EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) requested that the Oak Ridge Institute for Science and Education (ORISE) perform a radiological survey of the property at 145 Cherry Avenue in Waterbury, Connecticut. This property covers the footprint once occupied by the former Benrus Clock Company, which used radium paint in the manufacturing of clocks and watches into the mid-1940s. The original seven-story factory is still present and currently occupied by Bender Plumbing Company. The objective of this survey was to locate possible discrete sources of radium, if any, that would be associated with former Benrus Clock Company operations.

ORISE performed the radiation survey on November 7 and 8, 2016, and identified elevated levels of radiation, most notably in the northeast corner of the seventh floor. Because elevated levels of radiation identified were determined to be associated with radium-226, ORISE concluded that discrete sources of radium are present, but that current site uses (i.e., equipment storage) are unlikely to result in an unacceptable dose to Bender workers. Based on these results, it is recommended that the NRC maintain oversight by working with the site owner to control and mitigate risks from exposure to discrete sources of radium-226 at the former Benrus Clock Company until remediation can be completed. Due to the contamination identified in previous surveys, the site owner already had certain controls in place that limited access to areas confirmed to be contaminated during the initial site visit. Specifically, the site owner used the areas identified as storage spaces, only permitting access for retrieval purposes. The NRC inspector stressed the importance of maintaining these controls in place and of reconsidering them if materials are moved or removed from the affected areas in the future. The owner acknowledged that he understood and would do so. The NRC inspector advised that this would be very important if the site owner continued with plans to move his business to a new facility.

SITE STATUS REPORT

Property: Benrus Clock Company
145 Cherry Avenue
Waterbury, CT 06702

Docket Number: 03038943

Current Property Name(s): Bender Plumbing

Current Property Owner(s): David Bender

Inspection Dates: November 7 and 8, 2016

Inspector(s): Orysia Masnyk Bailey/NRC, assisted by David King/ORAU and Nick Altic/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 our review of historical information has identified Ra-226 use. The property at 145 Cherry Avenue in Waterbury, Connecticut, was identified as the former Benrus Clock Company, a former manufacturing facility, which operated from the 1920s to the mid-1940s (ORNL 2015). Additional information on the site is also available in the West Valley Nuclear Services Co. Inc. report (DEEP 1998), the Agency for Toxic Substances and Disease Registry (ATSDR) report (ATSDR 1999), and the Scientech report (Scientech 2003). 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 more in-depth scoping survey to better reach a conclusion on whether site cleanup is needed.

Data collected during the initial site visit is used to plan future actions that may be needed to reduce the exposure of Ra-226 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 2016).

2.0 PROPERTY DESCRIPTION AND INITIAL SITE VISIT CONSIDERATIONS

2.1 Property Description and History

The main structure, located at 145 Cherry Avenue in Waterbury, Connecticut, is a seven-story structure with a combination of brick and poured concrete walls, wood floors (possibly original), and concrete columns at regular intervals within the interior (pictured in Figure 1). The main (first story) level is used for operation of the Bender Plumbing Company. All other floors are used to store equipment and supplies. Based on historical surveys (DEEP 1998, ATSDR 1999 and Scientech 2003), Ra-226 would most likely be located on the 4th, 5th, and 7th floors where watch dials and/or cases with radium-luminous paint were produced (ORNL 2015). The adjoining warehouse structures pictured on Page A-1 of Appendix A were also investigated as

part of the initial site visit, though there is no known link to radium-related activities in these structures. The site visit described in the following discussion confirms results from the extensive historical surveys indicating that Ra-226 is present at levels that could produce a radiological dose above 25 millirem per year (mrem/yr).

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.

Figure 1. Aerial photo of 145 Cherry Avenue in Waterbury, Connecticut

2.2 Initial Site Visit Considerations

Prior to commencing survey activities, the general building layout was examined for consistency with historical information and to identify impediments to conducting the survey and/or health and safety considerations. The seven-story building appears to be the original facility except for the addition of office space on the south side of the first floor (extending toward the parking lot). The structural integrity is sound, including floors, and walls. Much of the floor space contains shelving and large quantities of plumbing supplies and boxed storage records used by the Bender Plumbing Company, which severely limited access to surfaces (see, for example, Page A-2 on Appendix A). The property owner indicated that they plan to relocate business operations in the near future and plans to empty all floors of stored materials in calendar year 2017.

