

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON, DC 20555-0001

February 9, 2024

NRC INFORMATION NOTICE 2024-01: MINIMIZATION AND CONTROL OF  
CONTAMINATION INVOLVING DISCRETE  
RADIOACTIVE PARTICLES AT DECOMMISSIONING  
FACILITIES

**ADDRESSEES**

All holders of and applicants for an operating license or construction permit for a nuclear power reactor issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," including those that have permanently ceased operations and certified that fuel has been permanently removed from the reactor vessel.

All holders of and applicants for a power reactor combined license, standard design approval, or manufacturing license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." All applicants for a standard design certification, including such applicants after initial issuance of a design certification rule.

All holders of and applicants for an independent spent fuel storage installation license under 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."

All holders of, and applicants for, a fuel facility license under 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

**PURPOSE**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to inform licensees of recent challenges involving detection and contamination control of hot particles, commonly referred to as discrete radioactive particles (DRPs),<sup>1</sup> during plant operations and decommissioning. This communication is intended to reinforce compliance with the 10 CFR Part 20, Subpart F, "Surveys and Monitoring," 10 CFR 20.1501 "General" requirement to use appropriate survey practices to detect and in coordination with 10 CFR 20.1406

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<sup>1</sup> DRPs are typically called "hot particles," which have been described as particles less than 1 mm in any dimension, of high activity, and generally insoluble in water. Particles or objects greater than 1 mm that approximate point sources when field scanning or measuring are also addressed in this discussion due to their similarities to DRPs especially in detection and potential risk-significance. Examples of DRPs are fuel fleas, activated metal shavings from reactor component wear or segmentation, and activated bioshield concrete fragments from segmentation.

“Minimization of contamination,” reduce the spread of residual radioactivity. Residual radioactivity may include hot particles and, therefore, licensees are reminded of the importance of documenting issues important to decommissioning in the reporting and recordkeeping files required by 10 CFR 50.75, “Reporting and recordkeeping for decommissioning planning.” Similar requirements for subject addresses are contained in 10 CFR 72.30, “Financial assurance and recordkeeping for decommissioning” and 10 CFR 70.25, “Financial assurance and recordkeeping for decommissioning.” These efforts will help mitigate future challenges associated with the survey and remediation of contaminated areas at decommissioning sites and potential delays in license termination. The NRC expects that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid potential challenges with mitigation and remediation. However, the information contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

## **BACKGROUND**

The regulations at 10 CFR 20, Subpart F, require that each licensee conduct surveys in areas, including the subsurface, that (1) are necessary for compliance with regulations and (2) are deemed reasonable under the circumstances to assess the magnitude and extent of radiation levels, concentrations or quantities of residual radioactivity, and the potential radiological hazards associated with the detected radiation levels and residual radioactivity. Additionally, according to 10 CFR 20.1201(a)(2)(ii), licensees are required to control the occupational dose to individual adults to a shallow-dose equivalent of 50 rem (0.5 Sv) to the skin of the whole body or to the skin of any extremity. The occupational skin dose limit applies to that dose from exposure to “hot particles” or DRPs during operations. If these radioactive particles are not properly controlled and dispositioned during operations, they may become a residual radioactivity concern at the time of decommissioning of the facility with potential public exposure concerns after license termination.

During plant operations and major component replacement outages, hot particles are likely to be present and additional surveys and controls are commonly instituted. Addressing contamination in a timely manner will prevent both the spread of contamination and exposure to residual radioactivity. Regular surveys of areas likely to have hot particles are typically conducted with the intent to control, identify, and remediate contamination at the source. Controlling and minimizing the spread of contamination are vital to prevent productivity and efficiency losses during decommissioning.

The regulation at 10 CFR 50.75(g)(1) requires that licensees maintain a record of spills or other unusual occurrences involving the spread of contamination in and around a facility or site. These records include any known information on the identification of involved nuclides and their quantities, forms, and concentrations. These records may be limited to instances when significant contamination remains even after any clean-up procedures are used or when there is a reasonable likelihood that contaminants may have spread to inaccessible areas or porous materials and apply during decommissioning.

