

**TECHNICAL EVALUATION REPORT
CLEANUP PLAN FOR REMEDIATION TO UNRESTRICTED USE OF NEW
OPPORTUNITIES, INC., 232 NORTH ELM STREET, WATERBURY, CT
DOCKET 03038966**

April 19, 2019

1.0 INTRODUCTION

1.1 NOW Submittal

By letter dated June 27, 2018 (Agency Documents Access and Management System (ADAMS) Accession No. ML19028A060), New Opportunities of Waterbury, Inc., (NOW) submitted a Cleanup Plan for 232 North Elm Street in Waterbury, Connecticut. The Cleanup Plan describes the remedial actions of certain areas of the 232 North Elm Street site to reduce residual radioactivity to concentrations that would meet unrestricted release criteria in Section 20.1402 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Radiological criteria for unrestricted use." U.S. Nuclear Regulatory Commission (NRC) staff sent a Request for Additional Information (RAI) to NOW on February 1, 2019 (ADAMS Accession No. ML19032A599), which NOW's contractor responded to on February 12, 2019 (ADAMS Accession No. ML19044A389).

1.2 Background

Prior to establishing its autonomy in 1857, the former Waterbury Clock Company was part of the Benedict and Burnham Manufacturing Company, which began manufacturing brass clocks in 1850. By 1873, the Waterbury Clock Company moved its base of operations to the corner of Cherry Avenue and North Elm Street in Waterbury, Connecticut. The company started using luminous radium paint in 1919, and that process presumably continued, at least, until 1944 when operations were moved to other facilities. In 1949, the plant was subdivided into parcels that were subsequently acquired by small manufacturing firms or individuals for storage or light industrial uses.

As part of NRC's non-military radium program, the NRC staff conducted radiological survey activities during site visits to the 232 North Elm Street property on November 29 through December 1 and on December 16 and 18 of 2016. Subsequently, on May 11, 2017, the NRC staff informed NOW of the radiological survey results for its building on 232 North Elm Street (ADAMS Accession No. ML17018A170). Radiological surveys showed that, in certain areas, radium-226 contamination could result in exceedance of the public dose limit in 10 CFR 20.1301. The NRC staff worked with the site owner to implement voluntary controls to limit access to these areas of the site. Further, NRC's unrestricted release criteria under 10 CFR 20.1402, which is more restrictive than the public dose limit, would be exceeded, necessitating remediation.

On March 7, 2018, the NRC issued a letter of forbearance to NOW stating that the NRC staff would not license the site if efforts were made to remediate the site (ADAMS Accession No. ML17318A176).

Enclosure

1.3 Summary of Proposed Action

In the Cleanup Plan, NOW intends to remove or sand contaminated wood surfaces with residual radioactivity to acceptable levels. For contaminated brick and concrete areas of the building, NOW intends to remove the upper surfaces by scarifying or needling (these processes will grind away or remove the uppermost surface of the brick or concrete). High-efficiency particulate air (HEPA) vacuums and HEPA filtered ventilated enclosures will be used to minimize dispersion of contamination.

2.0 REGULATORY BASIS

10 CFR Part 20, Subpart E – “Radiological Criteria for License Termination,” and specifically 10 CFR 20.1402, “Radiological Criteria for Unrestricted Use,” establishes the requirements for the release of a site for unrestricted use. Section 20.1402 of 10 CFR Part 20 provides, in pertinent part, that:

a site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from the background radiation results in a [total effective dose equivalent] to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) a year.

As discussed in SECY-17-0026, “Policy Considerations and Recommendations for Remediation of Non-Military, Unlicensed Historic Radium Sites in Non-Agreement States,” and approved by the Commission in the subsequent Staff Requirements Memorandum, the NRC staff is ensuring these non-military radium sites have doses not exceeding the 25 millirem per year (mrem/yr) dose criterion within 10 CFR 20.1402.

3.0 ANALYSIS

This Technical Evaluation Report describes the NRC staff analysis of the Cleanup Plan for conformity with the radiological dose criterion for license termination of 25 mrem/yr for unrestricted use provided in 10 CFR 20.1402. The NRC staff review was informed by NUREG-1575, “Multi-Agency Radiation Survey and Site Investigation Manual” and NUREG-1757, “Consolidated Decommissioning Guidance”.

3.1 Radionuclides of Concern

The NRC is evaluating properties where review of historical information has identified Ra-226 (Ra-226) use. The property at 232 North Elm Street in Waterbury, Connecticut, was identified as the former Waterbury Clock Company, a clock manufacturing facility, which once operated during the period from 1919 to the mid-1940s, and the NRC identified the site as being possibly contaminated from previous operations involving Ra-226. After the NRC staff conducted radiological survey activities, the presence of discrete Ra-226 contamination was confirmed.