3.0 SITE OBSERVATIONS AND FINDING

3.1 Summary of Activities

The inspection team conducted an initial site visit at the Benrus property on November 7 and 8, 2016. A pre-inspection meeting was held with David Bender (owner), Richard Fil (Robinson and Cole, LLP), Paul Steinmeyer (Radiation Safety Associates, Inc. [RSA]), Michael Firsick (Connecticut Department of Energy and Environmental Protection [CT DEEP]), and Steve Fecteau (Bender Vice President). Participants discussed the inspection team's intention to re-visit some of the locations identified as potentially contaminated with radium in the historical

assessment and to perform general area scans in other areas of the facility. The inspection team was granted access to all portions of the facility. RSA and CT DEEP, as well as Paul Steinmeyer and Richard Fil, accompanied the inspection team throughout the site visit.

Radiological surveys performed by the inspection team consisted of gamma radiation scans within the building using a Ludlum model 44-10 2-inch by 2-inch (2×2) sodium iodide detector connected to a Ludlum model 2221 ratemeter/scaler, alpha-plus-beta radiation direct measurements using a Ludlum model 44-142 plastic scintillator connected to a Ludlum model 2221 ratemeter/scaler (also used to measure smears in the field), and radiation exposure rate measurements using a Ludlum model 192 sodium iodide based microRoentgen (μR) ratemeter.[1] Table 1 presents the specific instruments used. Smear samples were also collected at selected locations to quantify the removable contaminant fractions. Gamma radiation scans and dose rate measurements were also performed on the exterior perimeter land areas and adjacent support structures.

Table 1. Benrus Clock Company Survey Instruments

Radiation Type (units)	Detector Type	Detector Model (Number)	Ratemeter (Number)
Alpha plus beta (cpm)	Plastic Scintillator	44-142 (1031) Calibrated 11/3/2016	2221 (1143) Calibrated 8/8/2016
Gross gamma (cpm)	Sodium Iodide	44-10 (908) Calibrated 11/1/2016	2221 (590) Calibrated 8/19/2016
Gross gamma (μR/h)	Exposure Meter	192 (1127) Calibrated 6/3/2016	N/A
Gamma Spectrum Analyzer (SAM-940)	Lanthanum Bromide	940 (864) Daily check source response	N/A

N/A = not applicable
Number = ORAU equipment barcode
cpm= counts per minute
μR/h= microRoentgen per hour

In general, the 2×2 background responses ranged from about 5,000 to 15,000 cpm, depending on proximity to stored ceramic sinks, toilets, and the brick structure of the building. The alpha-plus-beta background detected ranged from the upper 200s to 300 cpm on the wood floor, though 300 cpm is assumed here for correcting gross counts. With the other sodium iodide detector, the exposure rate varied depending on proximity to stored and structural materials, though a 5-μR/h reading was consistently measured throughout the building. A 40 μR/h, above background, threshold is established in the NRC's Temporary Instruction 2800/043 (NRC 2016) to implement controls. These measurements indicate that, with conservative assumptions, a

[1]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).

member of the public regularly working in some areas of the building could receive an annual dose in excess of NRC's public dose limit of 100 mrem/yr (10 CFR 20.1301).

Figure 2 presents the general layout of the Benrus floor plan. Each floor is divided into 36 sections or grids measuring 3.2 meters (north-south) by 4 meters (east-west) (10.5-feet by 13.33-feet) with a numbered concrete column at each intersection. When elevated radiation levels were identified, the inspection team referenced the building floor and grid number for ease of reference. Daily activities and results are discussed below.

