

Enclosure

**OAK RIDGE ASSOCIATED UNIVERSITIES:
SITE STATUS REPORT FOR HARVEY-HUBBELL AT
1575 STATE STREET, BRIDGEPORT, CONNECTICUT**

FEBRUARY 2, 2018

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) requested that Oak Ridge Associated Universities (ORAU) perform a radiation survey of the property at 1575 State Street in Bridgeport, Connecticut. This property covers part of the footprint once occupied by the former Harvey-Hubbell facility, which manufactured luminous radium flush switches, flip switches, and pull-chain pendants in the 1900s. Manufacturing ceased in 1990 and the original factory was demolished in 2008, but soil from the site may be contaminated with radium. The objective of this survey was to locate possible discrete sources of radium, if any, that would be associated with former Harvey-Hubbell operations.

ORAU performed the radiation survey on June 21, 2017, and did not identify elevated levels of radiation that could be attributed to discrete sources of radium. Because no elevated levels of radiation were identified, ORAU concludes that discrete sources of radium are not present in surface soil. Based on these results, it is recommended that the NRC not pursue additional action at the 1575 State Street property.

SITE STATUS REPORT

Property: Former Harvey-Hubbell facility
1575 State Street
Bridgeport, CT 06605

Docket Number: 03038957

Current Property Name(s): Harvey-Hubbell, Inc.

Current Property Owner(s): Harvey-Hubbell, Inc.

Inspection Dates: June 21, 2017

Inspector(s): Laurie Kauffman and Todd Jackson/U.S. Nuclear Regulatory Commission (NRC), supported by Kaitlin Engel and Stephen Pittman/Oak Ridge Associated Universities (ORAU)

1.0 INTRODUCTION

The Energy Policy Act of 2005 amended section 11e.(3) of the Atomic Energy Act of 1954 to place discrete sources of radium-226 (Ra-226) under NRC regulatory authority as byproduct material. The property at 1575 State Street in Bridgeport, Connecticut was identified as the former Harvey-Hubbell facility, a manufacturer of luminous radium flush switches, flip switches, and pull-chain pendants, which operated from 1909 to 1990 (ORNL 2015). The objectives of the initial site visit were to determine if discrete sources of Ra-226 and/or distributed Ra-226 contamination are present, to identify the areas of highest contamination, to determine if there are any current health and safety concerns, and to determine if a scoping survey is needed.

Data collected during the initial site visit are used to plan future actions that may be needed to reduce Ra-226 exposure to current or future site occupants to levels that do not exceed the applicable regulatory requirement. It is important to note that destructive testing is not generally performed as described within NRC's procedures, Temporary Instruction 2800/043 "Inspection of Facilities Potentially Contaminated with Discrete Radium-226 Sources" (NRC 2017) (Agencywide Documents Access and Management System [ADAMS] Accession number ML16330A678).

2.0 PROPERTY DESCRIPTION AND INITIAL SITE VISIT CONSIDERATIONS

2.1 Property Description and History

Harvey-Hubbell II opened a small manufacturing facility in 1888 in a small loft in Bridgeport, Connecticut. The factory, pictured in Figure 1 on the corner of State Street and Bostwick Avenue, was built in 1909 to increase manufacturing efficiency and was best known for producing pull-socket light switches. The large electric sign on the roof displayed a lightbulb turning on and off when the chain was pulled (Pehanick 2005). In addition to being a recognized producer of pull-socket light switches, an advertisement from 1922 listed this facility as manufacturing luminous flush-type switches and pull-chain pendants (McGraw-Hill 1922).

Manufacturing ceased at this plant in 1990. The lower building on the right in Figure 1 had already been demolished by then, and the large building on the left was razed in early 2005 (Pehanick 2005), though the Bridgeport History Center states that the Bostwick Avenue plant was demolished in 2008 (Witkowski 2011).

As shown in the aerial view of the property in Figure 2, the 3.7-acre property is now an empty, mostly grass-covered field, with some areas of asphalt and rocks. Hubbell personnel informed the survey team that the original building formed a U-shape along the north, east, and south sides of the now vacant lot. An extensive internet search of public records did not reveal any information about radium cleanup of the facility (ORNL 2015). Therefore, it is possible that soil from the site may be contaminated with radium.

