                     | 10 | 40 | 1.00 | 11 | 7  | 18 | 58.40  | 9/12/2017 | 5:53:15 | PM |
| 21                                     | 10 | 41 | 1.00 | 21 | 7  | 30 | 92.29  | 9/12/2017 | 5:54:33 | PM |
| 21                                     | 10 | 42 | 1.00 | 14 | 7  | 22 | 124.16 | 9/12/2017 | 5:55:51 | PM |
| 21                                     | 10 | 43 | 1.00 | 13 | 3  | 17 | 98.42  | 9/12/2017 | 5:57:09 | PM |
| 21                                     | 10 | 44 | 1.00 | 14 | 9  | 25 | 105.13 | 9/12/2017 | 5:58:26 | PM |
| Missing vial 45. (Area not accessible) |    |    |      |    |    |    |        |           |         |    |
| Missing vial 46. (Area not accessible) |    |    |      |    |    |    |        |           |         |    |
| 21                                     | 10 | 47 | 1.00 | 15 | 4  | 19 | 40.25  | 9/12/2017 | 5:59:47 | PM |
| 21                                     | 10 | 48 | 1.00 | 19 | 3  | 23 | 84.40  | 9/12/2017 | 6:01:05 | PM |
| 22                                     | 10 | 49 | 1.00 | 17 | 10 | 27 | 66.90  | 9/12/2017 | 6:02:29 | PM |
| 22                                     | 10 | 50 | 1.00 | 15 | 7  | 23 | 98.85  | 9/12/2017 | 6:03:48 | PM |
| 22                                     | 10 | 51 | 1.00 | 16 | 7  | 24 | 80.63  | 9/12/2017 | 6:05:06 | PM |
| 22                                     | 10 | 52 | 1.00 | 18 | 8  | 26 | 90.37  | 9/12/2017 | 6:06:24 | PM |
| 22                                     | 10 | 53 | 1.00 | 12 | 9  | 21 | 108.26 | 9/12/2017 | 6:07:42 | PM |
| 22                                     | 10 | 54 | 1.00 | 24 | 11 | 35 | 49.27  | 9/12/2017 | 6:09:00 | PM |
| 22                                     | 10 | 55 | 1.00 | 18 | 10 | 28 | 88.42  | 9/12/2017 | 6:10:18 | PM |
| 22                                     | 10 | 56 | 1.00 | 18 | 7  | 27 | 111.61 | 9/12/2017 | 6:11:36 | PM |
| 22                                     | 10 | 57 | 1.00 | 15 | 7  | 22 | 68.98  | 9/12/2017 | 6:12:53 | PM |
| 22                                     | 10 | 58 | 1.00 | 16 | 13 | 29 | 64.54  | 9/12/2017 | 6:14:11 | PM |
| 22                                     | 10 | 59 | 1.00 | 18 | 13 | 33 | 118.07 | 9/12/2017 | 6:15:29 | PM |
| 22                                     | 10 | 60 | 1.00 | 16 | 10 | 26 | 92.47  | 9/12/2017 | 6:16:47 | PM |
| 23                                     | 10 | 61 | 1.00 | 10 | 10 | 21 | 103.98 | 9/12/2017 | 6:18:12 | PM |
| 23                                     | 10 | 62 | 1.00 | 15 | 9  | 24 | 76.71  | 9/12/2017 | 6:19:29 | PM |
| 23                                     | 10 | 63 | 1.00 | 17 | 11 | 28 | 67.80  | 9/12/2017 | 6:20:47 | PM |
| 23                                     | 10 | 64 | 1.00 | 15 | 12 | 27 | 68.87  | 9/12/2017 | 6:22:05 | PM |
| 23                                     | 10 | 65 | 1.00 | 15 | 10 | 25 | 96.30  | 9/12/2017 | 6:23:23 | PM |
| 23                                     | 10 | 66 | 1.00 | 12 | 5  | 19 | 101.92 | 9/12/2017 | 6:24:41 | PM |
| Missing vial 67. (Area not accessible) |    |    |      |    |    |    |        |           |         |    |
| Missing vial 68. (Area not accessible) |    |    |      |    |    |    |        |           |         |    |
| 23                                     | 10 | 69 | 1.00 | 25 | 16 | 41 | 50.36  | 9/12/2017 | 6:26:01 | PM |
| 23                                     | 10 | 70 | 1.00 | 19 | 15 | 34 | 73.76  | 9/12/2017 | 6:27:19 | PM |