In the 1997 final rule on decommissioning planning (76 FR 35511), the NRC amended its regulations to improve decommissioning planning by establishing a new regulation at 10 CFR 20.1406, “Minimization of contamination,” and amending the regulation in

10 CFR 20.1501(a). These regulations state that the surveys of areas include the subsurface to evaluate residual radioactivity. As described in the 1997 final rule, “residual radioactivity” that is significant for decommissioning planning is a quantity of radioactive material that would require remediation during decommissioning to meet the unrestricted use criteria of 10 CFR 20.1402, “Radiological criteria for unrestricted use.” Consistent with 10 CFR 50.75(g) requirements, licensees maintain records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site until the license is terminated. The regulation applies to events that occur while the plant is operating and during decommissioning. The requirement outlined in 10 CFR 20.1501(b) is associated with the existing 10 CFR 50.75(g) provisions in requiring that survey records of subsurface residual radioactivity are kept with records important for decommissioning.

In 2008, the NRC issued Regulatory Guide 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life Cycle Planning,” and, in 2012, issued Regulatory Guide 4.22, “Decommissioning Planning During Operations.” Both Regulatory Guides are focused on contamination control during design and operations to facilitate future decommissioning. This guidance provides a threefold contaminant management philosophy during active decommissioning: (1) prevention of unintended releases, (2) early detection, if there is unintended release of radioactive contamination, and (3) prompt assessment to support a timely and appropriate response.

While DRPs in the outside environment (outside buildings or containment) are not specifically addressed in NRC guidance during decommissioning, reviewing the lessons learned below, employing the above containment management philosophy, having a good understanding of NUREG-1575, “*Multi-Agency Radiation Survey and Site Investigation Manual*” (MARSSIM) guidance and maintaining good surveying practices could prevent delays in decommissioning. MARSSIM provides detailed guidance on planning, conducting, evaluating, and documenting building surface and surface soil final status radiological surveys for demonstrating compliance with dose or risk-based regulations or standards. MARSSIM focuses on the demonstration of compliance during the final status survey following scoping, characterization, and any necessary remedial actions. The NRC staff is currently determining the appropriate guidance to address this form of contamination throughout decommissioning.

## **DISCUSSION**

As more plants have entered decommissioning, the NRC noted inconsistencies in the types of events entered in the 10 CFR 50.75(g) file and the level of detail documenting spill or leak events at decommissioning sites. In accordance with 10 CFR 50.75(g), licensees are required to document “significant” residual radioactivity that remains or when there is reasonable likelihood that contaminants may have spread to inaccessible areas. These records combined with characterization information such as the involved nuclides, quantities, forms, and concentrations are important to maintain so that NRC staff can review how the licensee conducted surveys and assessed the dose from material left in place. Licensee understanding of the characteristics and location of residual radioactivity for final status surveys is vital to addressing the impacts of inaccessible areas. A site may be challenged with demonstrating compliance with the radiological criteria for license termination if contamination is not resolved before a final status survey (FSS) begins.

As discussed in the Examples of Lessons Learned section, demolition and decommissioning activities can generate or release DRPs that were unknowingly present in equipment or components being removed or dismantled as part of the decommissioning process. The presence of DRPs could result from inadvertent or unintentional contamination of soil during waste loading or from a lack of sufficient ventilation and containment during waste handling operations.

Consistent with 10 CFR 50.82, "Termination of license," specific information is required in a License Termination Plan (LTP). As described in NUREG 1700, "Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans," a description of the techniques that will be employed to remove or remediate surface and subsurface soils, groundwater, and surface water and sediments should be contained in the LTP. DRPs may become an issue even at sites with no history of fuel failure or releases during operation, because DRPs may be produced and released during the segmentation or dismantling of reactor vessel internals and other contaminated piping, equipment, or components. Often, the Historical Site Assessment and site characterization activities are completed well in advance of when the LTP is submitted to the NRC. In some cases, site characterization occurs prior to many of the segmentation and dismantling activities that may contribute to the spread of contamination. In multiple cases, contamination events have occurred after the LTP license amendment request is submitted to the NRC and, in some cases, after the LTP is approved.

