

Enclosure

**OAK RIDGE ASSOCIATED UNIVERSITIES:
SITE STATUS REPORT FOR THE FORMER ARROW ELECTRIC COMPANY AT
103 HAWTHORN STREET, HARTFORD, CONNECTICUT**

JULY 7, 2017

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) requested that Oak Ridge Associated Universities (ORAU) perform a radiation survey of the property at 103 Hawthorn Street in Hartford, Connecticut. This property was once occupied by Arrow Electric Company, which possibly manufactured radium luminous flush switches and pull-chain pendants from the early 1920s to late 1970s. In 1999, the original facility was destroyed by fire, and left-over materials were subsequently removed. However, soil at the site could be contaminated with radium. The objective of this initial site visit was to determine whether discrete sources of radium associated with former Arrow Electric Company operations remained at the site.

ORAU performed the radiation survey on April 5, 2017, and did not identify elevated levels of radiation. Almost 11,000 gamma radiation measurements were collected through continuous data logging and over 75 exposure rate measurements were manually recorded across the property. Because no elevated levels of radiation were identified, ORAU concludes that discrete sources of radium are not present in the surface soil. Based on these results, it is recommended that the NRC not pursue additional action at the 103 Hawthorn Street property.

SITE STATUS REPORT

Property: Former Arrow Electric Company
103 Hawthorn Street
Hartford, CT 06106

Docket Number: 03038937

Current Property Name(s): City of Hartford

Current Property Owner(s): City of Hartford

Inspection Dates: April 5, 2017

Inspector(s): Steve Hammann/U.S. Nuclear Regulatory Commission (NRC) and Briana DeBoer/NRC, supported by Jason Lee/Oak Ridge Associated Universities (ORAU) and Stephen Pittman/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 NRC is evaluating properties where Oak Ridge National Laboratory's (ORNL) review of historical information identified possible Ra-226 use. The property at 103 Hawthorn Street in Hartford, Connecticut, was identified as the former Arrow Electric Company, a manufacturing company that possibly used Ra-226 during operations from the early 1920s to late 1970s (ORNL 2016). The historic address of 103 Hawthorn Street, Hartford, Connecticut is now part of the City of Hartford's parcel listed at 85 Hawthorn Street. The objectives of the initial site visit were to determine if discrete sources of Ra-226 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 to plan future actions.

Data collected during the initial site visit, which includes gamma radiation scans and exposure rate measurements, are used to plan future actions that may be needed to reduce the exposure of Ra-226 to current and 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 2016).

2.0 PROPERTY DESCRIPTION AND INITIAL SITE VISIT CONSIDERATIONS

2.1 Property Description and History

The site summary included in the *Historical Non-Military Radium Sites Research Effort Addendum* report (ORNL 2016) 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. Historical documentation identified the Arrow Electric Company as a manufacturer of luminous

flush switches and pull-chain pendants containing radium. It is suspected that these items were manufactured until 1979. In 1999, the original facility at 103 Hawthorn Street was destroyed by fire and remaining materials were subsequently removed from the property (ORNL 2016). The location of the removed materials is unknown. Figure 1 illustrates the estimated boundary of the 103 Hawthorn facility footprint and the likely location of the former Arrow Electric Company facility. Currently, the 103 Hawthorn Street property is a vacant lot owned by the City of Hartford. An extensive search of public records did not reveal any information about contamination or cleanup of Ra-226 at the property (ORNL 2016).

The 103 Hawthorn Street property is approximately 8,000 square meters of land consisting of young growth trees, scattered thick underbrush, and some open, grass-covered areas. Certain areas of the property are littered with miscellaneous materials. This is especially prevalent immediately inside the fence along Hawthorn Street. In addition, scattered piles of dirt, concrete, and other construction materials (rubble) are present within and around the property boundary; it is unknown whether or not these materials are associated with the former Arrow Electric Company facility. There is no visual evidence of the original Arrow Electric Company structure.



Figure 1. Aerial Photograph Indicating Former Arrow Electric Property at 103 Hawthorn Street (USDA-APFO 2016)

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. Approximately 75 percent of the property within the bounded area was accessible for radiological surveys. Access was limited in certain areas due to thick underbrush and/or steep slopes.

3.0 SITE OBSERVATIONS AND FINDINGS

3.1 Summary of Activities

The inspection team conducted an initial site visit at the former Arrow Electric Company property on April 5, 2017. Immediately prior to entering the survey area, Jason Lee (ORAU), Stephen Pittman (ORAU), Steve Hammann (NRC), and Briana DeBoer (NRC) held a pre-inspection meeting. Participants discussed their intention to perform general land area surveys inside the predetermined boundaries and periphery area.

