DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

November 16, 2021

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

Dear Secretary Granholm:

The Defense Nuclear Facilities Safety Board (Board) reviewed the safety basis for the Central Waste Complex (CWC) at the Hanford Site, identifying weaknesses and areas for improvement. The Board understands that the Department of Energy (DOE) and the contractor are developing a revised documented safety analysis (DSA) intended to improve the technical bases for safe operation of this facility. Therefore, the Board's observations are discussed in detail in the staff report enclosed with this letter for your information and use while developing this revision.

The Board notes that incorrect application of DOE guidance may have led to underestimating the consequences of an accidental release from this facility, potentially leading to an inadequate set of safety controls. Although the safety basis documents appear to have applied DOE guidance as provided in DOE Standard 5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, DOE's Richland Operations Office identified a non-conservative estimate of the materials at risk which could increase the estimated public and worker exposures due to an unintended release of radioactive materials by an order of magnitude. Additionally, the contractor has not adequately analyzed and controlled potential energetic chemical hazards from waste stored at the facility. Consequently, events such as those that DOE experienced at the Waste Isolation Pilot Plant (2014) and Idaho National Laboratory (2018) may not be adequately prevented.

While DOE has issued a revised version of DOE Standard 5506, the standard is not yet implemented and included in DOE contracts. The Board advised DOE in a letter dated July 26, 2021, that a comprehensive and complex-wide plan for rigorous implementation of DOE Standard 5506 at defense nuclear facilities will improve safety.

The Board notes that DOE did not formally approve the CWC consolidated hazards analysis (CHA) that systematically identifies hazards and the controls needed for their prevention or mitigation. Although the CHA has been made available for DOE review, the process used at

Hanford does not require that DOE formally approve the document before it is implemented. Subpart B, "Safety Basis Requirements," under Title 10, Code of Federal Regulations, Part 830 (10 CFR 830), *Nuclear Safety Management*, considers hazards analyses to be part of the DSA that is reviewed and approved by DOE, and pertinent changes to the approved DSA to be subject to the unreviewed safety question process invoked by the rule. The Board identified a similar practice at the Savannah River Site in a letter to DOE dated July 16, 2010. It would be prudent for DOE to ensure that safety bases for defense nuclear facilities meet the requirements of Subpart B to 10 CFR 830.

Again, the enclosed report describes the issues identified during the review and is provided for your information and use.

Sincerely,

Joyce L. Connery

Joyce Connery
Chair

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

July 23, 2021

Review of the Central Waste Complex Safety Basis

Summary. The Defense Nuclear Facilities Safety Board's (Board) staff reviewed the safety basis documents and supporting references for the Central Waste Complex (CWC) at the Hanford Site. The staff identified several weaknesses and opportunities for improvement that were discussed with contractor, Central Plateau Cleanup Company (CPCCo), and Department of Energy (DOE) representatives during a meeting on April 22, 2021, and broadly fall into the following categories:

- ***Waste Material Characterization:*** Although Hanford processes and stores transuranic (TRU) waste, it is not a current TRU waste generator site supported by the National TRU Program (NTP). The lack of involvement and active agreement between the Hanford Site and NTP may result in costly rework or failure to identify safety issues.

- ***Hazards and Accident Analyses*:** The master documented safety analysis (MDSA) for CWC does not fully analyze some unique accident scenarios that may warrant consideration for specific controls. Rather, some scenarios are assumed to be bounded by other events or conditions across the Solid Waste Operations Complex (SWOC), which includes T-Plant, the Burial Grounds, and the Waste Receiving and Processing (WRAP) Facility, in addition to CWC.

- ***Adequacy of Credited Controls*:** Identification and formality of necessary controls are lacking in several instances. There is heavy reliance on operational practices.

Background. CWC is one of four facilities that make up Hanford's SWOC, which consists of the T-Plant Complex, the Low-Level Burial Grounds, WRAP, and CWC. These facilities are functionally interrelated, each handling and storing low-level, TRU, and other hazardous wastes. CWC's mission is to receive, stage, store, treat, and ship a variety of waste.

SWOC is operated under a combined MDSA [1] that was originally implemented by CH2M HILL Plateau Remediation Company (CHPRC). CHPRC's management responsibility for the facilities transitioned to CPCCo in January 2021. The contract change did not result in any significant changes at the CWC facility. CPCCo is currently updating the MDSA to separate the Low-Level Burial Grounds, WRAP, and CWC from the T-Plant Complex. This revision, known as Revision 0 of the documented safety analysis (DSA), is currently scheduled for completion by the end of February 2022.