The site summary included in the *Historical Non-Military Radium Sites Research Effort Addendum* report (ORNL 2015) provides known site details about the type, form, history, potential locations, and other information related to discrete sources of Ra-226 used at the site.

2.2 Initial Site Visit Considerations

Prior to commencing survey activities, the land area was examined for consistency with historical information and to identify impediments to conducting the survey and/or health and safety considerations. At the time of the site visit, the grass was less than 1 meter tall, allowing for surveys in the majority of the property. However, dense weeds along the fence line limited the accessible area. Overall, 90 percent of the property was accessible for survey.



Figure 1. Harvey-Hubbell (Pehanick 2005)



Figure 2. Aerial View of Former Harvey-Hubbell Property (Google Maps, June 2017)

3.0 SITE OBSERVATIONS AND FINDINGS

3.1 Summary of Activities

The inspection team conducted an initial site visit at the 1575 State Street property on June 21, 2017. A pre-inspection meeting was held on June 21, 2017 with Kaitlin Engel and Stephen Pittman (ORAU), Laurie Kauffman and Todd Jackson (NRC), Donald Marchesseault (Hubbell, Assistant General Counsel), Greg Blessing (Hubbell, Environmental, Health & Safety), Paul Steinmeyer (Radiation Safety Associates, Inc.), and Gary McCahill (Connecticut Department of Energy and Environmental Protection [CT DEEP]). Participants discussed the inspection team's intention to perform general area surveys around the property.

Radiological surveys performed by the inspection team consisted of gamma radiation scans using a Ludlum model 44-10 2-inch by 2-inch (2×2) sodium iodide detector connected to a Ludlum model 2221 ratemeter/scaler and radiation exposure rate measurements using a Ludlum model 192 sodium iodide (NaI)-based microRoentgen (μR) ratemeter¹. Table 1 presents the specific instruments used during the site visit.

| Table 1. Harvey-Hubbell Survey Instruments | | | |
|---|----------------------|--|--|
| Radiation Type (units) | Detector Type | Detector Model (Number) | Ratemeter (Number) |
| Gross gamma (cpm) | Sodium Iodide | 44-10 (639) Calibrated 04/13/2017 | 2221 (395) Calibrated 04/11/2017 |
| | | 44-10 (1151) Calibrated 04/13/2017 | 2221 (505) Calibrated 03/16/2017 |
| Gross gamma (μR/h) | Exposure Meter | 192 (1127, 1128) Calibrated 06/02/2017 | N/A |
| Gamma Spectrum Analyzer (SAM-940) | Lanthanum Bromide | 940 (864) ^a | N/A |

N/A = not applicable

Number = ORAU equipment barcode

cpm = counts per minute

μR/h = microRoentgen per hour

^aDevice performs automatic calibration upon startup and is source checked before use.

The inspection team split into two survey teams to survey the property. Both teams used 2×2 sodium iodide detectors connected to global positioning system (GPS) equipment and model 192 ratemeters for exposure rates to acquire gamma radiation data. Approximately 40 to 50 percent of the total property was surveyed using a line-transect survey approach as shown in Figure B.1, which is a reasonable approach to evaluate the entire site. Soil samples were collected from two locations identified for further investigation due to slightly elevated gamma levels when compared to other parts of the property. Photographs taken during the initial site visit are presented in Appendix A.

3.2 Summary of Results

Table 2 presents summary statistics of survey data collected during the initial site visit. For 2×2 sodium iodide detector measurements, the mean is close to the median; there are no obvious anomalies; and 98 percent of the data points fall within three standard deviations of the mean which shows minimal spatial variation in radiation flux across the site. Likewise, exposure rate measurement data demonstrated similar statistical characteristics with 99+ percent of the data points falling within three standard deviations of the mean. These results are consistent with

¹ NOTE: Roentgen is a unit of exposure (energy absorbed in air), whereas a rem is a unit of dose delivered to a person (resulting from the radiation energy absorbed in that person). While Roentgen and rem are related, these are different units. Because they are similar for gamma ray energies from Ra-226, NRC makes the simplifying assumption in this case that these units are equivalent (1 Roentgen = 1 rem).

survey data from an un-impacted (background) property. Gamma measurements using the 2×2 sodium iodide detectors and exposure rate data using the model 192 ratemeters are mapped in Appendix B.