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 coupled to Ludlum model 2221 ratemeter/scaler with audible indicator. The ratemeter/scalers were connected to a Trimble Geo7X global positioning system (GPS) data logging system to record real-time gamma count rate measurements and location information. Radiation exposure rate measurements were collected using a Ludlum model 192 sodium iodide-based microRoentgen (μR) ratemeter¹ and a Thermo Scientific Micro Rem AO ratemeter provided by NRC. Table 1 presents the specific instruments used during the initial site visit.

Summary of Daily Activities – April 4, 2017:

Survey activities were cancelled due to rain. However, the ORAU team visited the site to make visual observations from outside the fence.

Summary of Daily Activities – April 5, 2017:

The inspection team arrived on site at 07:00 a.m. and conducted a brief pre-inspection meeting. The inspection team performed general radiological surveys of the land area using 2×2 sodium iodide detectors connected to GPS equipment and hand-held exposure ratemeters. Approximately 75 percent of the property was accessible, and approximately 50 percent of the property was surveyed. Access was limited in some areas primarily due to thick underbrush and unsafe slopes/footing. No anomalous radiation levels were identified during the survey, and no direct evidence of the former Arrow Electric Company structure was observed—some of the rubble piles may be from the original structure, though this could not be confirmed. A close-out meeting with NRC was held at approximately 10:30 a.m., and the inspection team departed the site at 10:45 a.m. Photographs taken during the initial site visit are presented in Appendix A.

¹Roentgen 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 that these units are equivalent (1 Roentgen = 1 rem).

| Radiation Type (units) | Detector Type | Detector Model (Number) | Ratemeter (Number) |
|---|---|--------------------------------|---------------------------|
| Gross gamma (cpm) | Sodium Iodide | 44-10 (908) | 2221 (590) |
| | | 44-10 (664) | 2221 (1143) |
| Gross gamma exposure ratemeter (μ R/h and μ Rem/h) | Sodium Iodide (μ R/h) | N/A | Ludlum 192 (1127) |
| | Tissue equivalent, organic (μ Rem/h) | | Thermo Micro Rem (092421) |

N/A = not applicable

Number = ORAU/NRC equipment barcode

cpm = counts per minute

μ R/h = microRoentgen per hour

μ Rem/h = microRem per hour

3.2 Summary of Results

Table 2 presents summary statistics of survey data collected during the initial site visit. The 2x2 sodium iodide detector responses generally ranged from 6,000 to 11,000 cpm, with some random fluctuations near the center of the property to reach a maximum response of just over 12,000 cpm. As shown in the table, the mean detector response is 8,843 cpm, the median is 8,935 cpm, and the standard deviation is 1,076. These results (median close to the mean; no anomalies; 99+ percent within three standard deviations of the mean) are consistent with survey data from an un-impacted (background) property. Gamma survey data were mapped and are presented in Appendix B. Data were binned and are color coded to illustrate the range of cpm results across the property. Note that the map shows where the inspection team investigated rubble piles beyond the eastern and western boundaries for completeness—no anomalies were detected.

The exposure rate data in Table 2 shows a similar lack of anomalies with a range of 4 to 10 μ R/h, with all values falling within 3 standard deviations from the mean. These data are not mapped like the cpm results given the number of measurements and scale of the map. Because no anomalous radiation levels were detected with either detector, no samples were collected during the survey.

| Table 2. Radiation Measurement Summary Statistics | | | | | | | |
|---|--------------|-------|------------|------------|-------|--------|----------|
| Detector | No. of Meas. | Units | Min. Value | Max. Value | Mean | Median | St. Dev. |
| 2×2 | 10,720 | cpm | 5,019 | 12,115 | 8,843 | 8,935 | 1,076 |
| Exposure Rate Meter | 79 | μR/h | 4 | 10 | 6.8 | 6.0 | 1.5 |

3.3 Summary of Dose Assessment Results

Because no elevated radiation levels were detected above background and no discrete sources of Ra-226 were encountered, a dose attributed to discrete radium sources was not calculated.

4.0 OBSERVATIONS AND RECOMMENDATIONS

There was no indication from the areas surveyed that the former Arrow Electric Company property contains discrete sources of Ra-226 as determined by the following observations:

- Gamma radiation levels across the site were consistent with background.
- The absence of gamma radiation anomalies suggests there are no sources of Ra-226 present.
- 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.

Therefore, the recommendation to the NRC staff is that a more detailed scoping survey is not justified at this time and NRC staff should not pursue additional action at the property.

5.0 REFERENCES

NRC 2016. *Inspection of Facilities Potentially Contaminated with Discrete Radium-226 Sources*, Temporary Instruction 2800/043, 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. ML16035A053).

ORNL 2016. *Historical Non-Military Radium Sites Research Effort Addendum*, "Arrow Electric Company: Site Summary," pp. 10-14, Oak Ridge National Laboratory, Oak Ridge, Tennessee, November 22. (ADAMS Accession No. ML17047A696).