To evaluate the safety posture of CWC, the Board's staff reviewed pertinent portions of the MDSA describing the hazards and accident analyses, and identification and classification of controls, related to CWC. In addition to the MDSA, the review included the technical safety requirements (TSR) [2] document and the related references in the MDSA. The Board's staff met with representatives from DOE and CHPRC in November 2020, followed by two additional meetings with representatives from CPCCo and DOE in February 2021. The Board's staff identified several weaknesses and opportunities for improvement that were discussed with DOE and CPCCo representatives on April 22, 2021.

Discussion. The MDSA identifies the bounding event for SWOC to be a large inside fire caused by a high speed, loaded truck penetrating a facility and impacting stored waste. This event results in an unmitigated dose consequence of about 275 rem total effective dose (TED) to the collocated workers at 100 meters from the facility, and about 2.5 rem TED to a member of the public at the site boundary. The dose at the site boundary is significantly lower than the DOE Evaluation Guideline of 25 rem TED for identification of safety class controls; therefore, none have been identified for CWC. Several safety significant controls have been identified for protection of the workers. These include container vents and fire suppression systems for inside storage buildings. Specific administrative controls (SAC) include material at risk (MAR) limits (called source strength control at CWC), vehicle access control, and a container integrity program.

The MDSA contains the following statements regarding compliance with DOE guidance: "A new Material at Risk (MAR) algorithm was used in the accident analyses and other changes were made to be consistent with the methodology of DOE-STD-5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*." The DOE Richland Operations Office (DOE-RL), however, concluded that the methodology described by the contractor "refers to the 'average' drum, but applies the median instead of the mean value. For the evaluated inventory, the mean is approximately an order of magnitude higher than the median value [3]." DOE-RL provided these observations to the contractor in April 2020 (after the approval of the MDSA) "for incorporation into Revision 0 of a DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, based Safety Basis for the Solid Waste Operations Complex without the T-Plant facility." Consequently, the accident analyses presented in the MDSA appear to have underestimated the unmitigated consequences. At this time the full impact on the controls to be proposed in Revision 0 of the DSA remain unknown, while CPCCo corrects DOE-RL's observed discrepancy.

The following sections summarize the Board's staff's observations after reviewing the approved version of the MDSA:

Waste Material Characterization—HNF-EP-0063, Rev 18, *Hanford Site Solid Waste Acceptance Criteria* [4], identifies CWC as a storage and treatment unit for defense nuclear facility waste generated by CPCCo activities as well as non-defense nuclear facility waste generated by other Hanford activities. Waste types include low-level waste (LLW), mixed low-level waste (MLLW), TRU, TRU mixed (TRUM), Toxic Substance Control Act of 1976,

polychlorinated biphenyl, and other waste types requiring treatment before disposal. The primary types of waste processed or stored are LLW, MLLW, TRU, and TRUM[1].

Hanford is not currently operating under a TRU waste certification program supported by NTP. There is no active Central Characterization Program (CCP) component for certification of the waste currently stored or generated at Hanford, and NTP is not approving Hanford waste streams. Therefore, Hanford's TRU waste is not presently being certified and shipped to the Waste Isolation Pilot Plant (WIPP) for disposal. Hanford last shipped transuranic waste to WIPP in 2011. All TRU or TRUM waste stored at CWC has been assigned to a waste stream recognized by NTP. CCP is expected to perform its role under the WIPP Certified Program in the future. Under a recent Tri-Party Agreement with Washington State and the Environmental Protection Agency, Hanford can complete TRU waste shipments to WIPP by as late as September 2050. According to this agreement, 99 percent of the TRUM waste would be shipped to WIPP by 2040.

With NTP certification of TRU waste as safe and approved for disposal at WIPP still years in the future, the staff review team believes that interactions with NTP could be a valuable aspect of the safety determination for TRU waste stored or generated at Hanford, which ultimately could lead to the successful disposition of TRU waste at WIPP. On the other hand, the current lack of involvement and active agreement between the Hanford Site and NTP could result in costly rework or failure to identify safety issues that would prevent certification.

Generator site contractors and DOE typically rely on the expertise of NTP to recognize and evaluate difficult or unknown waste hazards. Both the generator site contractor, CPCCo, and DOE are assuming the risk by generating TRU waste without the direct involvement of NTP. Potential hazards associated with generating at-risk TRU waste may not be fully recognized and addressed in safety basis documents by the generator site contractor and DOE without access to the expertise of NTP. An active dialogue and involvement with NTP could offer added value and risk reduction potential.