Protocol# 10 - Wipe Test.lsa

User: Sai Yan

## vault floor

|                   |     |           |      |      |    |    |        |           |           |         |    |
|-------------------|-----|-----------|------|------|----|----|--------|-----------|-----------|---------|----|
| 23                | 10  | 71        | 1.00 | 15   | 7  | 22 | 47.67  | 9/12/2017 | 6:28:37   | PM      |    |
| 23                | 10  | 72        | 1.00 | 29   | 8  | 39 | 87.47  | 9/12/2017 | 6:29:55   | PM      |    |
| 65                | 10  | 73        | 1.00 | 18   | 13 | 32 | 108.70 | 9/12/2017 | 6:31:20   | PM      |    |
| 65                | 10  | 74        | 1.00 | 14   | 5  | 20 | 119.01 | 9/12/2017 | 6:32:38   | PM      |    |
| 65                | 10  | 75        | 1.00 | 9    | 9  | 20 | 146.60 | 9/12/2017 | 6:33:56   | PM      |    |
| 65                | 10  | 76        | 1.00 | 18   | 8  | 26 | 75.68  | 9/12/2017 | 6:35:14   | PM      |    |
| 65                | 10  | 77        | 1.00 | 15   | 6  | 22 | 99.19  | 9/12/2017 | 6:36:32   | PM      |    |
| 65                | 10  | 78        | 1.00 | 18   | 11 | 30 | 84.65  | 9/12/2017 | 6:37:49   | PM      |    |
| 65                | 10  | 79        | 1.00 | 11   | 11 | 23 | 112.94 | 9/12/2017 | 6:39:07   | PM      |    |
| 65                | 10  | 80        | 1.00 | 19   | 9  | 28 | 64.89  | 9/12/2017 | 6:40:25   | PM      |    |
| 65                | 10  | 81        | 1.00 | 19   | 8  | 27 | 52.52  | 9/12/2017 | 6:41:43   | PM      |    |
| 65                | 10  | 82        | 1.00 | 15   | 9  | 25 | 79.45  | 9/12/2017 | 6:43:01   | PM      |    |
| 65                | 10  | 83        | 1.00 | 24   | 13 | 38 | 85.61  | 9/12/2017 | 6:44:19   | PM      |    |
| 65                | 10  | 84        | 1.00 | 10   | 13 | 23 | 107.92 | 9/12/2017 | 6:45:36   | PM      |    |
| 3                 | 10  | 85        | 1.00 | 18   | 11 | 30 | 85.59  | 9/12/2017 | 6:47:01   | PM      |    |
| 3                 | 10  | 86        | 1.00 | 12   | 14 | 28 | 128.31 | 9/12/2017 | 6:48:19   | PM      |    |
| 3                 | 10  | 87        | 1.00 | 16   | 10 | 27 | 88.13  | 9/12/2017 | 6:49:37   | PM      |    |
| 3                 | 10  | 88        | 1.00 | 15   | 9  | 27 | 159.28 | 9/12/2017 | 6:50:55   | PM      |    |
| 3                 | 10  | 89        | 1.00 | 19   | 7  | 28 | 89.19  | 9/12/2017 | 6:52:12   | PM      |    |
| 3                 | 10  | 90        | 1.00 | 17   | 10 | 28 | 95.74  | 9/12/2017 | 6:53:30   | PM      |    |
| 3                 | 10  | 91        | 1.00 | 10   | 13 | 23 | 98.78  | 9/12/2017 | 6:54:48   | PM      |    |
| 3                 | 10  | 92        | 1.00 | 16   | 11 | 28 | 96.18  | 9/12/2017 | 6:56:06   | PM      |    |
| 3                 | 10  | 93        | 1.00 | 13   | 8  | 21 | 55.07  | 9/12/2017 | 6:57:24   | PM      |    |
| 3                 | 10  | 94        | 1.00 | 22   | 7  | 29 | 68.27  | 9/12/2017 | 6:58:42   | PM      |    |
| 3                 | 10  | 95        | 1.00 | 18   | 14 | 34 | 122.64 | 9/12/2017 | 7:00:00   | PM      |    |
| 3                 | 10  | 96        | 1.00 | 27   | 9  | 36 | 34.00  | 9/12/2017 | 7:01:18   | PM      |    |
| 26                | 10  | 97        | 1.00 | 17   | 6  | 24 | 98.43  | 9/12/2017 | 7:02:42   | PM      |    |
| 26                | 10  | 98        | 1.00 | 16   | 6  | 22 | 67.07  | 9/12/2017 | 7:04:00   | PM      |    |
| 26                | 10  | 99        | 1.00 | 14   | 16 | 33 | 138.78 | 9/12/2017 | 7:05:18   | PM      |    |
| 26                | 10  | 100       | 1.00 | 17   | 8  | 26 | 108.79 | 9/12/2017 | 7:06:36   | PM      |    |
| 26                | 10  | 101(F1D)  | 1.00 | 13   | 8  | 22 | 101.04 | 9/12/2017 | 7:07:54   | PM      |    |
| 26                | 10  | 102(F18D) | 1.00 | 19   | 2  | 21 | 25.18  | 9/12/2017 | 7:09:12   | PM      |    |
| 26                | 10  | 103(F25D) | 1.00 | 12   | 7  | 21 | 166.35 | 9/12/2017 | 7:10:30   | PM      |    |
| 26                | 10  | 104(F41D) | 1.00 | 27   | 5  | 32 | 57.44  | 9/12/2017 | 7:11:48   | PM      |    |
| 26                | 10  | 105(F49D) | 1.00 | 12   | 2  | 14 | 45.51  | 9/12/2017 | 7:13:05   | PM      |    |
| 26                | 10  | 106(F54D) | 1.00 | 25   | 9  | 36 | 72.83  | 9/12/2017 | 7:14:23   | PM      |    |
| 26                | 10  | 107(F70D) | 1.00 | 8    | 7  | 15 | 85.98  | 9/12/2017 | 7:15:41   | PM      |    |
| 26                | 10  | 108(F78D) | 1.00 | 14   | 9  | 26 | 150.75 | 9/12/2017 | 7:16:59   | PM      |    |
| 127               | 10  | 109(F88D) | 1.00 | 22   | 13 | 35 | 62.66  | 9/12/2017 | 7:18:42   | PM      |    |
| 127               | 10  | 110(F97D) | 1.00 | 24   | 9  | 34 | 88.45  | 9/12/2017 | 7:20:00   | PM      |    |
| Missing vial 111. |     |           |      |      |    |    |        |           |           |         |    |
| BK 6              | 127 | 10        | 112  | 1.00 | 16 | 5  | 23     | 113.66    | 9/12/2017 | 7:21:20 | PM |

Protocol# 6 - Wipe Test.lsa

User: Sai Yan

vault ceiling

**Assay Definition**

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170913\_0859

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170913\_0859\20170913\_0859.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170913\_0859\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

**Count Conditions**

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Repeat Sample Count: 1

Number of Vials/Sample: 1

Calculate % Reference: Off

**Background Subtract**

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

**Count Corrections**

Static Controller: On

Luminescence Correction: Off

GCT: n/a

Colored Samples: n/a

Heterogeneity Monitor: n/a

PAC: n/a

Coincidence Time (nsec): 18

Delay Before Burst (nsec): 75

PAC Strength: n/a

**Instrument Block Data**

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

**Cycle 1 Results**

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC   | SIS       | DATE       | TIME |
|-----|----|----|-------|------|------|------|--------|-----------|------------|------|
| 2   | 6  | 1  | 1.00  | 31   | 6    | 37   | 34.04  | 9/13/2017 | 9:01:13 AM |      |
| 2   | 6  | 2  | 1.00  | 23   | 10   | 33   | 66.85  | 9/13/2017 | 9:02:31 AM |      |
| 2   | 6  | 3  | 1.00  | 11   | 3    | 16   | 147.20 | 9/13/2017 | 9:03:49 AM |      |
| 2   | 6  | 4  | 1.00  | 18   | 5    | 23   | 49.18  | 9/13/2017 | 9:05:07 AM |      |
| 2   | 6  | 5  | 1.00  | 11   | 9    | 22   | 124.39 | 9/13/2017 | 9:06:25 AM |      |

