DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

February 24, 2023

The Honorable Jennifer M. Granholm
Secretary of Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Granholm:

Some nuclear waste drums at Idaho National Laboratory (INL) pose a risk of deflagration, which could potentially expose workers to radiological waste released from the drum. In a letter dated March 12, 2019, the Defense Nuclear Facilities Safety Board (Board) highlighted the safety risks of these drums. The Department of Energy (DOE) responded by providing examples of improvements in how such drums are staged.

The Board has continued its oversight of how DOE is managing the safety of waste at INL, and finds that additional hazard controls are warranted to enhance safety while workers move potentially flammable drums. Furthermore, DOE could take steps to reduce the need for moving those drums.

DOE recently issued Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, which provides important requirements and guidance to DOE's contractors on how such deflagrations and other over-pressurization events should be analyzed and controlled. DOE and its site contractors are discussing whether and when they will implement this revision to the standard. As the Board stated in its letter dated July 26, 2021, "Careful implementation of the revised standard should help prevent radiological release events…." Implementing the revised standard at INL should address many of the safety issues identified by the Board's review, as detailed in the attached report.

The Board encourages DOE to implement the revised standard at relevant defense nuclear facilities, as well as DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*. Pursuant to 42 United States Code § 2286b(d), the Board requests a briefing within 90 days of receipt of this letter that addresses (1) whether, when and how DOE intends to implement DOE Standard 5506-2021 at INL's defense nuclear facilities and (2) any actions DOE is taking regarding the safety issues described in the attached report.

Sincerely,

Joyce Connery

Joyce L. Connery
Chair

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

September 28, 2022

Flammable Gas Hazards in Idaho National Laboratory's Nuclear Waste Drums

Summary. Members of the Defense Nuclear Facilities Safety Board's (Board) technical staff reviewed how the Department of Energy (DOE) is managing the safety of nuclear wastes that generate flammable gases and vapors at Idaho National Laboratory (INL). As part of this review, the staff held discussions with DOE's Idaho Operations Office and its contractor that operates the relevant waste facilities at INL. When the staff began its review, this contractor was Fluor Idaho, LLC. In January 2022, Idaho Environmental Coalition, LLC became the operating contractor[1].

This review was a follow-up to the April 2018 event at INL's Radioactive Waste Management Complex (RWMC), in which four waste drums over-pressurized due to methane generation. The over-pressurization caused the drum lids to be ejected, spreading radiological waste within the facility (see Figure 1). Following that event, the Board issued a report [1] that highlighted the hazards of waste drums at RWMC that have elevated levels of flammable gas. The Board stated that "RWMC lacks effective controls to prevent or mitigate methane deflagrations." In response, DOE informed the Board of improvements in the staging of drums known to have elevated levels of flammable gas [2].

In this follow-up review, the staff examined the safety of such waste drums at RWMC. While DOE's contractors have improved the procedures regarding the staging of these drums, the staff found that further hazard controls would enhance safety during movement of drums. If a deflagration were to occur during movement, workers could potentially be exposed to radioactive materials, as well as physical impact from a forcefully ejected drum lid. DOE could also take additional steps to avoid the need for moving such drums.

DOE recently issued DOE Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*. This revised standard includes updated content on flammable gas hazards, and the careful implementation of the standard would lead to improved analysis and controls at INL. DOE and its site contractors are discussing whether and when they will implement the revised standard. It is currently unclear whether INL will implement the revised standard.

[1] Given that a contract transition occurred during the review, this report refers generically to 'contractor' when describing practices that continued through the transition.

Figure 1. *One of the drums involved in the April 2018 event [3]*

Scope. The staff's review focused on drums with solid nuclear wastes, including both transuranic waste and low-level waste. These containers are located at RWMC, which consists of the Accelerated Retrieval Project (ARP) and the Advanced Mixed Waste Treatment Project (AMWTP). The wastes originated from various sources, including INL, DOE's former Rocky Flats site, and other sites around the country.