At the NRC's request, the two soil samples were collected for gamma spectroscopy analysis. At the time, neither sample was believed to contain elevated concentrations of Ra-226—the field screen using the SAM-940 did not identify Ra-226 contamination (see Figures B-3 and B-4). Therefore, the samples were collected to confirm the slightly elevated and localized areas of gamma radiation are due to naturally occurring radioactive material (NORM).

Appendix C presents raw analytical results for samples 5307S0001 and 5307S0002. Samples were held at the analytical laboratory to allow the decay products Bi-214 and Pb-214 to reach equilibrium with Ra-226, and the higher reported value (in this case for Pb-214) is used as the proxy for Ra-226. As shown in Appendix C, the maximum reported Pb-214 concentration is 1.88 pCi/g. While an average background concentration of approximately 1 pCi/g is expected, results may be attributed to natural variations in NORM concentrations. In addition, surveyors observed that each area sampled was characterized by relatively uniform gamma radiation levels and contained crushed red brick/rocky soils (likely NORM), and this material is unlike the balance of the site. Samples were collected from locations producing the highest gamma response. These results support the conclusion that elevated gamma radiation levels are due to NORM and, more specifically, are not associated with discrete sources of Ra-226.

| Table 2. Radiation Measurement Summary Statistics | | | | | | | |
|---|--------------|-------|------------|------------|-------|--------|----------|
| Detector | No. of Meas. | Units | Min. Value | Max. Value | Mean | Median | St. Dev. |
| 2×2 | 15,377 | cpm | 4,027 | 15,281 | 9,239 | 9,108 | 1,286 |
| Exposure Ratemeter | 223 | μR/h | 7 | 11.5 | 8.7 | 9 | 0.79 |

3.3 Summary of Dose Assessment Results

A site-specific dose assessment was not performed for the former Harvey-Hubbell site. Because no elevated radiation levels were detected above background and no contamination was encountered, a dose assessment was not necessary.

4.0 OBSERVATIONS AND RECOMMENDATIONS

Based on the data collected, the former Harvey-Hubbell property does not contain discrete sources of Ra-226 in excess of regulatory requirements, as determined by the following observations:

- Gamma radiation levels across the site were generally consistent with background; the absence of gamma radiation anomalies suggests there are no sources of Ra-226 present.
- Soil samples collected from two areas with slightly elevated gamma radiation levels contain Ra-226 concentrations attributable to natural variability in background; thus, the elevated survey results are likely due to NORM and not discrete sources of Ra-226.

Additionally, these low readings attributed to NORM are outside of NRC's regulatory requirements.

- Risk of potential contamination on the site is low and, if present, would most likely be found at a significant depth in the subsurface soil.

Based on the above observations, it is recommended that the NRC not perform a more detailed scoping survey. The rationale behind this recommendation is that the initial site visit generated a robust dataset that already meets the scoping survey purpose. Furthermore, it is also recommended that the NRC staff should not pursue additional action at the former Harvey-Hubbell property given no elevated radiation levels (relative to background) were identified in the surface soils.

5.0 REFERENCES

McGraw-Hill 1922. *Electrical Merchandising—The Monthly Magazine of the Electrical Trade*, Vol. 27, No. 1, p. 106, New York, January.

NRC 2017. *Inspection of Facilities Potentially Contaminated with Discrete Radium-226 Sources*, Temporary Instruction 2800/043, Revision 1, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, Washington, D.C., October. (Agencywide Documents Access and Management System [ADAMS] Accession No. ML16330A678).

ORNL 2015. *Historical Non-Military Radium Sites Research Effort Addendum*, "Harvey-Hubbell: Site Summary," pp. 64-67, Oak Ridge National Laboratory, Oak Ridge, Tennessee, November 24. (ADAMS Accession No. ML16291A488).