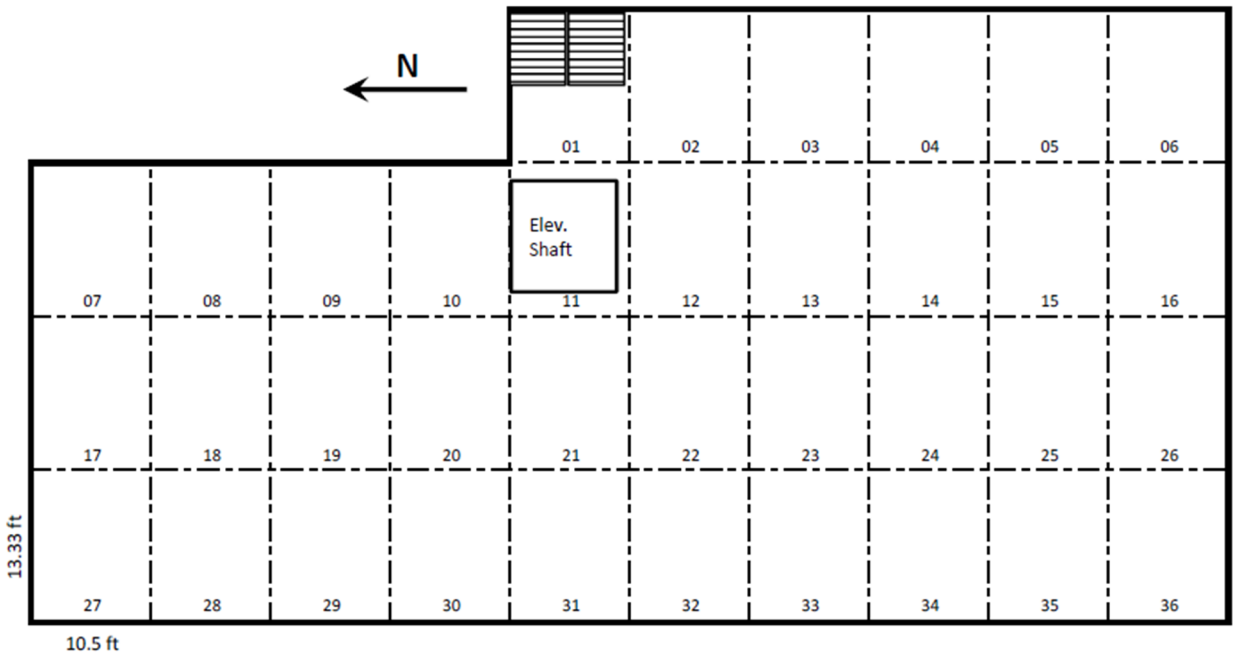


Figure 2. Benrus Floor Plan

Summary of Daily Activities – November 7, 2016:

At the completion of the meeting with the site owner, the initial site visit was initiated on the 7th floor, where the potential for contamination was believed to be the highest, based on historic records (DEEP 1998, ATSDR 1999, and Scientech, 2003). Gamma radiation scans identified general area contamination along the northern wall, so the area was further investigated. The maximum direct radiation levels along with background radiation levels (the conservative lower-end of the observed background range is presented) identified in the area were as follows:

- 600,000 cpm on contact using the 2×2 sodium iodide detector, compared to a background of approximately 5,500 cpm.
- 240,000 cpm alpha-plus-beta on contact using the model 44-142 plastic scintillator, compared to a background of approximately 300 cpm.
- 450 µR/h on contact using the model 192 exposure meter, compared to a background of approximately 5 µR/hr.
- 100 µR/h at 1 meter, including a background contribution of approximately 5 µR/hr, (3.3 feet) above the floor surface using the model 192 exposure meter, which exceeds the NRC's 40 µR/h threshold for controls.

Along with these maximums, the inspection team identified general contamination on the floor within grids 07, 17, and 27. This entire floor area is presumed to be contaminated to some degree, though there were too many obstacles to fully assess radiological conditions. Other small areas of contamination were identified in Grids 09 and 35, though levels do not approach the maximums. Smears were collected in Grid 07 (direct measurement [DM] locations DM-01 and -02), Grid 35 (DM-03), and Grid 09 (DM-04).

The inspection team held a conference call with NRC Headquarters (NRC/HQ) and Regional Division management and staff to discuss the 7th floor preliminary results. NRC/HQ requested confirmation that the elevated radiation levels on the 7th floor were due to the presence of Ra-226 and that gamma radiation surveys be performed on the outside of industrial areas to determine if there were any locations of elevated gamma radiation in excess of the 40 µR/h threshold as discussed in Temporary Instruction 2800/043 (NRC 2016). The team was also instructed to scan office spaces where Bender Plumbing employees regularly work, even in areas not part of the original structure.

At the completion of the conference call, the inspection team returned to the 7th floor with a SAM-940 spectrum analyzer and confirmed the presence of Ra-226 contamination (see Appendix A, Page A-2).