Background. Nuclear wastes like those at INL can generate flammable gases or vapors. There are many mechanisms for generating such gases, including radiolysis, chemical reactions, and evaporation of absorbed liquids [4]. If the concentration of flammable gases or vapors within the headspace of the waste drum reaches the flammable range (i.e., above the lower flammability limit [LFL] and below the upper flammability limit [UFL]), then an ignition source (e.g., a spark) could lead to a deflagration. A deflagration involves the rapid burning of the flammable gas, leading to a rapid pressure increase in the drum, and potentially the release of radiological material from the drum. DOE uses vents on containers (including drums) of transuranic and low-level waste to help dissipate flammable gases before they reach flammable concentrations [5].

In a 2018 event at ARP-V, four waste drums over-pressurized, leading to ejection of the drum lids and a significant portion of the waste. Fluor Idaho's investigation [6] into the April 2018 event at ARP-V found that the event involved the exothermic oxidation of uranium, which led to chemical reactions that rapidly generated methane, a flammable gas. Fluor Idaho found that the methane did not ignite inside the drums in that instance, but the staff notes that deflagrations could occur in the future.

During its oversight after the 2018 event, the staff learned that INL has waste drums with elevated levels of flammable gas, despite using vents. About 10 vented waste drums at RWMC

exceed the LFL[2], and others have gas concentrations that approach the LFL (approximately 10 more containers exceed 25 percent of the LFL). Flammable gases and vapors in these drums include methane, hydrogen, and xylene. Additional waste containers at INL could approach or exceed the LFL since about 10,000 containers have not yet been tested for flammable gas concentrations. DOE only requires that these concentrations be measured before a waste container is shipped to the Waste Isolation Pilot Plant (WIPP), a disposal site in New Mexico. Thus, waste containers can be staged for years at sites like INL before any flammable gas measurements take place.

In 2019, the Board issued a letter and report that discussed the risks of waste drums with elevated concentrations of flammable gases [1]. The Board requested that DOE provide the Board with its "schedule for measuring the flammable gas concentrations in untested product drums at INL." DOE responded [2] that "Untested waste drums will be sampled prior to shipment to WIPP," as a continuation of the existing practice. DOE also stated that Fluor Idaho was "researching the feasibility of conducting waste drum headspace flammable gas sampling on newly packaged drums," but did not implement such sampling.

The Board also requested that DOE provide information on its "safety strategy for such drums that are found to be flammable or near-flammable." DOE stated that such drums would be segregated from other drums (illustrated in Figure 2), that they would be handled and stored "in accordance with approved methods, permits and safety standards," and that its contractor would monitor the level of flammable gas near the drums. This monitoring is intended to ensure that the air in the building (outside the drums) is not also approaching flammable conditions. In the current review, the staff examined the procedures for handling these drums.

Figure 2. *Staging area for waste drums known to have elevated levels of flammable gas*

[2] The number of such containers changes over time. Statistics provided in this report are based on data currently available to the staff. In some cases, measured concentrations are above the UFL. This should not be considered a safe condition, since there is no control to ensure the drums stay above the UFL. Thus, there could be a flammable condition at a future time or at a different location other than where the gas sample was taken.

While the staff was conducting its review, DOE issued a relevant safety standard, DOE Standard 5506-2021. In this revised standard [4], DOE provided refined language on how its site contractors should analyze and control deflagrations and other over-pressurizations in waste containers, including drums. The new standard includes insights from the 2018 INL event. DOE and its various site contractors are currently discussing whether and when the new standard will be implemented.

Discussion. The staff focused on the measures that DOE's contractor for the RWMC takes to prevent or mitigate deflagrations during the movement of waste drums that are known to be flammable or are approaching flammable conditions. The staff concluded that additional hazard controls are warranted during such movement. The staff made observations regarding how the safety analyses for RWMC (prepared and maintained by contractors, approved by DOE) assess the potential consequences of deflagrations. The staff identified further observations regarding how the contractor (currently Idaho Environmental Coalition) is managing the safety of waste drums with elevated levels of flammable gas or vapor.