Pehanick, Andrew 2005. *Postcard History Series: Bridgeport*, Arcadia Publishing, Charleston, South Carolina, ISBN 0-7385-3766-7 (available online).

Witkowski, Mary 2011. Bridgeport Library, Bridgeport History Center, viewed online on January 4 at <http://bportlibrary.org/hc/west-end/Harvey-Hubbell/>.

APPENDIX A
PHOTOS FROM THE HARVEY-HUBBELL SITE VISIT



A-1. Harvey-Hubbell Site Looking Southeast



A-2. Harvey-Hubbell Site Looking North

APPENDIX B
SURVEY RESULTS FROM THE HARVEY-HUBBELL SITE VISIT

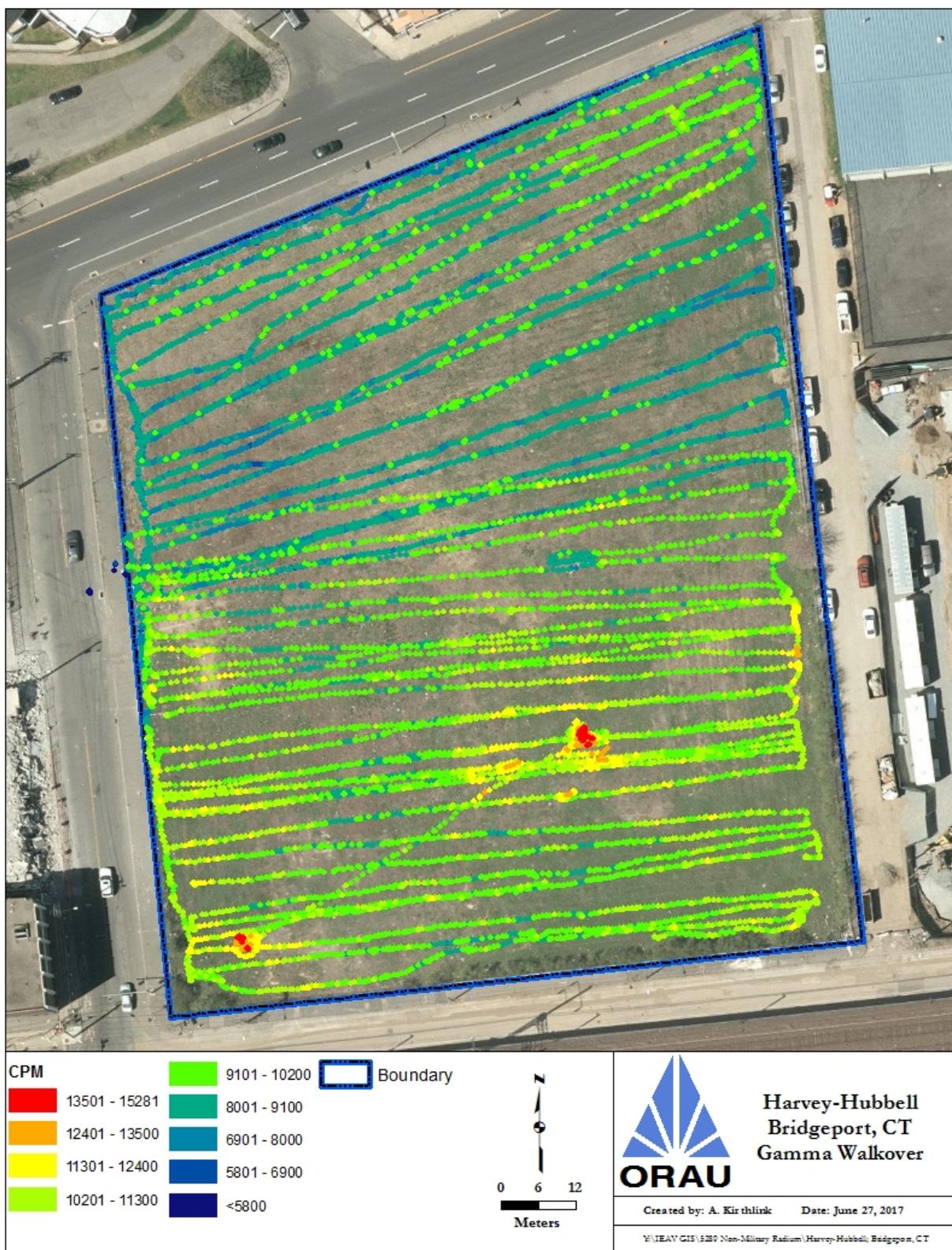


Figure B.1. Gamma Walkover Map Using 2x2 Sodium Iodide Detectors

| | | | |
|-----------------------------|----------------------|----------------------------|-----------------------------|
| Site: Harvey Hubbell | Area: Land | Date(s): 6/21/2017 | Time: 09:00 - 12:00 |
| Surveyor(s): KME/STP | | Purpose: Site Visit | |
| Radiation Type | Instrument | Detector | Background |
| Gamma | 192 No.1127, No.1128 | NA | 4.5 - 5.0 $\mu\text{R/h}^a$ |

^aBackground varied depending on naturally occurring radioactive material in the area.