Protocol# 6 - Wipe Test.lsa

User: Sai Yan

## vault ceiling

|                                        |   |    |      |    |    |    |        |           |             |
|----------------------------------------|---|----|------|----|----|----|--------|-----------|-------------|
| 2                                      | 6 | 6  | 1.00 | 20 | 4  | 25 | 79.38  | 9/13/2017 | 9:07:42 AM  |
| 2                                      | 6 | 7  | 1.00 | 24 | 6  | 30 | 33.38  | 9/13/2017 | 9:09:01 AM  |
| 2                                      | 6 | 8  | 1.00 | 16 | 9  | 25 | 70.65  | 9/13/2017 | 9:10:19 AM  |
| 2                                      | 6 | 9  | 1.00 | 11 | 13 | 24 | 79.59  | 9/13/2017 | 9:11:36 AM  |
| 2                                      | 6 | 10 | 1.00 | 25 | 8  | 33 | 61.49  | 9/13/2017 | 9:12:55 AM  |
| 2                                      | 6 | 11 | 1.00 | 15 | 5  | 21 | 65.16  | 9/13/2017 | 9:14:12 AM  |
| 2                                      | 6 | 12 | 1.00 | 17 | 6  | 23 | 59.35  | 9/13/2017 | 9:15:30 AM  |
| 14                                     | 6 | 13 | 1.00 | 11 | 9  | 20 | 70.41  | 9/13/2017 | 9:16:55 AM  |
| 14                                     | 6 | 14 | 1.00 | 18 | 13 | 31 | 71.47  | 9/13/2017 | 9:18:13 AM  |
| 14                                     | 6 | 15 | 1.00 | 16 | 3  | 19 | 31.47  | 9/13/2017 | 9:19:31 AM  |
| 14                                     | 6 | 16 | 1.00 | 16 | 6  | 23 | 90.24  | 9/13/2017 | 9:20:49 AM  |
| 14                                     | 6 | 17 | 1.00 | 15 | 13 | 28 | 94.12  | 9/13/2017 | 9:22:07 AM  |
| 14                                     | 6 | 18 | 1.00 | 16 | 7  | 23 | 50.49  | 9/13/2017 | 9:23:25 AM  |
| 14                                     | 6 | 19 | 1.00 | 12 | 13 | 25 | 132.86 | 9/13/2017 | 9:24:43 AM  |
| 14                                     | 6 | 20 | 1.00 | 15 | 7  | 23 | 86.70  | 9/13/2017 | 9:26:01 AM  |
| 14                                     | 6 | 21 | 1.00 | 9  | 8  | 17 | 73.50  | 9/13/2017 | 9:27:19 AM  |
| 14                                     | 6 | 22 | 1.00 | 16 | 9  | 25 | 108.21 | 9/13/2017 | 9:28:36 AM  |
| 14                                     | 6 | 23 | 1.00 | 13 | 6  | 19 | 44.48  | 9/13/2017 | 9:29:54 AM  |
| 14                                     | 6 | 24 | 1.00 | 7  | 16 | 27 | 247.02 | 9/13/2017 | 9:31:12 AM  |
| 18                                     | 6 | 25 | 1.00 | 21 | 5  | 27 | 71.74  | 9/13/2017 | 9:32:37 AM  |
| 18                                     | 6 | 26 | 1.00 | 20 | 8  | 29 | 67.52  | 9/13/2017 | 9:33:55 AM  |
| 18                                     | 6 | 27 | 1.00 | 21 | 8  | 31 | 83.57  | 9/13/2017 | 9:35:13 AM  |
| 18                                     | 6 | 28 | 1.00 | 19 | 7  | 27 | 74.57  | 9/13/2017 | 9:36:31 AM  |
| 18                                     | 6 | 29 | 1.00 | 20 | 7  | 27 | 44.08  | 9/13/2017 | 9:37:49 AM  |
| 18                                     | 6 | 30 | 1.00 | 19 | 17 | 38 | 119.53 | 9/13/2017 | 9:39:07 AM  |
| 18                                     | 6 | 31 | 1.00 | 16 | 7  | 24 | 81.68  | 9/13/2017 | 9:40:24 AM  |
| 18                                     | 6 | 32 | 1.00 | 35 | 6  | 42 | 58.51  | 9/13/2017 | 9:41:42 AM  |
| 18                                     | 6 | 33 | 1.00 | 16 | 13 | 30 | 100.31 | 9/13/2017 | 9:43:01 AM  |
| 18                                     | 6 | 34 | 1.00 | 19 | 8  | 28 | 103.89 | 9/13/2017 | 9:44:18 AM  |
| 18                                     | 6 | 35 | 1.00 | 23 | 7  | 30 | 56.01  | 9/13/2017 | 9:45:36 AM  |
| 18                                     | 6 | 36 | 1.00 | 19 | 12 | 32 | 107.72 | 9/13/2017 | 9:46:54 AM  |
| 37                                     | 6 | 37 | 1.00 | 10 | 8  | 18 | 100.76 | 9/13/2017 | 9:48:19 AM  |
| 37                                     | 6 | 38 | 1.00 | 23 | 8  | 31 | 48.12  | 9/13/2017 | 9:49:37 AM  |
| 37                                     | 6 | 39 | 1.00 | 15 | 4  | 20 | 91.16  | 9/13/2017 | 9:50:55 AM  |
| 37                                     | 6 | 40 | 1.00 | 17 | 7  | 25 | 66.09  | 9/13/2017 | 9:52:13 AM  |
| 37                                     | 6 | 41 | 1.00 | 24 | 12 | 37 | 83.25  | 9/13/2017 | 9:53:31 AM  |
| 37                                     | 6 | 42 | 1.00 | 11 | 8  | 19 | 59.60  | 9/13/2017 | 9:54:49 AM  |
| 37                                     | 6 | 43 | 1.00 | 18 | 8  | 26 | 48.18  | 9/13/2017 | 9:56:07 AM  |
| 37                                     | 6 | 44 | 1.00 | 11 | 6  | 17 | 70.86  | 9/13/2017 | 9:57:24 AM  |
| 37                                     | 6 | 45 | 1.00 | 24 | 4  | 29 | 61.68  | 9/13/2017 | 9:58:42 AM  |
| 37                                     | 6 | 46 | 1.00 | 19 | 6  | 26 | 73.73  | 9/13/2017 | 10:00:00 AM |
| 37                                     | 6 | 47 | 1.00 | 23 | 8  | 31 | 65.89  | 9/13/2017 | 10:01:18 AM |
| 37                                     | 6 | 48 | 1.00 | 17 | 3  | 20 | 40.85  | 9/13/2017 | 10:02:36 AM |
| 2                                      | 6 | 49 | 1.00 | 18 | 8  | 28 | 131.88 | 9/13/2017 | 10:04:00 AM |
| Missing vial 50. (Area not accessible) |   |    |      |    |    |    |        |           |             |
| 2                                      | 6 | 51 | 1.00 | 12 | 4  | 16 | 45.14  | 9/13/2017 | 10:05:19 AM |
| 2                                      | 6 | 52 | 1.00 | 13 | 4  | 17 | 79.54  | 9/13/2017 | 10:06:37 AM |
| 2                                      | 6 | 53 | 1.00 | 13 | 8  | 21 | 60.83  | 9/13/2017 | 10:07:55 AM |
| 2                                      | 6 | 54 | 1.00 | 18 | 4  | 22 | 32.52  | 9/13/2017 | 10:09:13 AM |
| 2                                      | 6 | 55 | 1.00 | 20 | 12 | 34 | 94.41  | 9/13/2017 | 10:10:31 AM |
| 2                                      | 6 | 56 | 1.00 | 10 | 8  | 19 | 115.86 | 9/13/2017 | 10:11:49 AM |
| 2                                      | 6 | 57 | 1.00 | 24 | 6  | 30 | 36.49  | 9/13/2017 | 10:13:07 AM |
| 2                                      | 6 | 58 | 1.00 | 16 | 9  | 26 | 95.56  | 9/13/2017 | 10:14:25 AM |
| 2                                      | 6 | 59 | 1.00 | 22 | 12 | 34 | 57.96  | 9/13/2017 | 10:15:43 AM |
| Missing vial 60. (Area not accessible) |   |    |      |    |    |    |        |           |             |
| 3                                      | 6 | 61 | 1.00 | 16 | 9  | 27 | 120.46 | 9/13/2017 | 10:17:09 AM |
| 3                                      | 6 | 62 | 1.00 | 21 | 16 | 38 | 105.13 | 9/13/2017 | 10:18:27 AM |
| 3                                      | 6 | 63 | 1.00 | 22 | 9  | 34 | 117.38 | 9/13/2017 | 10:19:45 AM |
| 3                                      | 6 | 64 | 1.00 | 24 | 6  | 30 | 39.72  | 9/13/2017 | 10:21:03 AM |
| 3                                      | 6 | 65 | 1.00 | 15 | 6  | 21 | 47.27  | 9/13/2017 | 10:22:21 AM |
| 3                                      | 6 | 66 | 1.00 | 16 | 13 | 29 | 81.88  | 9/13/2017 | 10:23:39 AM |
| 3                                      | 6 | 67 | 1.00 | 7  | 6  | 17 | 303.14 | 9/13/2017 | 10:24:57 AM |