Hazards and Accident Analyses—The MDSA describes hazards and accident analytical methodologies and results, and documents the controls identified for protection of workers and the public. The detailed hazards analysis that supports the derivation of controls for protection of potential receptors is documented in a separate reference to the MDSA called a consolidated hazards analysis (CHA) [6]. The Board's staff's review of the MDSA, CHA, and supporting references identified the following weaknesses and observations that should be addressed to ensure consistency with Subpart B to 10 CFR 830, *Nuclear Safety Management*, and its safe harbor methodology as described in DOE Standard 3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis*:

[1] As of October 22, 2020, the CWC inventory, based on waste volume, comprises 1 percent LLW, 1 percent MLLW, 30 percent TRU, and 68 percent TRUM. CWC is authorized to receive and store contact-handled waste as well as a limited amount of remote-handled waste. Most of the hazardous waste held at CWC falls under the Resource Conservation and Recovery Act of 1976 and is regulated by Washington State under Washington Administrative Code 173-303, *Dangerous Waste Regulations* [5]. CWC can also store waste that falls under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 cleanup activities.

Lack of DOE Approval of the CHA: The CHA for the MDSA describes a systematic analysis of all hazards identified for SWOC facilities. The controls identified as safety significant for protection of workers or the public are highlighted for insertion into the MDSA and the TSR documents. CPCCo does not consider the CHA to be part of the SWOC safety basis and therefore does not believe that it must be approved by DOE along with the MDSA.

Subpart B, "Safety Basis Requirements," under 10 CFR 830 considers the hazards analysis to be part of a DSA that is submitted for DOE review and approval:

> §830.204 (b) *The documented safety analysis for a Hazard Category 1, 2, or 3 DOE nuclear facility must, as appropriate for the complexities and hazards associated with the facility:…*
> (2) *Provide a systematic identification of both natural and man-made hazards associated with the facility;*
> (3) *Evaluate normal, abnormal, and accident conditions, including consideration of natural and man-made external events, identification of energy sources or processes that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials, and consideration of the need for analysis of accidents which may be beyond the design basis of the facility;*
> (4) *Derive the hazard controls necessary to ensure adequate protection of workers, the public, and the environment, demonstrate the adequacy of these controls to eliminate, limit, or mitigate identified hazards, and define the process for maintaining the hazard controls current at all times and controlling their use;….*

As such, Subpart B requires that changes to or inconsistencies identified in hazards analyses and their control sets be subject to the unreviewed safety question determination process as described in a procedure reviewed and approved by DOE. Lack of DOE approval of the CHA creates an inconsistency with the process established by DOE in 10 CFR 830.

Lack of Adequate Hazards Analysis: The MDSA [1] contains a discussion related to low flashpoint modules and alkali metal waste modules:

> *In the 27 low flashpoint waste storage modules, there are approximately 950 drums containing a general mix of flammable liquids with a low radioactivity concentration and other radioactive waste…. All modules are designed with convection draft ventilation, which includes inlet vents near the floors and exhaust vents near the ceilings to exhaust potentially ignitable gas accumulations. The vents prevent heat and VOC* [volatile organic compound] *buildup in the modules. Some* [low-flashpoint waste storage] *modules are designed with explosion relief panels.…*

The above discussions describe potential hazards associated with ignitable gas build-up inside the modules that could lead to an explosion and identify several features of these modules designed to prevent such an event. However, Table A-1 of the CHA does not identify such

events as related to CWC, though the modules have been described in the MDSA and authorized for storage.

Similarly, the MDSA contains the following discussion related to south alkali metal (SAM) Storage Modules:

> *There are one hundred sixty-eight 208-L (55-gal) steel drums of sodium stored in the alkali metal storage modules.…No sprinklers or water supply are provided for the SAM storage modules to avoid water and waste material incompatibilities. Convective ventilation involving roof and wall vents prevents possible buildup of any hydrogen offgas from the radioactive sodium. In accordance with UBC 198, Section 910 requirements, the explosion relief panels are designed to open at 20 lb/in^2 and provide a venting area of 1 ft^2 for each 50 ft^3 of interior space. The doors are designed to withstand internal pressures up to 100 lb/in^2.*

Per 10 CFR 830, hazards must be initially identified in the CHA document, and appropriate controls for those hazards must be derived. Relevant explosion hazards are not identified or addressed in the CHA, nor are the appropriate design features identified in the TSR to ensure they are maintained and provide the required explosion prevention function. Consequently, the hazards analysis is incomplete and the identified control set may be inadequate.