General area surveys of the 6th and 5th floors were performed next. Most areas were inaccessible due to material storage, including a 5th floor location (Grid 02) identified in 1998 as potentially contaminated. Exposure rate measurements were made by reaching between the large stored boxes. The exposure rate was approximately 20-25 µR/h, which is higher than background but lower than the NRC's threshold of 40 µR/h above background for implementing controls. The team also noted elevated gamma radiation levels in Grid 07 of the 6th floor, suspected to be due to "gamma shine" from Grid 07 on the 7th floor (levels were ~15 µR/h on contact with the floor and ~30 µR/h at 3 m in the air above the floor).

Summary of Daily Activities – November 8, 2016:

A plan-of-the-day meeting was held with Bender representatives, including their legal counsel, and the CT DEEP official. The plan was to complete surveys of remaining floors, office spaces, adjacent structures, and the outdoor area.

A general area gamma radiation survey of the 4th floor was performed. Measurements of elevated gamma radiation of up to 50,000 cpm and an exposure rate of approximately 20-25 µR/h were identified within Grids 02 and 03. The location and radiation levels encountered corresponded with the area documented during the 1998 investigation. Though much of the floor was covered with storage boxes and supplies, gamma scans of the area suggest much of the floor in Grids 02 and 03 are contaminated, but at levels lower than the NRC's threshold of 40 µR/h over background for implementing controls. A smear sample was collected in Grid 02 (Location DM-05).

Gamma radiation scans were performed on the 3rd floor. General area gamma radiation levels ranged up to 30 µR/h in Grid 07, which is higher than background but lower than the NRC's threshold of 40 µR/h above background for implementing controls. However, Grid 07 area was covered with a pallet of concrete mix, and the floor was covered with concrete mix dust, so additional measurements were not collected. Elevated readings were also noted in the area during the 1998 survey (DEEP, 1998). Although radiation levels above instrument background

were present, the cause of the elevated levels could not be confirmed due to the abundance of other stored materials (mainly porcelain sinks and toilets) and the inaccessibility of building surfaces to adequately collect direct alpha-plus-beta measurements.

The team then moved down to the 2nd floor and identified one small location of elevated radiation in Grid 18. A smear sample was collected (DM-06). The inspection team next moved to the 1st floor and found a small area of elevated activity in Grid 19. A smear sample was collected (DM-07). For the areas of elevated activity on both the 2nd and 1st floors, the contact exposure rate was about 40 µR/h at contact but could not be confirmed as distinguishable from background at 1 meter (3.3 feet). NRC requested a second smear sample in the 7th floor Grid 07 (approximately at Location of DM-02) to verify the earlier measurement.

Finally, the inspection team performed gamma radiation scans of the exterior structure and grounds as well as adjacent support buildings. These investigations did not identify any detector responses distinguishable from background. As in the main building, most of the floor space in the adjacent buildings was covered with Bender Plumbing materials and was inaccessible; much of the parking lot was covered with vehicles and equipment. The background for these areas ranged from 5,000 to 12,000 cpm with the 2×2 and 3 to 7 µR/h with the exposure rate meter.

3.2 Summary of Results

Table 2 presents a summary of results, including alpha-plus-beta radiation in cpm units and the associated values converted to total surface activity units of disintegrations per minute per 100 cm^2 (dpm/100 cm^2) using the equation below:

$$dpm/100\ cm^2 = \frac{C - B}{\varepsilon_{tot} \times G}$$

Where:
C = measured count rate (cpm)
B = background count rate (cpm)
G = geometry factor (unitless) = $\frac{Physical\ Detector\ Area\ (cm^2)}{100\ cm^2}$ = 1.00
ε_{tot} = total weighted efficiency (unitless) = 1.6

Due to the number of emissions from Ra-226 and its associated progeny, multiple radiation particles are counted during the surface activity measurement. Therefore, a total weighted efficiency for Ra-226 and its associated progeny was calculated by:

$$\varepsilon_{tot} = \sum_{n} F_n \times \varepsilon_{i,n} \times \varepsilon_{s,n}$$

Where:
F_n = fractional abundance of n^{th} emission
ε_n = instrument efficiency for n^{th} emission
$\varepsilon_{s\,n}$ = surface efficiency (0.25 for alpha and low-energy beta particles, 0.5 for high-energy beta particles) for n^{th} emission

Table 2 also presents smear sample results (dpm/100 cm^2) for removable alpha and beta activity as well as contact and 1-m readings of gross gamma radiation in cpm and µR/h units,

when collected. For ease of reference, the floor plan is also attached so each measurement can be related to a grid.