Protocol# 6 - Wipe Test.lsa

User: Sai Yan

## vault ceiling

|                   |   |            |      |    |    |    |        |           |             |
|-------------------|---|------------|------|----|----|----|--------|-----------|-------------|
| 3                 | 6 | 68         | 1.00 | 24 | 11 | 36 | 77.20  | 9/13/2017 | 10:26:15 AM |
| 3                 | 6 | 69         | 1.00 | 11 | 9  | 21 | 114.12 | 9/13/2017 | 10:27:33 AM |
| 3                 | 6 | 70         | 1.00 | 17 | 10 | 27 | 74.69  | 9/13/2017 | 10:28:51 AM |
| 3                 | 6 | 71         | 1.00 | 13 | 6  | 19 | 42.44  | 9/13/2017 | 10:30:09 AM |
| 3                 | 6 | 72         | 1.00 | 19 | 4  | 25 | 99.54  | 9/13/2017 | 10:31:27 AM |
| 26                | 6 | 73         | 1.00 | 18 | 7  | 26 | 77.91  | 9/13/2017 | 10:32:52 AM |
| 26                | 6 | 74         | 1.00 | 11 | 7  | 19 | 148.29 | 9/13/2017 | 10:34:10 AM |
| 26                | 6 | 75         | 1.00 | 23 | 7  | 31 | 69.92  | 9/13/2017 | 10:35:27 AM |
| 26                | 6 | 76         | 1.00 | 20 | 8  | 28 | 62.59  | 9/13/2017 | 10:36:46 AM |
| 26                | 6 | 77         | 1.00 | 19 | 10 | 30 | 140.33 | 9/13/2017 | 10:38:04 AM |
| 26                | 6 | 78         | 1.00 | 19 | 8  | 27 | 53.05  | 9/13/2017 | 10:39:22 AM |
| 26                | 6 | 79         | 1.00 | 16 | 8  | 24 | 55.57  | 9/13/2017 | 10:40:40 AM |
| 26                | 6 | 80         | 1.00 | 26 | 15 | 41 | 77.45  | 9/13/2017 | 10:41:58 AM |
| 26                | 6 | 81         | 1.00 | 12 | 9  | 21 | 103.92 | 9/13/2017 | 10:43:16 AM |
| 26                | 6 | 82         | 1.00 | 29 | 8  | 41 | 122.50 | 9/13/2017 | 10:44:34 AM |
| 26                | 6 | 83         | 1.00 | 20 | 5  | 25 | 37.72  | 9/13/2017 | 10:45:52 AM |
| 26                | 6 | 84         | 1.00 | 21 | 8  | 30 | 74.47  | 9/13/2017 | 10:47:10 AM |
| 65                | 6 | 85         | 1.00 | 28 | 10 | 39 | 80.58  | 9/13/2017 | 10:48:34 AM |
| 65                | 6 | 86         | 1.00 | 19 | 8  | 27 | 57.59  | 9/13/2017 | 10:49:53 AM |
| 65                | 6 | 87         | 1.00 | 12 | 9  | 23 | 139.32 | 9/13/2017 | 10:51:10 AM |
| 65                | 6 | 88         | 1.00 | 16 | 5  | 22 | 75.63  | 9/13/2017 | 10:52:28 AM |
| 65                | 6 | 89         | 1.00 | 22 | 5  | 29 | 117.30 | 9/13/2017 | 10:53:46 AM |
| 65                | 6 | 90         | 1.00 | 30 | 9  | 42 | 125.13 | 9/13/2017 | 10:55:05 AM |
| 65                | 6 | 91         | 1.00 | 14 | 12 | 26 | 70.84  | 9/13/2017 | 10:56:23 AM |
| 65                | 6 | 92         | 1.00 | 19 | 7  | 27 | 93.89  | 9/13/2017 | 10:57:41 AM |
| 65                | 6 | 93         | 1.00 | 32 | 12 | 49 | 122.22 | 9/13/2017 | 10:58:59 AM |
| 65                | 6 | 94         | 1.00 | 19 | 7  | 27 | 72.41  | 9/13/2017 | 11:00:17 AM |
| 65                | 6 | 95         | 1.00 | 18 | 14 | 32 | 68.81  | 9/13/2017 | 11:01:35 AM |
| 65                | 6 | 96         | 1.00 | 13 | 10 | 23 | 78.96  | 9/13/2017 | 11:02:53 AM |
| 23                | 6 | 97         | 1.00 | 23 | 13 | 37 | 106.32 | 9/13/2017 | 11:04:17 AM |
| 23                | 6 | 98         | 1.00 | 14 | 12 | 26 | 64.94  | 9/13/2017 | 11:05:35 AM |
| 23                | 6 | 99 (C14D)  | 1.00 | 22 | 7  | 30 | 73.99  | 9/13/2017 | 11:06:54 AM |
| 23                | 6 | 100 (C31D) | 1.00 | 22 | 12 | 34 | 66.09  | 9/13/2017 | 11:08:11 AM |
| 23                | 6 | 101 (C33D) | 1.00 | 16 | 8  | 25 | 86.38  | 9/13/2017 | 11:09:29 AM |
| 23                | 6 | 102 (C37D) | 1.00 | 17 | 7  | 25 | 96.50  | 9/13/2017 | 11:10:47 AM |
| 23                | 6 | 103 (C44D) | 1.00 | 19 | 10 | 29 | 52.58  | 9/13/2017 | 11:12:05 AM |
| 23                | 6 | 104 (C55D) | 1.00 | 20 | 7  | 28 | 82.08  | 9/13/2017 | 11:13:23 AM |
| 23                | 6 | 105 (C66D) | 1.00 | 18 | 9  | 27 | 45.62  | 9/13/2017 | 11:14:42 AM |
| 23                | 6 | 106 (C75D) | 1.00 | 14 | 12 | 27 | 113.09 | 9/13/2017 | 11:16:00 AM |
| 23                | 6 | 107 (C92D) | 1.00 | 13 | 7  | 20 | 76.64  | 9/13/2017 | 11:17:18 AM |
| 23                | 6 | 108 (C95D) | 1.00 | 15 | 11 | 27 | 103.71 | 9/13/2017 | 11:18:35 AM |
| Missing vial 109. |   |            |      |    |    |    |        |           |             |
| 22                | 6 | 110        | 1.00 | 18 | 3  | 22 | 61.72  | 9/13/2017 | 11:20:19 AM |

Background = 22 cpm

MDA = 40 dpm

With H-3 efficiency = 62%

Action Level = 47 cpm

All wipes are &lt; MDA

Unless otherwise marked

Sample #93 was recounted, see the recount

vault ceiling sample 93 rerun

**Assay Definition**

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170913\_1223

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170913\_1223\20170913\_1223.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170913\_1223\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

**Count Conditions**

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Repeat Sample Count: 1

Number of Vials/Sample: 1

Calculate % Reference: Off

**Background Subtract**

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Background = 22 cpm

MDA = 40 dpm

With H-3 efficiency = 62%

Action Level = 47 cpm

All wipes are < MDA

Unless otherwise marked

Recount of sample #93 was less than action level and MDA

**Count Corrections**

Static Controller: On

Luminescence Correction: Off

GCT: n/a

Colored Samples: n/a

Heterogeneity Monitor: n/a

PAC: n/a

Coincidence Time (nsec): 18

Delay Before Burst (nsec): 75

PAC Strength: n/a

**Instrument Block Data**

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

**Cycle 1 Results**

| PID             | P# | S# | Count | Time | CPMA | CPMB | CPMC | SIS    | DATE      | TIME        |
|-----------------|----|----|-------|------|------|------|------|--------|-----------|-------------|
| 25              | 8  | 1  |       | 1.00 | 14   | 8    | 24   | 126.80 | 9/13/2017 | 12:24:14 PM |
| Missing vial 2. |    |    |       |      |      |      |      |        |           |             |
| 25              | 8  | 3  |       | 1.00 | 16   | 5    | 22   | 94.66  | 9/13/2017 | 12:25:34 PM |

vault south wall

Assay Definition

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1757

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1757\20170911\_1757.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1757\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

Count Conditions

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Number of Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

Background = 25 cpm

MDA = 42 dpm

with H-3 efficiency = 62%

Detection Level = 51 cpm

All wipes are < MDA

unless otherwise marked.

Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Count Corrections

Static Controller: On

Colored Samples: n/a

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: n/a

Delay Before Burst (nsec): 75

GCT: n/a

PAC: n/a

PAC Strength: n/a

Instrument Block Data

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

Cycle 1 Results

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC | SIS    | DATE      | TIME       |
|-----|----|----|-------|------|------|------|------|--------|-----------|------------|
| 9   | 10 | 1  |       | 1.00 | 14   | 6    | 22   | 139.93 | 9/11/2017 | 5:58:42 PM |
| 9   | 10 | 2  |       | 1.00 | 20   | 3    | 25   | 94.55  | 9/11/2017 | 6:00:00 PM |
| 9   | 10 | 3  |       | 1.00 | 13   | 14   | 29   | 148.19 | 9/11/2017 | 6:01:18 PM |
| 9   | 10 | 4  |       | 1.00 | 17   | 4    | 22   | 88.36  | 9/11/2017 | 6:02:36 PM |
| 9   | 10 | 5  |       | 1.00 | 19   | 14   | 36   | 154.56 | 9/11/2017 | 6:03:54 PM |
| 9   | 10 | 6  |       | 1.00 | 18   | 11   | 29   | 78.40  | 9/11/2017 | 6:05:12 PM |
| 9   | 10 | 7  |       | 1.00 | 11   | 3    | 15   | 66.93  | 9/11/2017 | 6:06:30 PM |

Protocol# 10 - Wipe Test.lsa

User: Sai Yan

## vault south wall

Missing vial 8. (Area not accessible)

|                  |    |          |      |    |    |    |        |           |         |    |
|------------------|----|----------|------|----|----|----|--------|-----------|---------|----|
| 9                | 10 | 9        | 1.00 | 21 | 4  | 25 | 55.31  | 9/11/2017 | 6:07:49 | PM |
| 9                | 10 | 10       | 1.00 | 11 | 12 | 26 | 189.04 | 9/11/2017 | 6:09:07 | PM |
| 9                | 10 | 11       | 1.00 | 12 | 16 | 31 | 154.73 | 9/11/2017 | 6:10:25 | PM |
| 9                | 10 | 12       | 1.00 | 19 | 5  | 29 | 249.13 | 9/11/2017 | 6:11:43 | PM |
| 23               | 10 | 13       | 1.00 | 15 | 5  | 22 | 116.80 | 9/11/2017 | 6:13:07 | PM |
| 23               | 10 | 14       | 1.00 | 13 | 5  | 19 | 74.72  | 9/11/2017 | 6:14:26 | PM |
| 23               | 10 | 15       | 1.00 | 8  | 13 | 21 | 64.70  | 9/11/2017 | 6:15:44 | PM |
| 23               | 10 | 16       | 1.00 | 15 | 8  | 24 | 71.89  | 9/11/2017 | 6:17:01 | PM |
| 23               | 10 | 17       | 1.00 | 18 | 6  | 26 | 111.79 | 9/11/2017 | 6:18:19 | PM |
| 23               | 10 | 18       | 1.00 | 23 | 6  | 30 | 85.48  | 9/11/2017 | 6:19:37 | PM |
| 23               | 10 | 19       | 1.00 | 10 | 5  | 19 | 261.62 | 9/11/2017 | 6:20:55 | PM |
| 23               | 10 | 20       | 1.00 | 9  | 6  | 16 | 118.37 | 9/11/2017 | 6:22:13 | PM |
| 23               | 10 | 21       | 1.00 | 13 | 6  | 19 | 60.83  | 9/11/2017 | 6:23:31 | PM |
| 23               | 10 | 22       | 1.00 | 20 | 11 | 32 | 95.25  | 9/11/2017 | 6:24:49 | PM |
| 23               | 10 | 23       | 1.00 | 14 | 10 | 24 | 67.61  | 9/11/2017 | 6:26:07 | PM |
| 23               | 10 | 24       | 1.00 | 16 | 7  | 24 | 63.66  | 9/11/2017 | 6:27:25 | PM |
| 22               | 10 | 25       | 1.00 | 11 | 3  | 17 | 191.30 | 9/11/2017 | 6:29:08 | PM |
| 22               | 10 | 26       | 1.00 | 16 | 7  | 26 | 177.11 | 9/11/2017 | 6:30:27 | PM |
| 22               | 10 | 27       | 1.00 | 16 | 9  | 26 | 94.02  | 9/11/2017 | 6:31:45 | PM |
| 22               | 10 | 28       | 1.00 | 18 | 11 | 32 | 147.11 | 9/11/2017 | 6:33:03 | PM |
| 22               | 10 | 29       | 1.00 | 14 | 6  | 22 | 144.32 | 9/11/2017 | 6:34:21 | PM |
| 22               | 10 | 30       | 1.00 | 17 | 7  | 24 | 67.54  | 9/11/2017 | 6:35:39 | PM |
| 22               | 10 | 31       | 1.00 | 15 | 10 | 27 | 145.68 | 9/11/2017 | 6:36:56 | PM |
| 22               | 10 | 32       | 1.00 | 14 | 9  | 24 | 85.20  | 9/11/2017 | 6:38:14 | PM |
| 22               | 10 | 33       | 1.00 | 14 | 4  | 18 | 33.97  | 9/11/2017 | 6:39:32 | PM |
| 22               | 10 | 34       | 1.00 | 15 | 7  | 24 | 105.93 | 9/11/2017 | 6:40:50 | PM |
| 22               | 10 | 35       | 1.00 | 12 | 8  | 20 | 85.78  | 9/11/2017 | 6:42:08 | PM |
| 22               | 10 | 36       | 1.00 | 25 | 9  | 35 | 84.54  | 9/11/2017 | 6:43:26 | PM |
| 10               | 10 | 37       | 1.00 | 12 | 1  | 13 | 38.09  | 9/11/2017 | 6:45:12 | PM |
| 10               | 10 | 38       | 1.00 | 16 | 13 | 32 | 152.02 | 9/11/2017 | 6:46:30 | PM |
| 10               | 10 | 39       | 1.00 | 14 | 9  | 23 | 61.16  | 9/11/2017 | 6:47:48 | PM |
| 10               | 10 | 40       | 1.00 | 10 | 6  | 16 | 47.88  | 9/11/2017 | 6:49:06 | PM |
| 10               | 10 | 41       | 1.00 | 21 | 8  | 31 | 98.50  | 9/11/2017 | 6:50:24 | PM |
| 10               | 10 | 42       | 1.00 | 23 | 6  | 29 | 57.31  | 9/11/2017 | 6:51:42 | PM |
| 10               | 10 | 43       | 1.00 | 21 | 13 | 37 | 123.23 | 9/11/2017 | 6:52:59 | PM |
| 10               | 10 | 44       | 1.00 | 27 | 12 | 39 | 47.05  | 9/11/2017 | 6:54:17 | PM |
| 10               | 10 | 45       | 1.00 | 18 | 15 | 33 | 123.89 | 9/11/2017 | 6:55:35 | PM |
| 10               | 10 | 46(S5D)  | 1.00 | 17 | 11 | 30 | 127.12 | 9/11/2017 | 6:56:53 | PM |
| 10               | 10 | 47(S11D) | 1.00 | 9  | 6  | 17 | 148.56 | 9/11/2017 | 6:58:11 | PM |
| 10               | 10 | 48(S20D) | 1.00 | 10 | 7  | 17 | 79.05  | 9/11/2017 | 6:59:29 | PM |
| 25               | 10 | 49(S38D) | 1.00 | 11 | 4  | 15 | 81.91  | 9/11/2017 | 7:01:12 | PM |
| Missing vial 50. |    |          |      |    |    |    |        |           |         |    |
| 25               | 10 | 51       | 1.00 | 17 | 8  | 25 | 77.78  | 9/11/2017 | 7:02:32 | PM |