Additional Controls Warranted During Movement of Higher-Risk Drums—About 10 waste drums at RWMC have flammable gas concentrations[3] known to exceed the LFL. Additional drums have gas concentrations that approach the LFL; about 10 more drums exceed 25 percent of the LFL. These drums pose an elevated risk of deflagrations that could expose workers to radiological waste, and the physical hazard of being struck with a forcefully ejected drum lid. DOE's contractor occasionally moves these drums to a different location within RWMC to take gas samples to measure current concentrations of flammable gases. The movement involves picking up a drum using specialized equipment, placing it on a flat-bed truck, and driving it to another location. The contractor uses the same procedure [7] to move these higher-risk drums that it uses for any other drum.

The procedure did not include any measures that specifically address the safety risks of deflagration in these higher-risk drums. DOE's contractor informed the staff that it follows regulations relevant to flammable gases and that safety is built into its operations and procedures for all waste containers. When asked for a specific example of a relevant hazard control, contractor personnel mentioned that they use specialized equipment for picking up waste drums that precludes the possibility of puncturing the drum, thus removing one possible ignition source. While this is a beneficial measure, it does not preclude other ignition sources that may arise during movement, such as sparks resulting from friction on uranium in the waste, and static discharge.

To illustrate this safety hazard, the staff surveyed historical events and identified three deflagrations that occurred during the movement of drums at the former DOE site at Fernald [8, 9]. The occurrence reports indicate that uranium in the drums reacted with water to form hydrogen, which then ignited during movement. The occurrence reports described one of the events as follows [8]:

[3] For the purpose of this paper, the staff applied commonly tabulated values of the LFL for the relevant gases in air. For example, the LFL of methane in air at room temperature is about 5 volume percent. A refined estimate of the LFL would depend on the entire composition of the gas in the container, which is not available.

The driver moving the trailer heard a single explosion which sounded like the tire blowing on his tugger. The [drum] lids blew approximately 25 feet into the air.…The trailer that held the subject drum had just travelled over a rough section of the road.

DOE could consider alternative strategies or additional controls at RWMC to better address the deflagration hazard posed by higher-risk drums. For example, DOE could assess the feasibility of taking gas samples at the location where the drums are currently staged. This strategy would reduce the need for moving these higher-risk drums. If sampling could be safely accomplished without moving these drums, that would be a preferable approach.

DOE Standard 5506-2021 lists some additional controls that DOE could consider implementing at RWMC. Table 5-1 of the standard identifies lid restraints or impact resistant shielding as "preferred controls"[4] to "Minimize worker exposure" during handling of "suspect"[5] containers. One AMWTP procedure already calls for lid restraints when moving "unvented bulged" waste containers [7]. DOE could consider extending this provision to containers that are vented but still have high levels of flammable gas. Regarding impact resistant shielding, a consultant engaged by Fluor Idaho suggested installing blast shields on forklifts [10]. To the staff's knowledge, the DOE contractor has not implemented that suggestion. In addition to "preferred controls," the standard also lists "alternative controls." The alternative in this case is to "Minimize worker contact with suspect container…." Another AMWTP procedure [7] states that workers should not place their heads or torsos over unvented drums. This provision could be extended to vented drums with high concentrations of flammable gas.

Additionally, DOE could consider better securing drums during movement on the flatbed truck. DOE's contractor informed the staff that strapping drums down is not required for movements within AMWTP. However, toppling of a drum could potentially trigger an over-pressurization or deflagration, while securing the drums would reduce this safety risk.

Inappropriate Consequence Analysis—DOE Standard 3009, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, provides guidance to DOE's contractors on how to perform safety analysis. DOE published the current version of the standard in 2014 [11], while an older version is in use at the RWMC [12]. According to both versions of the standard, DOE contractors estimate the potential consequences of various accident scenarios, and then identify safety controls (i.e., safety class or safety significant controls) to prevent or mitigate scenarios with higher consequences. The documented safety analyses for AMWTP [13] and ARP [14] identified the consequences of drum deflagrations as low or moderate (summarized in Table 1). Per Standard 3009, safety controls are not required for consequences of that magnitude.

[4] Table 5-1 of DOE Standard 5506-2021 is primarily intended for scenarios with consequences that warrant safety class or safety significant controls. For lower consequence scenarios, the standard states "it still may be prudent to apply" these controls.

[5] "Suspect" containers refer to containers with a potential for a deflagration that causes lid loss. See Section 3.3.2.2 of DOE Standard 5506-2021 for a full definition.