Surveys using the 2×2 sodium iodide detector and an exposure rate meter were performed of approximately 50% of accessible areas in the main Benrus structures and occupied office spaces. When elevated radiation levels were identified, fixed point measurements were collected using the plastic scintillator at the location that produced the maximum gamma radiation response. Surveys of adjacent structures and outdoor areas covered an estimated 10-20% of accessible area, noting that most of the outdoor areas are covered by concrete, asphalt, equipment, etc. and adjacent structures are packed with materials used by Bender Plumbing business operations.

As indicated in Table 2, the most noteworthy results are from along the north wall of the 7th floor in Grids 07, 17, and 27. Two discrete spots (DM-01 and DM-02) generated the maximum values and scans suggest that most, if not all of those three grids, are contaminated. Results at or above the Temporary Instruction threshold exposure rate of 40 µR/h were only identified in Grids 07 and 17 on the 7th floor during this site visit.

Eight smears were collected from seven locations. Removable (or transferrable) alpha and beta activity was identified in all 7th floor smear samples, though the summed (alpha plus beta) removable activity is ~1% or less of the total (fixed plus removable) activity. The maximum removable results are associated with DM-02 and DM-08. The respective removable activity results for these locations were 1,100 disintegrations per 100 square centimeters (dpm/100 cm^2) for gross alpha and 550 dpm/100 cm^2 for gross beta as compared to the 130,000-150,000 dpm/100 cm^2 total (fixed plus removable) surface activity levels in Grid 07 on the 7th floor.

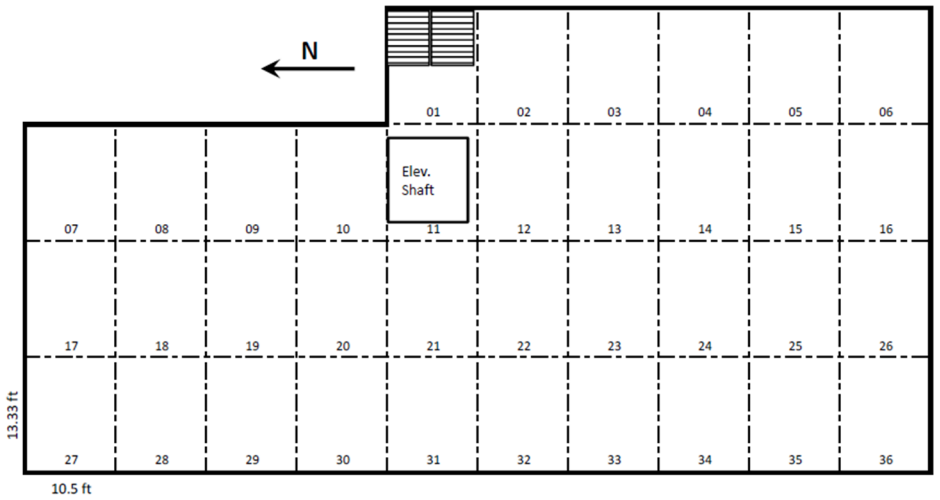
3.3 Summary of Dose Assessment Results

To date, a site-specific dose assessment has not been performed for the Benrus site. However, considerations can be made for the areas of contamination (and the corresponding exposure rate measurements) identified during the initial site visit to assess potential doses to occupants. Although the entirety of the individual floors were not scanned, the estimated areas of contiguous contamination including 12.2 meters x 3.2 meters (40 feet x 10.5 feet) on the 7th floor, 3.2 meters x 4 meters (13 feet x 10.5 feet) on the 5th floor, and 4.1 meters x 6.4 meters (13.3 feet x 21 feet) on the 4th floor, are large enough to be considered comparable to an individual workspace or small residential areas. Corresponding exposure rate measurements were found to be in excess of 40 µR/hr on the 7th floor, suggesting that potential doses could exceed the 25 mrem/yr unrestricted use limit (10 CFR 20.1402) and 100 mrem/yr public dose limit (10 CFR 20.1301) as discussed in the Temporary Instruction. Results on other floors indicate that radium contamination is present greater than background, but below the NRC's 40 µR/hr threshold derived from NRC's 100 mrem/yr public dose limit (10 CFR 20.1301). It is important to note that NRC's criterion for unrestricted use is 25 mrem/yr for current and reasonably foreseeable future uses. Because portions of former clock companies in the City of Waterbury have been turned into residences, a reasonably foreseeable future use for this facility is as a residence. Residential scenarios typically result in lower residual contamination criteria than industrial use scenarios.