vault north wall

Assay Definition

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1621

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1621\20170911\_1621.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1621\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

Count Conditions

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Number of Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

background = 22 cpm

MDA = 40 dpm

with H-3 efficiency = 62%

action Level = 47 cpm

All wipes are < MDA

unless otherwise marked.

Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Count Corrections

Static Controller: On

Colored Samples: n/a

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: n/a

Delay Before Burst (nsec): 75

GCT: n/a

PAC: n/a

PAC Strength: n/a

Instrument Block Data

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

Cycle 1 Results

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC   | SIS       | DATE    | TIME |
|-----|----|----|-------|------|------|------|--------|-----------|---------|------|
| 14  | 4  | 1  | 1.00  | 10   | 10   | 20   | 76.08  | 9/11/2017 | 4:22:48 | PM   |
| 14  | 4  | 2  | 1.00  | 9    | 9    | 19   | 118.64 | 9/11/2017 | 4:24:06 | PM   |
| 14  | 4  | 3  | 1.00  | 17   | 6    | 24   | 89.50  | 9/11/2017 | 4:25:24 | PM   |
| 14  | 4  | 4  | 1.00  | 12   | 5    | 19   | 135.71 | 9/11/2017 | 4:26:42 | PM   |
| 14  | 4  | 5  | 1.00  | 16   | 8    | 25   | 103.66 | 9/11/2017 | 4:28:00 | PM   |
| 14  | 4  | 6  | 1.00  | 13   | 7    | 21   | 82.35  | 9/11/2017 | 4:29:18 | PM   |
| 14  | 4  | 7  | 1.00  | 16   | 8    | 26   | 116.98 | 9/11/2017 | 4:30:36 | PM   |



Protocol# 4 - Wipe Test.lsa

User: Sai Yan

## vault north wall

|                  |   |          |      |    |    |    |        |           |         |    |
|------------------|---|----------|------|----|----|----|--------|-----------|---------|----|
| 14               | 4 | 8        | 1.00 | 12 | 7  | 19 | 66.78  | 9/11/2017 | 4:31:54 | PM |
| 14               | 4 | 9        | 1.00 | 14 | 5  | 21 | 210.75 | 9/11/2017 | 4:33:12 | PM |
| 14               | 4 | 10       | 1.00 | 10 | 11 | 23 | 188.10 | 9/11/2017 | 4:34:30 | PM |
| 14               | 4 | 11       | 1.00 | 13 | 9  | 24 | 124.81 | 9/11/2017 | 4:35:48 | PM |
| 14               | 4 | 12       | 1.00 | 8  | 12 | 22 | 132.92 | 9/11/2017 | 4:37:06 | PM |
| 3                | 4 | 13       | 1.00 | 13 | 7  | 22 | 161.30 | 9/11/2017 | 4:38:30 | PM |
| 3                | 4 | 14       | 1.00 | 14 | 14 | 30 | 164.25 | 9/11/2017 | 4:39:48 | PM |
| 3                | 4 | 15       | 1.00 | 16 | 12 | 29 | 96.99  | 9/11/2017 | 4:41:06 | PM |
| 3                | 4 | 16       | 1.00 | 20 | 9  | 29 | 70.71  | 9/11/2017 | 4:42:24 | PM |
| 3                | 4 | 17       | 1.00 | 15 | 5  | 22 | 111.55 | 9/11/2017 | 4:43:42 | PM |
| 3                | 4 | 18       | 1.00 | 15 | 9  | 24 | 55.44  | 9/11/2017 | 4:45:00 | PM |
| 3                | 4 | 19       | 1.00 | 16 | 12 | 29 | 68.43  | 9/11/2017 | 4:46:18 | PM |
| 3                | 4 | 20       | 1.00 | 15 | 5  | 20 | 46.06  | 9/11/2017 | 4:47:36 | PM |
| 3                | 4 | 21       | 1.00 | 15 | 11 | 28 | 107.94 | 9/11/2017 | 4:48:54 | PM |
| 3                | 4 | 22       | 1.00 | 14 | 4  | 18 | 49.40  | 9/11/2017 | 4:50:12 | PM |
| 3                | 4 | 23       | 1.00 | 14 | 7  | 22 | 70.47  | 9/11/2017 | 4:51:30 | PM |
| 3                | 4 | 24       | 1.00 | 15 | 11 | 28 | 143.29 | 9/11/2017 | 4:52:48 | PM |
| 26               | 4 | 25       | 1.00 | 10 | 12 | 23 | 161.37 | 9/11/2017 | 4:54:12 | PM |
| 26               | 4 | 26       | 1.00 | 12 | 4  | 16 | 77.54  | 9/11/2017 | 4:55:31 | PM |
| 26               | 4 | 27       | 1.00 | 21 | 12 | 34 | 83.08  | 9/11/2017 | 4:56:48 | PM |
| 26               | 4 | 28       | 1.00 | 14 | 7  | 22 | 70.11  | 9/11/2017 | 4:58:06 | PM |
| 26               | 4 | 29       | 1.00 | 20 | 7  | 27 | 46.52  | 9/11/2017 | 4:59:24 | PM |
| 26               | 4 | 30       | 1.00 | 7  | 10 | 18 | 139.55 | 9/11/2017 | 5:00:43 | PM |
| 26               | 4 | 31       | 1.00 | 15 | 10 | 25 | 59.87  | 9/11/2017 | 5:02:00 | PM |
| 26               | 4 | 32       | 1.00 | 11 | 7  | 21 | 226.50 | 9/11/2017 | 5:03:18 | PM |
| 26               | 4 | 33       | 1.00 | 6  | 2  | 8  | 34.11  | 9/11/2017 | 5:04:36 | PM |
| 26               | 4 | 34       | 1.00 | 23 | 5  | 30 | 136.67 | 9/11/2017 | 5:05:54 | PM |
| 26               | 4 | 35       | 1.00 | 11 | 9  | 21 | 97.74  | 9/11/2017 | 5:07:12 | PM |
| 26               | 4 | 36       | 1.00 | 12 | 7  | 20 | 119.57 | 9/11/2017 | 5:08:30 | PM |
| 27               | 4 | 37       | 1.00 | 15 | 12 | 27 | 62.31  | 9/11/2017 | 5:09:54 | PM |
| 127              | 4 | 38       | 1.00 | 15 | 3  | 19 | 68.63  | 9/11/2017 | 5:11:12 | PM |
| 127              | 4 | 39       | 1.00 | 12 | 8  | 23 | 171.49 | 9/11/2017 | 5:12:30 | PM |
| 127              | 4 | 40       | 1.00 | 11 | 3  | 14 | 45.40  | 9/11/2017 | 5:13:48 | PM |
| 127              | 4 | 41(N5D)  | 1.00 | 12 | 17 | 32 | 188.37 | 9/11/2017 | 5:15:06 | PM |
| 127              | 4 | 42(N9D)  | 1.00 | 15 | 9  | 26 | 104.57 | 9/11/2017 | 5:16:24 | PM |
| 127              | 4 | 43(N15D) | 1.00 | 24 | 5  | 30 | 57.41  | 9/11/2017 | 5:17:42 | PM |
| 127              | 4 | 44(N34D) | 1.00 | 20 | 6  | 28 | 167.35 | 9/11/2017 | 5:19:00 | PM |
| Missing vial 45. |   |          |      |    |    |    |        |           |         |    |
| 127              | 4 | 46       | 1.00 | 16 | 6  | 22 | 66.97  | 9/11/2017 | 5:20:19 | PM |