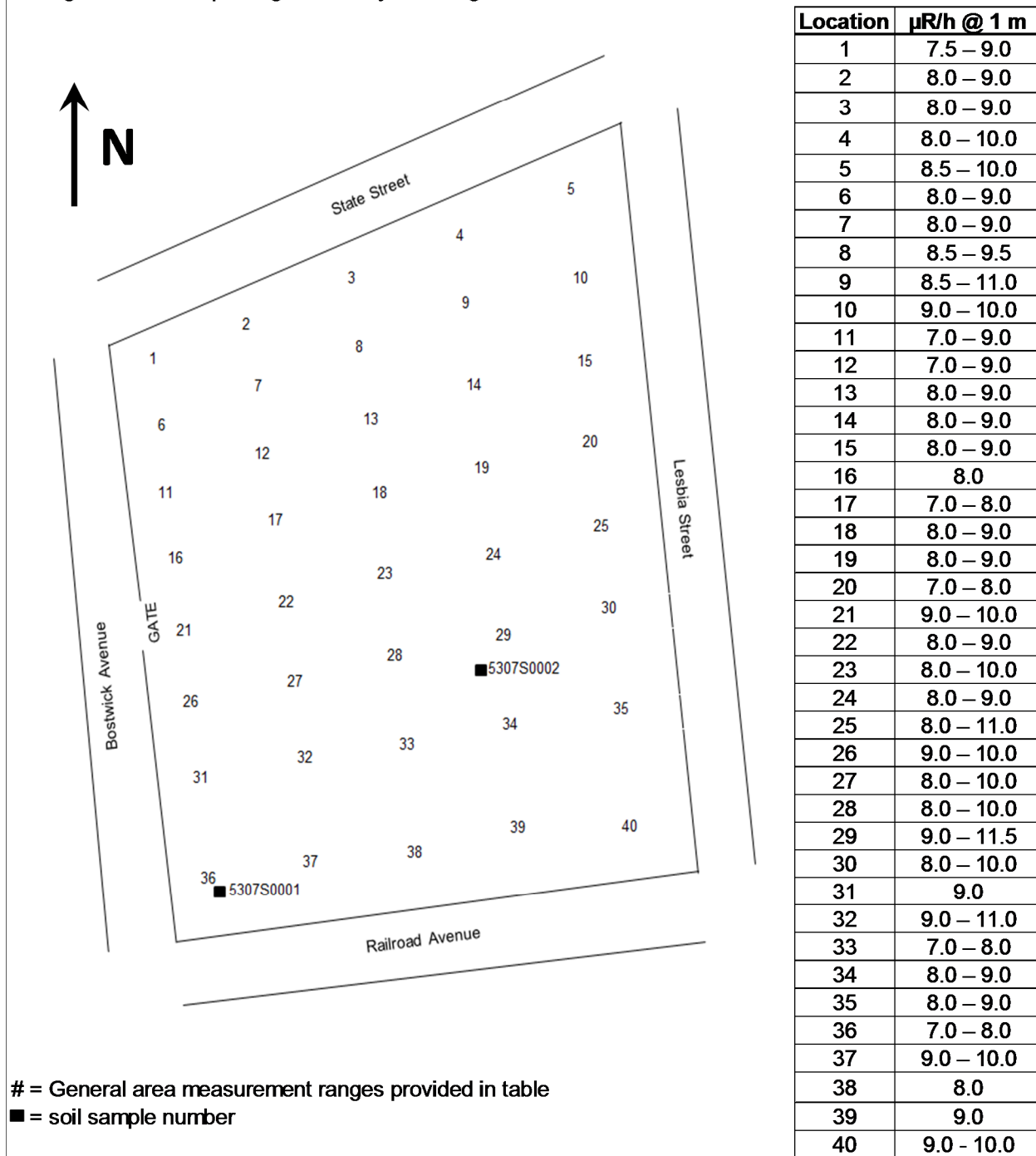


Figure B.2. Exposure Map Using 192 Ratemeters & Sample Locations

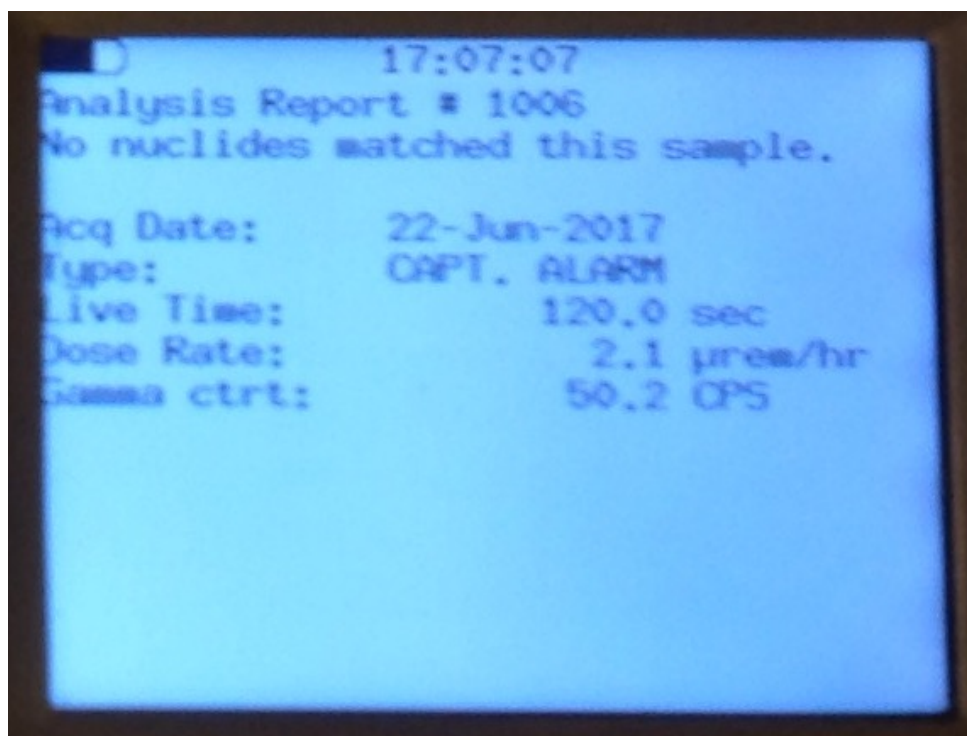


Figure B.3. SAM-940 Analysis Report for Sample 5307S0001

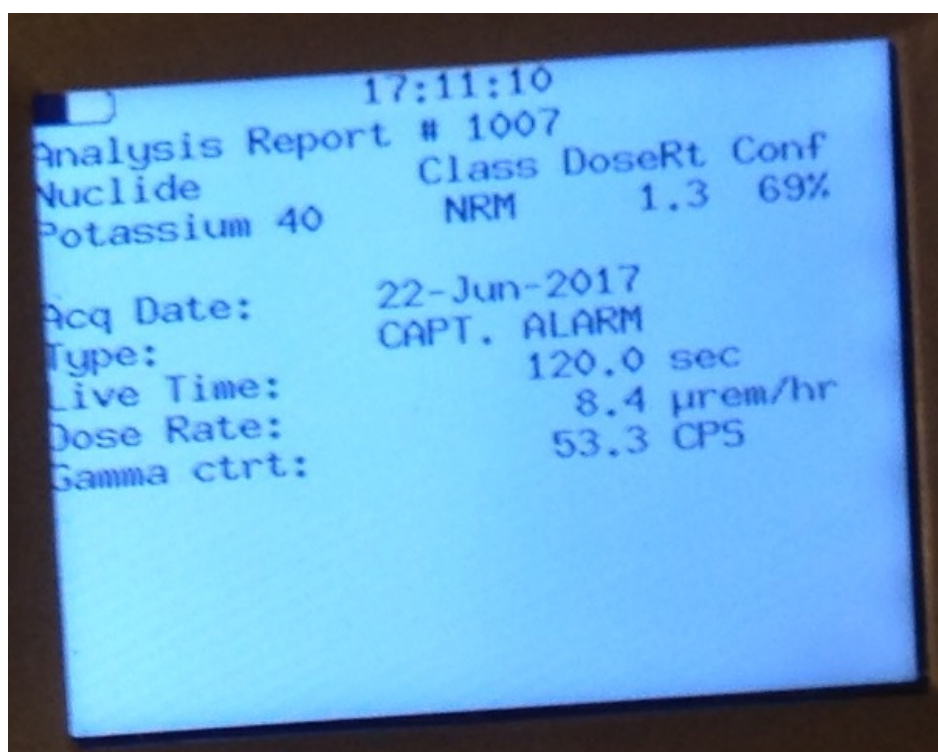


Figure B.4. SAM-940 Analysis Report for Sample 5307S0002

APPENDIX C
RAW ANALYTICAL RESULTS FOR THE HARVEY-HUBBELL SITE VISIT

REVISION 2

Sample Results Summary

Date: 23-Oct-17

TestAmerica Inc TARL

Ordered by Method, Batch No., Client Sample ID.

Report No. : 71911

SDG No: 54120

| Batch | Client Id Work Order | Parameter | Result +- CSU (2 s) | Qual | Units | Tracer Yield | MDL | CRDL | RER2 |