Table 2. Benrus Clock Company Site Visit Discrete Measurements[a]

Floor No.	Loc. No.	Grid No.	Alpha-plus-Beta[b]		Removable			Gamma[d]			Location description
			Gross	Total		(dpm/100 cm^2)[c]		Contact		1 m	
			(cpm)	(dpm/100 cm^2)	Smear (DM) No.	Alpha	Beta	kcpm	µR/hr	µR/hr	
N/A	N/A	N/A	300	0	N/A	12.0	14.5	5.5	N/A	5	area background for site[e]
7	DM-01	07	238,709	149,006	R0001	100	72	540	450	90	Hot spot on floor
	DM-02	07	203,937	127,273	R0002	450	230	600	450	100	Hot spot on floor
	DM-03	07	N/A	N/A	R0008	1,100	550	N/A	N/A	N/A	Re-smear next to R0002
	DM-04	35	2,465	1,353	R0003	3.5	9.4	41	45	15	Floor in walkway (~1m^2)
	DM-05	09	2,053	1,096	R0004	1.4	3.5	52	55	15	Hot spot on floor (< 1ft^2)
	DM-06	13	259	0	N/A	N/A	N/A	N/A	N/A	N/A	General area measurement
	DM-07	13	282	0	N/A	N/A	N/A	N/A	N/A	N/A	General area measurement
	DM-08	17	7,041	4,213	N/A	N/A	N/A	N/A	N/A	70	Floor in walkway
	DM-09	17	2,388	1,305	N/A	N/A	N/A	N/A	N/A	22	Floor in walkway
	DM-10	27	4,136	2,398	N/A	N/A	N/A	N/A	N/A	35	Floor in walkway
	DM-11	27	1,933	1,021	N/A	N/A	N/A	N/A	N/A	30	Floor near NW corner
6	DM-12	07	N/A	N/A	N/A	N/A	N/A	N/A	15	17	Shine from 7th floor
5	DM-13	02	N/A	N/A	N/A	N/A	N/A	25	N/A	20	Between boxes
4	DM-14	02	5,508	3,255	R0005	-0.71	-4.7	25	N/A	25	Hot spot on floor
3	DM-15	07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	30	Behind pallet of material
2	DM-16	18	2,392	1,308	R0006	1.4	-3.5	42	40	5	Hot spot on floor (< 1ft^2)
1	DM-17	19	2,156	1,160	R0007	-0.71	1.2	47	38	7	Hot spot on floor (< 1ft^2)

a) Yellow and red highlighted values are above background and the NRC's Temporary I threshold, respectively
b) 44-142 plastic scintillator (alpha-plus-beta)
c) As reported by REAL, values reported in background row are the analytical minimum detectable activity
d) 44-10 2×2 and Model 192
e) Alpha-plus-beta and gamma values in this row are the conservative lower-end of the observed background range
N/A = not applicable; not collected at this location



4.0 OBSERVATIONS AND RECOMMENDATIONS

Based on the data collected, the former Benrus Clock Company contains discrete sources of Ra-226 in excess of regulatory requirements. ORISE made the following observations:

- Ra-226 was positively identified on the 7th floor at levels that produce exposure rates in excess of the 40 µR/h Temporary Instruction threshold, suggesting that potential doses may exceed the 25 mrem/yr criteria for unrestricted use and 100 mrem/yr public dose limit applied to operating NRC licensed facilities limits to future occupants (i.e., 10 CFR 20.1402 and 10 CFR 20.1301) discussed in Section 3.3 of this report.

- The Ra-226 alpha-plus-beta levels identified on the 7th floor surface were in excess of the not-to-exceed screening value of 140,000 dpm/100 cm^2, and multiple measurements exceeded the large-area 1,400 dpm/100 cm^2 screening value associated with NRC's unrestricted use criterion.

- Contamination above background values was detected on the 5th and 4th floors, but these values were below NRC's 40 µR/h Temporary Instruction threshold.