Table 1. *Consequences of waste drum deflagrations, as presented in the safety analysis documents for the AMWTP and ARP. The consequences are provided for the three receptors specified in DOE Standard 3009-2014.*

	Facility worker	**Co-located worker**	**Maximally-exposed offsite individual**
AMWTP (deflagration of two drums)	Moderate	8.2 rem total effective dose (TED) (low, per Standard 3009)	0.2 rem TED (low, per Standard 3009)
ARP (deflagration of one drum)	Moderate	9 rem TED (low)	< 1 rem TED (low)

Regarding the consequence analyses performed by DOE's contractor, the staff observed the following:

- ***Airborne release of powdery material***: Some waste at RWMC consists of finely-divided, powder-like material [15] that can be readily released into the air, as illustrated by the 2018 drum event. According to the investigation report [3], personnel in the area "stated there was so much dust and debris in the air [inside ARP-V] that they could not see through the window." Photographs after the event (see Figure 1 and Figure 3) show finely divided material that eventually settled on the floor and other surfaces. Personnel involved with the cleanup also found that a significant fraction of the waste from the drums had been ejected during the over-pressurization event.

Figure 3. *Two of the drums involved in the April 2018 event at ARP-V [3]*

The 2021 revision of DOE Standard 5506 [4] extensively discusses how DOE contractors should analyze deflagrations and other over-pressurization events in containers with powdery waste. Section 4.4.1 of the standard states that the fraction of

the waste released into the air will be a function of the release pressure, and ultimately suggests a composite release fraction[6] of 1.4E-2. The Board has questioned the basis for this value, suggesting it may be too low [16], but the staff is using it here to highlight the content of the revised standard.

The RWMC facilities have not implemented DOE Standard 5506-2021, and thus do not use the composite release fraction of 1.4E-2. The AMWTP analysis [13] (Section 3.4.2.5) assumes the waste consists of contaminated combustible materials. DOE Standard 5506 (both versions) specifies a composite release fraction of 5.4E-4 for that material type in a drum deflagration. Thus, modeling a drum with powdery contents according to the revised standard would result in much higher release fractions.

The ARP analysis [14] (Section 3.4.2.7) did consider a sludge drum with powdery contents. However, the ARP analysis used a composite release fraction that is orders of magnitude lower than the value discussed in DOE Standard 5506-2021. Again, applying the revised standard would result in much higher release fractions.

The information presented in the standard calls into question the technical adequacy of the current safety analyses for the RWMC. DOE and its contractor may have to consider whether a "potential inadequacy of the safety analysis" (PISA) exists [17]. This situation would be addressed by implementing the new standard, which would help ensure that consequence analyses better reflect the risk of deflagrations and over-pressurizations involving finely divided material. If the RWMC analyses were revised to incorporate the composite release fraction of 1.4E-2, and no other changes were made, the consequences to the co-located worker would be high enough to require safety significant controls for deflagrations.

- ***Co-located worker analysis***: In the unmitigated analysis, the AMWTP analysis assumes that the co-located worker evacuates, such that this receptor is not exposed to the plume after 15 minutes. The analysis states, "A collocated worker at 100 m (328 ft) is assumed to quickly become aware of the fire and take action. However, for this analysis, it is conservatively assumed that evacuation is delayed for 15 minutes."

  Regarding the unmitigated analysis, DOE Standard 3009-2014 [11] does not support the assumption that a co-located worker would evacuate. The standard discusses how the unmitigated analysis could account for the facility worker (immediately in the vicinity of the hazard) recognizing the event and leaving, but not the co-located worker. Thus, the assumption in the AMWTP analysis is inconsistent with DOE Standard 3009-2014. While the AMWTP analysis is using an older version of the standard [12], that older version does not address the co-located worker. This situation illustrates the importance of applying the new standard, which is more comprehensive.

[6] The composite release fraction is the fraction of the radiological material in the waste container that becomes airborne in a respirable form. Using the terminology of DOE Standard 5506 (both versions), it is the product of the damage ratio (DR) (if applicable), the airborne release fraction (ARF), and the respirable fraction (RF). If there are multiple release mechanisms, the composite release fraction may be the summation of several DR*ARF*RF terms.