|-------|-------------------------|-----------|----------------------|------|-------|-----------------|-----|------|------|
|-------|-------------------------|-----------|----------------------|------|-------|-----------------|-----|------|------|

Redacted

7293012 RL-GAM-001

5307S0001

| | | | | | | |
|----------|---------|----------------------|---|--|-------|----------|
| NACGK2AA | AC-228 | 1.31E+00 +- 1.8E-01 | | | pCi/g | 2.06E-01 |
| | BI-212 | 1.87E+00 +- 4.6E-01 | | | pCi/g | 5.57E-01 |
| | BI-214 | 1.15E+00 +- 1.2E-01 | | | pCi/g | 1.16E-01 |
| | K-40 | 1.14E+01 +- 1.2E+00 | | | pCi/g | 7.11E-01 |
| | PA-234 | 4.31E-02 +- 3.9E-01 | U | | pCi/g | 2.36E-01 |
| | PA-234m | -5.96E+00 +- 7.2E+00 | U | | pCi/g | 6.06E+00 |
| | PB-210 | -1.70E+01 +- 3.6E+01 | U | | pCi/g | 4.88E+01 |
| | PB-212 | 1.29E+00 +- 1.7E-01 | | | pCi/g | 7.15E-02 |
| | PB-214 | 1.28E+00 +- 1.5E-01 | | | pCi/g | 1.22E-01 |
| | RA-0 | 1.24E+00 +- 1.6E-01 | | | pCi/g | 2.44E-01 |
| | RA-224 | 6.77E-01 +- 6.3E-01 | U | | pCi/g | 9.09E-01 |
| | RA-228 | 1.25E+00 +- 1.4E-01 | | | pCi/g | 2.40E-01 |
| | TH-0 | 1.29E+00 +- 1.1E-01 | | | pCi/g | 2.06E-01 |
| | TH-228 | 1.24E+00 +- 5.1E-01 | | | pCi/g | 9.46E-01 |
| | TL-208 | 4.59E-01 +- 6.3E-02 | | | pCi/g | 6.13E-02 |
| | U-0 | 1.43E+00 +- 2.0E-01 | | | pCi/g | 1.90E-01 |
| | U-235 | 4.39E-02 +- 4.2E-02 | U | | pCi/g | 6.15E-02 |