APPENDIX A
PHOTOS FROM THE FORMER ARROW ELECTRIC COMPANY INITIAL SITE VISIT



A-1. Litter Along Hawthorn Street Fence Line



A-2. Photo Taken from Hawthorn Street Looking South

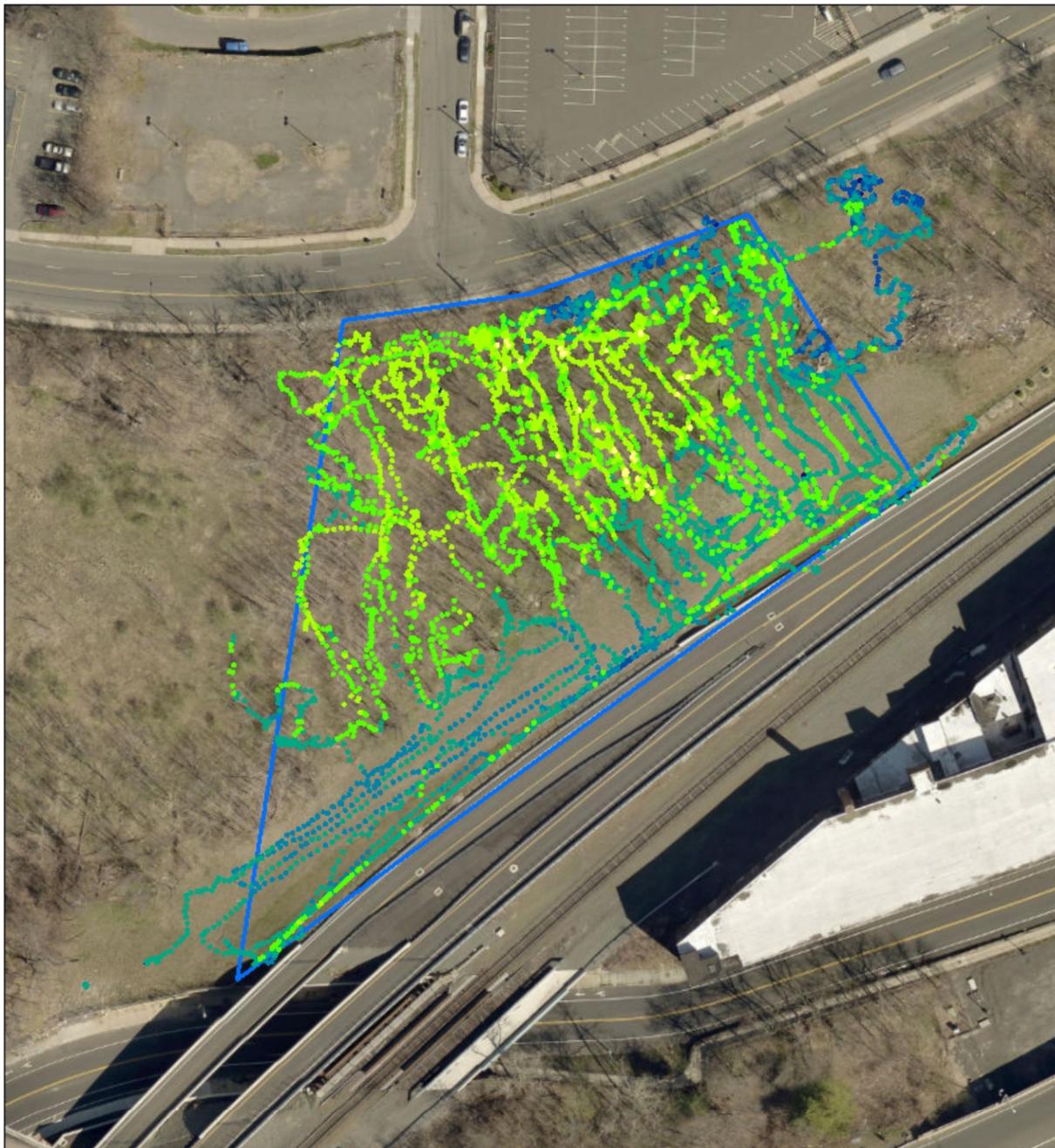


A-3. Rubble Pile Along Western Boundary



A-4. View from Capitol Avenue Looking Northeast

APPENDIX B
GAMMA SURVEY RESULTS MAP FROM THE FORMER ARROW ELECTRIC
COMPANY INITIAL SITE VISIT



| | | |
|---------------|-------------|-------------------------|
| CPM | 7951 - 9000 | Arrow Electric Boundary |
| 11101 - 12115 | 6901 - 7950 | |
| 9907 - 11100 | 5851 - 6900 | |
| 9001 - 9906 | <5850 | |

Meters

ORAU

**Non-Military Radium
Arrow Electric
Gamma Walkover**

Created by: A. Kir thlink Date: April 13, 2017

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