- ***Facility worker analysis***: The safety analyses for AMWTP and ARP qualitatively assign "moderate" consequences to the facility worker, who is assumed to be in the immediate vicinity of the safety hazard. The basis for this qualitative judgment is not clear.

  DOE Standard 3009-2014 defines "high" consequences to the facility worker as "Prompt death, serious injury, or significant radiological and chemical exposure." The older version of Standard 3009 currently in use at RWMC uses similar language [12]. DOE Standard 5506-2021 points out that "A lid that is forcefully ejected from a waste container during a deflagration presents a physical hazard to a facility worker. This hazard could cause serious injury or death to the worker and may necessitate controls for facility workers who are handling *suspect* drums."

  The 2018 event at INL's ARP-V illustrates this hazard. In that event, one of the drum lids was so forcefully ejected that it penetrated one layer of the fabric ceiling, and then lodged in the ceiling. A worker who is struck by such a forcefully ejected drum lid can be expected to suffer "prompt death" or "serious injury", which suggests consequences to the facility worker should be considered "high." Further, there is at least a potential for "significant radiological" exposure to the facility worker. While the assessment of that exposure necessarily involves qualitative judgment, it is not clear why the contractor did not assign high consequences.

- ***Sympathetic deflagrations***: The original version of DOE Standard 5506 discusses the analysis of sympathetic deflagrations, in which a deflagration in one waste container leads to a deflagration in one adjacent container. The 2021 version of the standard states there may be special cases where multiple (more than two) deflagrations should be considered: "However, if multiple *suspect* drums are intentionally co-located such as for remediation, two or more sympathetic deflagrations should be evaluated for the unmitigated analysis to correspond to the number of *suspect* containers being staged/stored. The mitigated analysis should consider whether drums should be physically separated from adjacent drums that could cause a sympathetic deflagration." Given how the RWMC contractor stages drums with elevated levels of flammable gas (see Figure 2), the language in the revised standard may be applicable.

  The safety analysis for ARP only considers a deflagration in a single drum. The AMWTP analysis includes a sympathetic event with two drums. These analyses should be revisited, considering the revised standard.

These observations could have significant implications for the consequence analysis of deflagrations at AMWTP and ARP. They also demonstrate the importance of updating facility safety analyses to current DOE standards (i.e., DOE Standard 3009-2014 and DOE Standard 5506-2021). As stated above, the revised release fractions in DOE Standard 5506-2021 would result in much higher estimates of the consequences. In the absence of other changes, there could be a need for safety significant controls.

Opportunities for Identifying Higher-risk Containers—DOE's contractor has implemented controls for staging waste containers known to have elevated levels of flammable gases (i.e., above the thresholds for shipment to WIPP). These controls include segregating these containers from other containers. Segregation should help enhance safety[7], since it helps keep workers away from higher-risk containers as they handle other containers. Thus, it would be beneficial for DOE's contractor to identify any further containers with elevated levels of flammable gas, so that it could segregate those containers as well.

Some 10,000 waste containers at INL have not yet been tested for flammable gas concentrations. If there is a way to identify containers that are more likely to have elevated levels of flammable gases, INL could prioritize those containers for testing (or assume that they are problematic, pending testing). DOE's contractor said there is no practical means of prioritizing containers for testing because there is insufficient data on the contents of individual containers.

According to the information that site personnel provided to the Board's staff, some containers that are currently above the LFL (i.e., potentially flammable) contain material recovered during the cleanup after the April 2018 event. Thus, the waste that caused that earlier event is still generating enough methane to cause a deflagration today. Contractor personnel stated that some waste drums related to that cleanup have not yet been sampled for flammable gas concentrations. Depending on the nature of their contents, those drums could also have elevated methane concentrations. Thus, testing those drums represents an opportunity to identify some higher-risk containers.