5307S0002

| | | | | | | |
|----------|--------|---------------------|--|--|-------|----------|
| NACGL2AA | AC-228 | 1.68E+00 +- 1.8E-01 | | | pCi/g | 1.86E-01 |
| | BI-212 | 1.73E+00 +- 4.4E-01 | | | pCi/g | 5.41E-01 |
| | BI-214 | 1.54E+00 +- 1.4E-01 | | | pCi/g | 1.03E-01 |
| | K-40 | 9.61E+00 +- 1.0E+00 | | | pCi/g | 6.09E-01 |

TestAmerica Inc RER2 - Replicate Error Ratio = (S-D)/[sqrt(sq(TPU)+sq(TPUD))] as defined by ICPT BOA.
rptTALRchSaSum U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan
mary2 V5.8.5 software.
A2002

TestAmerica Laboratories, Inc.

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REVISION 2

Sample Results Summary

Date: 23-Oct-17

TestAmerica Inc TARL

Ordered by Method, Batch No., Client Sample ID.

Report No. : 71911

SDG No: 54120

| Batch | Client Id Work Order | Parameter | Result +- CSU (2 s) | Qual | Units | Tracer Yield | MDL | CRDL | RER2 |
|---------|-------------------------|-----------|----------------------|------|-------|-----------------|----------|------|------|
| 7293012 | RL-GAM-001 | | | | | | | | |
| | 5307S0002 | | | | | | | | |
| | NACGL2AA | PA-234 | -3.77E-01 +- 4.0E-01 | U | pCi/g | | 9.76E-02 | | |
| | | PA-234m | 3.43E+00 +- 5.5E+00 | U | pCi/g | | 5.99E+00 | | |
| | | PB-210 | 1.77E+00 +- 6.0E-01 | | pCi/g | | 4.76E-01 | | |
| | | PB-212 | 1.83E+00 +- 2.1E-01 | | pCi/g | | 4.58E-02 | | |
| | | PB-214 | 1.88E+00 +- 1.7E-01 | | pCi/g | | 8.52E-02 | | |
| | | RA-0 | 1.65E+00 +- 1.9E-01 | | pCi/g | | 2.11E-01 | | |
| | | RA-224 | 3.56E+00 +- 6.4E-01 | U | pCi/g | | 8.28E-01 | | |
| | | RA-228 | 1.61E+00 +- 1.5E-01 | | pCi/g | | 2.21E-01 | | |
| | | TH-0 | 1.67E+00 +- 1.2E-01 | | pCi/g | | 1.86E-01 | | |
| | | TH-228 | 1.57E+00 +- 3.7E-01 | | pCi/g | | 7.40E-01 | | |
| | | TH-234 | 1.49E+00 +- 3.8E-01 | | pCi/g | | 5.59E-01 | | |
| | | TL-208 | 5.85E-01 +- 6.9E-02 | | pCi/g | | 5.22E-02 | | |
| | | U-0 | 1.90E+00 +- 2.2E-01 | | pCi/g | | 2.08E-01 | | |
| | | U-235 | 9.36E-02 +- 4.3E-02 | | pCi/g | | 4.72E-02 | | |

No. of Results: 47

TestAmerica Inc RER2 - Replicate Error Ratio = (S-D)/[sqrt(sq(TPU)+sq(TPUD))] as defined by ICPT BOA.
 rptTALRchSaSummary2 V5.8.5 U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.
 A2002

TestAmerica Laboratories, Inc.

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