- The inspection team located contamination consistent with historical surveys (DEEP 1998, ATSDR 1999, and Scientech 2003), though the initial site visit data are less comprehensive. The historical reports did not provide sufficient information for the NRC to perform comprehensive dose calculations. However, current surveys indicate that remedial actions may be required on the 7th floor, and potentially on the 5th and 4th floors, to ensure doses would be below the 25 mrem/yr unrestricted use dose limits.

Based on the above observations, it is recommended that the NRC not perform a scoping survey, but should maintain oversight by working with the owners to control and mitigate risks from exposure to discrete sources of Ra-226 at the former Benrus Clock Company until remediation can be performed. Due to the contamination identified in previous surveys, the site owner already had certain controls in place that limited access to areas confirmed to be contaminated during the initial site visit. Specifically, the site owner used the areas identified as storage spaces, only permitting access for retrieval purposes. The NRC inspector stressed the importance of maintaining these controls in place and of reconsidering them if materials are moved or removed from the affected areas in the future. The owner acknowledged that he understood and would do so. The NRC inspector advised that this would be very important if the site owner continued with plans to move his business to a new facility.

5.0 REFERENCES

ATSDR 1999. Public Health Implications of Radiation Contamination at Former Clock Factories Located in Bristol (Hartford County), New Haven, (New Haven County), Thomaston (Litchfield County), and Waterbury (New Haven County), Connecticut, prepared by the Connecticut Department of Public Health under Cooperative Agreement with The Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services. January 29. (Agencywide Documents Access and Management System [ADAMS] Accession No. ML17038A052).

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Scientech 2003. *Connecticut Radium Sites Verification Survey*, prepared for: Valley Council of Governments, prepared by: SCIENTECH, Inc., New Milford, Connecticut, ML, October. (ADAMS Accession No. ML17039A514).

APPENDIX A
PHOTOS FROM THE BENRUS CLOCK COMPANY SITE VISIT

Figure A-1. Former Benrus Clock Company Looking NNW

Figure A-2. Former Benrus Clock Company Looking NW

Figure A-3. Former Benrus Clock Company Looking West

Figure A-4. Former Benrus Clock Company Looking East

Figure A-5. Grid 07, Locations 01 and 02/08, 7th Floor, Looking NE

Figure A-6. Grids 17 and 27, 7th Floor, Looking West

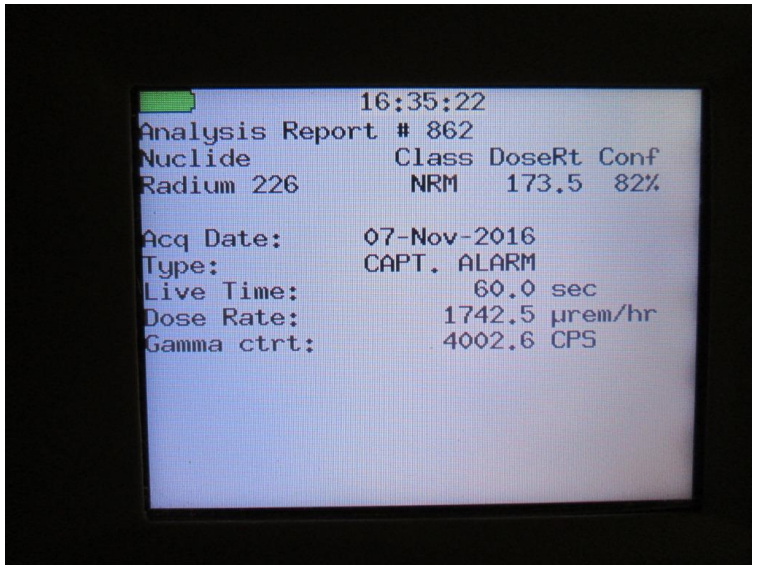

Figure A-7. SAM-940 Output, Grid 07, 7th Floor

Figure A-8. Grid 09, Location 04, 7h Floor, Looking N (under dumbbell)

Figure A-9. Grid 35, Location 03, 7h Floor, Looking West

Figure A-10. Grid 02, 5th Floor, Looking East

Figure A-11. Grid 02, Location 05, 4th Floor, Looking East

Figure A-12. Grid 07, 3rd Floor, Looking NE

Figure A-13. Grid 18, Location 06, 2nd Floor, Looking NW

Figure A-14. Grid 19, Location 07, 1st Floor, Looking NNW