It is also important to revisit the approximately 10,000 untested containers in the context of DOE Standard 5506-2021. That standard provides a revised definition for "suspect" containers. The definition includes containers with an "inadequate vent (e.g., flammable gas generation rate greater than venting capability)," along with waste that has a potential for exceeding the LFL. The definition of "suspect" also includes cases where "waste stream data is either inadequate or unavailable to rule out" that potential. Given that INL has some drums that are known to exceed the LFL, and it lacks the data to identify which of the untested drums may also exceed the LFL, at least some of the untested drums should qualify as "suspect." As mentioned above, Table 5-1 of DOE Standard 5506-2021 includes required control strategies for high-consequence scenarios involving suspect containers. Thus, implementation of the new standard would involve revisiting the analysis and controls for the untested population.

Lack of Long-term Plan for Some Waste—About 50 waste containers at RWMC cannot be shipped to WIPP due to concentrations of flammable gas that exceed the thresholds for shipment [18]. The DOE contractor's primary strategy for these containers is to wait for the flammable gas concentrations subside on their own. In some cases, the contractor has installed additional filtered vents (see Figure 4) to increase the venting capacity of the containers. However, despite these measures, some containers have been staged at INL for years and are still above the shipment limits.

[7] Co-locating higher-risk containers together does introduce some risks, as mentioned in the section on sympathetic deflagrations.

DOE does not appear to have a long-term plan for these containers if flammable gas concentrations do not sufficiently decrease over time. The contractor eventually may have to open these containers and take further actions. It would be prudent to begin planning now for any such actions, including the hazards involved in the work. Active operations at ARP and AMWTP are expected to cease in the coming years, at which point the capability of doing the needed work may be diminished.

Figure 4. *Waste drum at INL with multiple vents, with adhesive filters covering the vents*

Historically, DOE's contractors for RWMC have sometimes attempted to repackage waste to address waste containers with elevated levels of flammable gas. Contractors have taken waste from a drum and repackaged that waste into one or more new drums. In some cases, the repackaged drums were also above the shipping limits [1]. Thus, simply repackaging the material may not be a successful strategy.

Considerations for the Implementation of DOE Standard 5506-2021—As DOE and its contractors discuss whether to implement the revised standard at various facilities, one consideration may be the remaining lifetime and mission of those facilities. While some of the mission at RWMC is ending, other operational activities will likely continue for years. These activities include the staging of waste containers, pending shipment to disposal sites such as WIPP. Other future activities could include remediation of waste that does not meet WIPP's waste acceptance criteria. The safety risks highlighted in this report relate to such enduring missions, and the staff therefore sees the implementation of the revised standard as beneficial to safety. The implementation of the standard could be tailored to the remaining mission (i.e., revisions to safety analyses would not need to cover mission work that has been completed).

Conclusion. The staff reviewed the safety of waste drums at INL's RWMC that are known to have elevated concentrations of flammable gases. The staff found that additional hazard controls are warranted to prevent or mitigate deflagrations that could be initiated during the movement of such drums. DOE could consider changing its process for taking gas samples

from such drums to reduce the movement of these drums, thus reducing the likelihood of deflagrations in these drums.

The staff also identified deficiencies regarding how DOE's contractors analyze the consequences of a deflagration, and how they are managing higher-risk containers. DOE's recent revision of DOE Standard 5506 contains relevant guidance on how deflagrations and other over-pressurizations should be analyzed and controlled. The topics in this report demonstrate the value of implementing the current version of the relevant DOE standards: Standard 5506-2021 and Standard 3009-2014.

References

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[10] Jensen Hughes, Inc., *Independent Evaluation of the Drum Event Controls at ARP V (WMF-1617)*, Attachment 1 to EPF MISC-1426, Combustible Gas Generation and Mitigation in ICP Waste, Idaho Cleanup Project, 2019.

[11] Department of Energy, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, DOE Standard 3009-2014, 2014.

[12] Department of Energy, *Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, DOE Standard 3009-94 Change Notice 3, 2006.

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[16] Defense Nuclear Facilities Safety Board, *Staff Review of DOE Standard 5506*, Letter to Secretary of Energy Jennifer M. Granholm, Department of Energy, July 26, 2021.

[17] Department of Energy, *10 CFR Part 830, Nuclear Safety Management*, 2020.

[18] Department of Energy, *Contact-Handled Transuranic Waste Authorized Methods for Payload Control*, CH-TRAMPAC Rev 4, 2013.