Given the time frame between when the contamination originated and the proposed remediation, Ra-226 should be in secular equilibrium with its short-lived progeny, meaning that Radon-222 (radon) and its short-lived progeny are present to the extent that the radon (a noble

gas) does not diffuse out of the media in which it originates. Remediation of the Ra-226 to acceptable levels would mean that any remaining short-lived radon progeny would naturally decay to similar levels within a few days. Accordingly, NRC's unrestricted use criterion within 10 CFR 20.1402, does not include radon due to the difficulty in determining whether it comes from natural or licensable sources of radium.

3.2 Demonstrating Conformity with Criteria for Unrestricted Use

The NOW Cleanup Plan addresses conformity with the criteria for release of a site for unrestricted use in 10 CFR 20.1402 (25 mrem/yr to the average member of the critical group). To demonstrate that this criterion is met, NOW proposes to use a Derived Concentration Guideline Levels (DCGL) screening value for Ra-226 of 1,116 disintegrations per minute per 100 square centimeters (dpm/100 cm²) based on the building occupancy scenario in DandD, Version 2.4. DandD is a computer code that assesses compliance with the dose criteria of 10 CFR Part 20, Subpart E. NOW also proposes the use of 819 dpm/100 cm² as the screening value corresponding to 19 mrem/yr¹. The NRC staff reviewed the proposed DCGL value and has no comments because the proposed DCGL value would equate to a dose of less than 25 millirem per year.

3.2.1 Characterization Survey

The primary characterization of residual radioactive material at the site is based on the NRC's surveys performed in the 2016 Site Status Report (ADAMS Accession No. ML17018A173), as supplemented by additional data collected by NOW's contractor. Nineteen locations in Buildings I and J (Buildings I and J are also referred to as Phase 1 and 2, respectively by NOW) were identified that exceeded 40 microroentgen per hour (μR/h) on contact; most associated with small discrete locations of less than 100 cm². Dose rates exceeding 40 μR/h at 1 meter is the threshold within Temporary Instruction 2800/043 (TI), "Inspection of Facilities Potentially Contaminated with Discrete Radium-226 Sources" (ADAMS Accession No. ML16035A053) for considering implementing immediate controls. The exposure rate at three locations exceeded the criteria for immediate controls in the TI 2800/043. These locations are in the fifth floor office suite at the eastern end of Building I. Measurements taken almost directly below, on the 4th floor, also exceeded the TI threshold but were noted as having high gradients such that it is likely to be contamination in the ceiling (flooring on the 5th floor) causing the readings. Other discrete areas exceeding 40 μR/h on contact were noted throughout the 4th floor of Building I, but, at one meter, these did not exceed the TI threshold of 40 μR/h.

One area on the fourth floor of Building J (measurement ID 2-4-2) had a reading, on contact, exceeding the TI criteria of 40 μR/h, which necessitated the application of controls because the measurement was taken at chest height on a column (versus the typical assumptions of measurements from the floor). Other measurements in the same area were similarly noted as exceeding the TI threshold of 40 μR/h but were, again, associated with relatively small discrete areas and did not necessitate controls. It is important to note that the NRC staff use the threshold of 40 μR/h to determine whether immediate controls need to be considered for current site uses; while DCGL values are used to determine whether the site meets the NRC's unrestricted use criterion for reasonably foreseeable future uses.

¹ The State of Connecticut standard is 19 mrem/yr.

Decontamination Decommissioning & Environmental Services, LLC (DDES), NOW's contractor, noted that the contamination exceeding the proposed DCGLs is primarily in discrete areas of the 4th and 5th floors and some window sills. DDES proposes to remediate up to 500 ft² of the 4th and 5th floors of the two buildings. Eleven locations were noted as having total contamination results exceeding the proposed cleanup criteria, which is consistent with the survey results previously identified.

Due to the data presented within the submittal and NRC's previous survey experience at this site, the NRC staff has no comment regarding the characterization data as it is sufficient for purposes of characterizing the site to determine potential dose to an average member of the critical group. However, a final status survey will need to be performed once remediation is complete and a report submitted to demonstrate compliance with 10 CFR 20.1402.

3.3 Waste Disposal

Section 10 of the Cleanup Plan describes DDES's Radioactive Waste Management Program. DDES estimates approximately 3-4 cubic yards of radioactive waste will be generated. Waste packages will be secured in an unoccupied and locked area at the site. Waste will be disposed of at Veolia Alaron ES in Wampum, Pennsylvania consistent with 10 CFR 20.2008(b). If mixed waste is generated, it will be disposed at a US Ecology facility. Shipping records will be considered quality documents under the service provider's Quality Assurance Program.

3.4 Radiation Protection

NOW is having the site remediation work performed by DDES under DDES's Massachusetts radioactive materials service provider license (License Number 56-0623). The NRC staff reviewed DDES's current license (Amendment 12) and confirmed it allows DDES to provide decommissioning services at temporary job sites in Massachusetts. 10 CFR 150.20 grants a general license to conduct the same activity in non-Agreement States. Thus, DDES is allowed to provide its services at temporary job sites in Connecticut, including at the 232 North Elm Street site. DDES's license authorizes activities including surveys, characterization, and remediation of radioactively contaminated materials.