vault west wall

Assay Definition

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1720

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1720\20170911\_1720.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1720\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

Count Conditions

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Number of Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

background = 32 cpm

MDA = 47 dpm

with H-3 efficiency = 62%

tion Level = 61 cpm

All wipes are < MDA

unless otherwise marked.

Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Count Corrections

Static Controller: On

Colored Samples: n/a

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: n/a

Delay Before Burst (nsec): 75

GCT: n/a

PAC: n/a

PAC Strength: n/a

Instrument Block Data

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

Cycle 1 Results

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC   | SIS       | DATE       | TIME |
|-----|----|----|-------|------|------|------|--------|-----------|------------|------|
| 21  | 8  | 1  | 1.00  | 12   | 14   | 27   | 120.88 | 9/11/2017 | 5:21:48 PM |      |
| 21  | 8  | 2  | 1.00  | 23   | 12   | 37   | 94.33  | 9/11/2017 | 5:23:06 PM |      |
| 21  | 8  | 3  | 1.00  | 16   | 6    | 23   | 72.89  | 9/11/2017 | 5:24:24 PM |      |
| 21  | 8  | 4  | 1.00  | 20   | 6    | 27   | 68.75  | 9/11/2017 | 5:25:41 PM |      |
| 21  | 8  | 5  | 1.00  | 14   | 6    | 20   | 63.64  | 9/11/2017 | 5:26:59 PM |      |
| 21  | 8  | 6  | 1.00  | 17   | 10   | 27   | 60.87  | 9/11/2017 | 5:28:17 PM |      |
| 21  | 8  | 7  | 1.00  | 22   | 10   | 32   | 73.80  | 9/11/2017 | 5:29:35 PM |      |

Protocol# 8 - Wipe Test.lsa

User: Sai Yan

## vault west wall

|                  |   |          |      |    |    |    |        |           |         |    |
|------------------|---|----------|------|----|----|----|--------|-----------|---------|----|
| 21               | 8 | 8        | 1.00 | 16 | 8  | 27 | 171.96 | 9/11/2017 | 5:30:53 | PM |
| 21               | 8 | 9        | 1.00 | 11 | 8  | 20 | 99.75  | 9/11/2017 | 5:32:11 | PM |
| 21               | 8 | 10       | 1.00 | 15 | 9  | 24 | 75.12  | 9/11/2017 | 5:33:29 | PM |
| 21               | 8 | 11       | 1.00 | 23 | 8  | 32 | 81.50  | 9/11/2017 | 5:34:47 | PM |
| 21               | 8 | 12       | 1.00 | 18 | 5  | 24 | 78.51  | 9/11/2017 | 5:36:05 | PM |
| 65               | 8 | 13       | 1.00 | 14 | 10 | 25 | 102.52 | 9/11/2017 | 5:37:29 | PM |
| 65               | 8 | 14       | 1.00 | 15 | 3  | 19 | 92.55  | 9/11/2017 | 5:38:47 | PM |
| 65               | 8 | 15       | 1.00 | 20 | 7  | 28 | 69.65  | 9/11/2017 | 5:40:05 | PM |
| 65               | 8 | 16       | 1.00 | 11 | 8  | 19 | 73.87  | 9/11/2017 | 5:41:23 | PM |
| 65               | 8 | 17       | 1.00 | 15 | 7  | 24 | 136.16 | 9/11/2017 | 5:42:41 | PM |
| 65               | 8 | 18       | 1.00 | 15 | 9  | 26 | 118.77 | 9/11/2017 | 5:43:59 | PM |
| 65               | 8 | 19       | 1.00 | 14 | 7  | 24 | 195.57 | 9/11/2017 | 5:45:17 | PM |
| 65               | 8 | 20       | 1.00 | 17 | 7  | 25 | 100.38 | 9/11/2017 | 5:46:35 | PM |
| 65               | 8 | 21       | 1.00 | 14 | 3  | 18 | 99.75  | 9/11/2017 | 5:47:53 | PM |
| 65               | 8 | 22       | 1.00 | 16 | 14 | 31 | 106.68 | 9/11/2017 | 5:49:11 | PM |
| 65               | 8 | 23       | 1.00 | 15 | 5  | 20 | 45.49  | 9/11/2017 | 5:50:28 | PM |
| 65               | 8 | 24       | 1.00 | 8  | 7  | 16 | 96.60  | 9/11/2017 | 5:51:46 | PM |
| 2                | 8 | 25       | 1.00 | 13 | 7  | 20 | 59.71  | 9/11/2017 | 5:53:10 | PM |
| 2                | 8 | 26(W4D)  | 1.00 | 17 | 8  | 26 | 117.20 | 9/11/2017 | 5:54:29 | PM |
| 2                | 8 | 27(W13D) | 1.00 | 23 | 9  | 32 | 64.85  | 9/11/2017 | 5:55:47 | PM |
| Missing vial 28. |   |          |      |    |    |    |        |           |         |    |
| 2                | 8 | 29       | 1.00 | 18 | 12 | 32 | 108.39 | 9/11/2017 | 5:57:06 | PM |

vault east wall

Assay Definition

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1552

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1552\20170911\_1552.results

Comma-Delimited File Name: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1552\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

Count Conditions

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Repeat Sample Count: 1

Number of Vials/Sample: 1

Calculate % Reference: Off

Background = 25 cpm

MDA = 42 dpm

with H-3 efficiency = 62%

Detection Level = 51 cpm

All wipes are < MDA

unless otherwise marked.

Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Count Corrections

Static Controller: On

Luminescence Correction: Off

GCT: n/a

Colored Samples: n/a

Heterogeneity Monitor: n/a

PAC: n/a

Coincidence Time (nsec): 18

Delay Before Burst (nsec): 75

PAC Strength: n/a

Instrument Block Data

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

Cycle 1 Results

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC   | SIS       | DATE       | TIME |
|-----|----|----|-------|------|------|------|--------|-----------|------------|------|
| 2   | 3  | 1  | 1.00  | 15   | 4    | 19   | 48.70  | 9/11/2017 | 3:53:57 PM |      |
| 2   | 3  | 2  | 1.00  | 12   | 13   | 26   | 128.21 | 9/11/2017 | 3:55:14 PM |      |
| 2   | 3  | 3  | 1.00  | 25   | 8    | 33   | 55.84  | 9/11/2017 | 3:56:32 PM |      |
| 2   | 3  | 4  | 1.00  | 23   | 9    | 34   | 87.47  | 9/11/2017 | 3:57:50 PM |      |
| 2   | 3  | 5  | 1.00  | 10   | 7    | 18   | 90.15  | 9/11/2017 | 3:59:08 PM |      |
| 2   | 3  | 6  | 1.00  | 16   | 9    | 28   | 148.06 | 9/11/2017 | 4:00:26 PM |      |
| 2   | 3  | 7  | 1.00  | 19   | 6    | 25   | 51.20  | 9/11/2017 | 4:01:44 PM |      |

Protocol# 3 - Wipe Test.lsa

User: Sai Yan

## vault east wall

|                  |   |          |      |    |    |    |        |           |         |    |
|------------------|---|----------|------|----|----|----|--------|-----------|---------|----|
| 2                | 3 | 8        | 1.00 | 15 | 7  | 25 | 146.93 | 9/11/2017 | 4:03:02 | PM |
| 2                | 3 | 9        | 1.00 | 12 | 11 | 25 | 182.44 | 9/11/2017 | 4:04:20 | PM |
| 2                | 3 | 10       | 1.00 | 15 | 9  | 25 | 106.46 | 9/11/2017 | 4:05:38 | PM |
| 2                | 3 | 11       | 1.00 | 10 | 0  | 10 | 27.93  | 9/11/2017 | 4:06:55 | PM |
| 2                | 3 | 12       | 1.00 | 10 | 4  | 14 | 67.52  | 9/11/2017 | 4:08:13 | PM |
| 25               | 3 | 13       | 1.00 | 16 | 10 | 28 | 139.66 | 9/11/2017 | 4:09:38 | PM |
| 25               | 3 | 14       | 1.00 | 14 | 9  | 23 | 53.18  | 9/11/2017 | 4:10:55 | PM |
| 25               | 3 | 15       | 1.00 | 15 | 5  | 21 | 103.12 | 9/11/2017 | 4:12:13 | PM |
| 25               | 3 | 16       | 1.00 | 9  | 6  | 17 | 133.83 | 9/11/2017 | 4:13:32 | PM |
| 25               | 3 | 17       | 1.00 | 16 | 15 | 32 | 99.51  | 9/11/2017 | 4:14:49 | PM |
| 25               | 3 | 18       | 1.00 | 22 | 13 | 35 | 73.38  | 9/11/2017 | 4:16:07 | PM |
| 25               | 3 | 19       | 1.00 | 24 | 13 | 40 | 119.33 | 9/11/2017 | 4:17:25 | PM |
| 25               | 3 | 20(E6D)  | 1.00 | 9  | 10 | 19 | 74.19  | 9/11/2017 | 4:18:44 | PM |
| 25               | 3 | 21(E11D) | 1.00 | 25 | 9  | 34 | 69.12  | 9/11/2017 | 4:20:01 | PM |
| Missing vial 22. |   |          |      |    |    |    |        |           |         |    |
| 25               | 3 | 23       | 1.00 | 15 | 9  | 25 | 98.64  | 9/11/2017 | 4:21:21 | PM |

vault pit wall

Assay Definition

Assay Description:

Wipe Test

Assay Type: CPM

Report Name: Report1

Output Data Path: C:\Packard\TriCarb\Results\Tri Le\Wipe Test

Raw Results Path: C:\Packard\Tricarb\Results\Sai Yan\Wipe Test\20170911\_1535\20170911\_1535.results

Comma-Delimited File Name: C:\Packard\TriCarb\Results\Tri Le\Wipe Test\Report1.csv

Assay File Name: C:\Packard\TriCarb\Assays\Wipe Test.lsa

Count Conditions

Nuclide: Fun Wipes

Quench Indicator: SIS

External Std Terminator (sec): n/a

Pre-Count Delay (min): 0.00

Quench Set: n/a

Count Time (min): 1.00

Count Mode: Normal

Assay Count Cycles: 1

Number of Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

Background = 33 cpm

MDA = 48 dpm

with H-3 efficiency = 62%

Detection Level = 62 cpm

All wipes are < MDA

unless otherwise marked.

Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: Off

| Regions | LL   | UL     |
|---------|------|--------|
| A       | 0.0  | 18.6   |
| B       | 18.6 | 156.0  |
| C       | 0.0  | 2000.0 |

Count Corrections

Static Controller: On

Colored Samples: n/a

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: n/a

Delay Before Burst (nsec): 75

GCT: n/a

PAC: n/a

PAC Strength: n/a

Instrument Block Data

MODEL=Tri-Carb 4910TR

SERIAL=SGLO34150058

Cycle 1 Results

| PID | P# | S# | Count | Time | CPMA | CPMB | CPMC   | SIS       | DATE    | TIME |
|-----|----|----|-------|------|------|------|--------|-----------|---------|------|
| 21  | 7  | 1  | 1.00  | 19   | 5    | 24   | 52.16  | 9/11/2017 | 3:36:33 | PM   |
| 21  | 7  | 2  | 1.00  | 15   | 9    | 25   | 76.75  | 9/11/2017 | 3:37:50 | PM   |
| 21  | 7  | 3  | 1.00  | 14   | 5    | 19   | 55.63  | 9/11/2017 | 3:39:09 | PM   |
| 21  | 7  | 4  | 1.00  | 24   | 9    | 35   | 88.61  | 9/11/2017 | 3:40:27 | PM   |
| 21  | 7  | 5  | 1.00  | 21   | 11   | 34   | 123.49 | 9/11/2017 | 3:41:45 | PM   |
| 21  | 7  | 6  | 1.00  | 9    | 11   | 22   | 130.95 | 9/11/2017 | 3:43:02 | PM   |
| 21  | 7  | 7  | 1.00  | 17   | 12   | 30   | 76.83  | 9/11/2017 | 3:44:20 | PM   |
| 21  | 7  | 8  | 1.00  | 18   | 9    | 29   | 126.66 | 9/11/2017 | 3:45:38 | PM   |

Protocol# 7 - Wipe Test.lsa

User: Sai Yan

## vault pit wall

|                  |   |         |      |    |    |    |        |           |            |
|------------------|---|---------|------|----|----|----|--------|-----------|------------|
| 21               | 7 | 9       | 1.00 | 19 | 12 | 31 | 52.27  | 9/11/2017 | 3:46:56 PM |
| 21               | 7 | 10      | 1.00 | 11 | 10 | 21 | 82.74  | 9/11/2017 | 3:48:14 PM |
| 21               | 7 | 11      | 1.00 | 23 | 6  | 30 | 79.45  | 9/11/2017 | 3:49:32 PM |
| 21               | 7 | 12(P4D) | 1.00 | 12 | 12 | 27 | 169.82 | 9/11/2017 | 3:50:50 PM |
| Missing vial 13. |   |         |      |    |    |    |        |           |            |
| 5                | 7 | 14      | 1.00 | 20 | 13 | 33 | 76.38  | 9/11/2017 | 3:52:16 PM |