The NRC may need to perform additional work to evaluate the adequacy of the licensee's compliance with regulations when uncertainties arise regarding the appropriateness of licensee surveys. This may include requests for additional information and potential license amendment requests to incorporate the appropriate survey techniques or dose considerations into the LTP.

### **Examples of Lessons Learned**

During active decommissioning, radioactive cross-contamination of site soil involving DRPs has occurred at reactor facilities due to material movement from buildings, debris piles or stockpiles, or waste containers. There have been instances of untimely or inadequate surveys conducted after cross-contamination involving DRPs. Discovery of DRPs during decommissioning operations and during confirmatory surveys resulted in increased regulatory oversight licensee effort to assess the presence and risk significance of the DRPs.

Below are summaries of recent DRP issues:

#### **Example 1**

Licensee surveys at a decommissioning nuclear power reactor site detected DRPs near containment hatch openings and surrounding survey units. The surveys were to be used for FSS to show license termination compliance within the power block land area. The DRPs, in the form of fuel fragments and metal shavings generated during reactor internal segmentation activities, were thought to have been released from containment and deposited on soil. The release occurred due to insufficient negative pressure during the movement of potentially contaminated equipment and large components through enlarged equipment hatches of containment buildings before the erection of waste loadout tents. The DRPs could have been dislocated by rain or wind, or during rigging activities from packaged waste during loading.

Without appropriate use of safety and radiological control protocols, it is possible for DRPs to be dislocated from the material during the removal process or waste liner transfers to licensed casks. DRP clean-up was achieved through a combination of FSS and a confirmatory survey for the area.

### Example 2

When a liner was loaded into an overpack, contamination on the outside of the inner liner was spread to the ground and cask, then spread further when the shipping cask was moved to another area of the site. The licensee determined that the contamination was spread by the action of inserting the liner into the overpack. Contamination on the inner liner had dried over a long storage period and was therefore more easily dispersible than normal when the inner liner was loaded into the overpack. In addition, high ambient radiation levels hindered the ability to perform a thorough survey. A timely survey after the packing of the inner liner could have prevented the spread of contamination beyond the localized area. DRP clean-up was achieved through a combination of FSS and Confirmatory Survey.

### Example 3

Concrete debris that was determined to be free of residual radioactive material was in an area that had previously undergone an FSS. Concrete debris that had been cleared by surveys prior to demolition was being staged for removal from the site. The concrete was consolidated in temporary staging areas and may have been moved between staging areas. Some of these staging areas were placed on units that had undergone FSS. Subsequently, DRPs were found in these previously surveyed land areas. The licensee was not able to determine where the DRPs came from or how they were transported. The DRPs may have resulted from building demolition or from subsequent movement of the concrete from the building demolition area into the areas previously determined to be free of residual radioactive material. These practices were not in compliance with the licensee's isolation and control measures. DRP clean-up was achieved through a combination of FSS and Confirmatory Survey.

## PAPERWORK REDUCTION ACT STATEMENT

This IN does not contain new or amended information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 10 CFR 3501 et seq.). Existing requirements were approved by the Office of Management and Budget (OMB) under approval control numbers 3150-0009, 3150-0011, 3150-0014, 3150-0132, and 3150-0151.

## **PUBLIC PROTECTION NOTIFICATION**

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

## CONTACTS

This IN requires no specific action or written response. Please direct any questions about this matter to the technical contact listed below or the appropriate Office of Nuclear Material Safety and Safeguards (NMSS), Reactor Decommissioning Branch, Project Manager.

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## REFERENCES

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**NRC INFORMATION NOTICE 2024-01: “MINIMIZATION OF CONTAMINATION AND CONTAMINATION CONTROL INVOLVING DISCRETE RADIOACTIVE PARTICLES FOR DECOMMISSIONING FACILITIES,” DATE: February 9, 2024**

**ADAMS Accession No.: ML23195A074**

**EPIDS No. L-2023-GEN-0005**

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