The Cleanup Plan, in Section 7, describes assignments and areas of responsibility for the Radiation Safety Officer and Health Physicist for the project as well as training for workers. Radiation Work Permits will be used for the administrative control of personnel entering or working in areas that have radiological hazards present. The Site Health and Safety Officer, which is listed as a separate position from the Radiation Safety Officer, has the responsibility and authority to terminate any work activities if conditions indicate the potential for unnecessary radiation exposure to site personnel or members of the public or for unsafe working conditions. This section also discusses the training programs that will be implemented for workers and visitors, such as briefings on the hazards within the work zone, which are consistent with the requirements of 10 CFR Part 19.

Sections 8 and 9 of the Cleanup Plan describe specific aspects of the radiation safety program that DDES will implement for the project. These sections include a brief description of procedures for monitoring workers and the work environment, including surveys and air monitoring. A Respiratory Protection Program will be implemented primarily as an as low as reasonably achievable practice, although remediation work may cause airborne contamination

where respiratory protection is a reasonable precautionary practice. DDES will evaluate internal exposures based upon validated air sampling results or bioassay results to determine intakes of Ra-226. External exposures will be assessed by thermoluminescent dosimeters (TLDs) or equivalent. Internal and external exposures will be appropriately summed to demonstrate compliance with the regulatory limits for occupational exposure. DDES anticipates exposures to be less than 100 mrem/yr total effective dose equivalent for workers, which is below NRC requirements for monitoring at 10 CFR 20.1502. However, it is reasonable for the contractor to perform personnel monitoring as it may do multiple projects during the year. The Contamination Control Program, discussed in Section 8.2 of the Cleanup Plan, provides instruction for posting, access control, and personal protective equipment (PPE) requirements to ensure that radioactive materials remain under control. Upgrading or downgrading the PPE requirements will be specified by radiation work permit. The Instrumentation Program, discussed in Section 8.3 of the Cleanup Plan, will utilize NIST traceable standards for calibration and instruments will be response checked and have other preoperational checks performed daily to ensure that instruments function properly.

The Cleanup Plan also generally discusses DDES's auditing program and environmental monitoring and control program. The environmental monitoring program credits the use of sealed enclosures that are HEPA filtered for the general work area combined with fixative agents to minimize any airborne emissions to the public. In response to RAIs, DDES will utilize perimeter sampling of airborne activity to demonstrate that public exposure would be less than 100 mrem/yr during the remediation activities by comparing the airborne activity to the 10 CFR 20, Appendix B effluent limits.

Section 12 of the Cleanup Plan discusses release surveys, including the remedial action support surveys and the final status survey. In response to RAIs, DDES states it will meet the surface activity DCGLs and airborne activity effluent limits in 10 CFR 20, Appendix B before releasing radiological controls in areas being remediated. While few details regarding the final status survey are given in Section 1.1 of the Cleanup Plan, DDES states it has developed a Final Status Survey Plan consistent with guidance in NUREG-1757, "Consolidated NMSS Decommissioning Guidance," and NUREG-1575, "Multi Agency Radiation Survey and Site Investigation Manual (MARSSIM)." DDES also stated in response to RAIs that it will consider source efficiencies when determining surface activity when doing Final Status Surveys consistent with MARSSIM. A Final Status Survey Report will be submitted to demonstrate compliance with 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use."

Based on the existing Massachusetts license, the commitments made in both the Cleanup Plan and in response to RAIs, the NRC staff understands that DDES has the necessary knowledge and experience to safely carry out the remediation work as planned. Thus, the NRC staff has no comment regarding the radiation safety provisions. The NRC staff will inspect the remediation work to verify that DDES performs the work in a safe manner and within regulations.

3.5 State Consultations

The NRC staff discussed this Cleanup Plan with the State of Connecticut's Department of Energy and Environmental Protection (CT DEEP). CT DEEP had no comments.

3.6 Evaluation of EPA/NRC Memorandum of Understanding Consultation Triggers

The NRC staff considers whether concentrations of residual radioactivity in soil or ground water would trigger consultation with the U.S. Environmental Protection Agency (EPA) under the EPA/NRC Memorandum of Understanding (MOU) (see NUREG-1757, Vol. 1, Rev. 2, Appendix H). Since this work does not involve soils or ground water, consultation under the MOU is not triggered.

4.0 OBSERVATIONS

As discussed in detail above, the NRC staff makes the following observations:

1. The NRC staff has reasonable assurance that residual radioactivity remaining at 232 North Elm Street after remediation will be in conformance with the 25 mrem/yr dose criterion for unrestricted use in 10 CFR 20.1402.
2. The NRC staff has reasonable assurance that the radiation protection program is sufficient to protect safety of workers and members of the public.

Therefore, the NRC staff has no comment as the Cleanup Plan is consistent with applicable NRC criteria and guidance.

Principal Contributors:

Adam Schwartzman, NMSS/DUWP
Greg Chapman, NMSS/DUWP
Richard Chang, NMSS/DUWP