Inappropriate Use of Screening Criteria: The Hazardous Material Protection Program and Organization section of the MDSA states:

> *No single location inventory of hazardous waste chemicals within the SWOC exceeds the applicable threshold quantity* [TQ] *or threshold planning quantity screening criteria values of 29 CFR 1910.119, 'Process safety management of highly hazardous chemicals;' 40 CFR 355, 'Emergency Planning and Notification;' or 40 CFR 68, 'Chemical Accident Prevention Provisions.' Consequently, it is not necessary to perform a quantitative assessment of the adequacy of existing controls or to provide credited controls for hazardous materials to reduce the risks from accidents.*

However, the use of threshold quantities as screening criteria to exclude chemical hazards from further analysis is inconsistent with DOE directives, guidance, and requirements. Chemicals with significantly smaller amounts than these threshold values may cause irreversible health hazards to workers. The guidance provided in DOE Standard 3009-94 does not contain any allowance for exclusion of chemical hazards from further analysis based on their TQ values. Such chemical hazards may only be excluded if they don't result in "significant chemical" consequences to workers. The revised version of DOE Standard 3009-2014 provides explicit criteria and a methodology for evaluation of the consequences of chemical and toxicological hazards that are based on a time-weighted average concentration and comparison with protective action criteria.

Insufficient Justification for Bounding Analyses: An accident at the WRAP facility is used to bound the Medium Indoor Fire (FIR-6) accident consequences at CWC. The WRAP scenario involves a 14-gallon hydraulic oil spill and fire initiated by a stacker/retriever vehicle accident that involves 52 waste drums[2]. However, the fire hazards analysis (FHA) [7] supporting the MDSA analyzes a forklift accident involving 26 gallons of fuel that results in a fire involving 168 waste drums at CWC. The WRAP scenario was stated to have been chosen because "Unmitigated consequences for the 26 gal fire were determined to be bounded by the FIR-6 stacker/retriever fire based on the number of drums that experience lid loss and partial ejection of contents." Neither the FHA nor the MDSA presents a consequence analysis for the CWC forklift scenario. Therefore, it is not clear how the WRAP scenario bounds the forklift scenario at CWC.

The Board's staff's review identified that CHPRC-0308, *Fire Analyses for the Solid Waste Operations Center Master Documented Safety Analysis* [8], addresses a CWC forklift accident whereby many more drums (168 versus 52) are affected. Since more than three times the number of drums may be affected, the consequences of a CWC forklift accident could be significantly higher than analyzed. The CWC forklift scenario (involving 168 drums) needs to be sufficiently analyzed to ensure that its consequences are bounded by the WRAP event and no additional controls are needed.

The Board's staff also noted that some additional potential bounding accident scenarios may not be properly analyzed. CPCCo representatives confirmed that both propane-powered forklifts and diesel-powered vehicles may be in the vicinity near waste drums at the same time to support operations. The MDSA provides individual analyses for fires initiated by and involving each type of vehicle[3]. However, the bounding fire accident scenarios do not account for the possibility of vehicles with different fuel loads being in the same vicinity at the same time. It is possible that the consequences of this accident could be greater than what is presented in the current analyses. In such a condition, more waste drums could be involved either by creating a secondary fuel pool fire, boiling liquid expanding vapor explosion (BLEVE) involving drums in the same waste array, or causing additional drums to be involved from across the aisles (created to prevent fire propagation) or involvement in a fuel pool fire/BLEVE. Either scenario could overcome existing controls and result in consequences potentially higher than those evaluated in the MDSA.

Lack of Evaluation of Energetic Chemical Reactions: The MDSA considers a single container deflagration accident scenario (FIR-1) to bound loss of confinement due to all energetic chemical reactions in a waste drum. As seen in the Idaho National Laboratory and WIPP radioactive materials release events, the initiating mechanism, consequence, and control set for an energetic reaction as compared to a gas deflagration are distinct and therefore warrant separate analysis as unique events. The basis for this issue aligns with the discussion raised by the Board regarding Los Alamos National Laboratory Area G in DNFSB Tech-46, *Potential*

[2] The unmitigated consequences are estimated to be 29.5 and 0.26 rem TED to the collocated workers at 100 meters and maximum offsite individual at the site boundary, respectively.
[3] A medium outside fire involving a propane-powered forklift results in "moderate" consequences to the workers at 100 meters (moderate is defined as unmitigated consequence of between 25 and 100 rem TED).

Energetic Chemical Reaction Events Involving Transuranic Waste at Los Alamos National Laboratory, dated September 2020. DOE's updated revision to Standard 5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, when implemented, will require energetic chemical reaction events to be appropriately identified, analyzed, and controlled.[4]

Potentially Unanalyzed Event: At the Waste Receiving and Staging Area (WRSA), waste receipt and shipment are performed in the same area where vehicles are operated and staged. However, WRSA does not have vehicle control limits with respect to fuel load, such as 120 gallons of combustible liquids or 40 gallons of propane limits set in other areas or inside facilities (see the discussion in the Alignment of Functional Requirements to Credited Safety Functions below). Therefore, WRSA could have a fire that is larger than the bounding fire scenario currently analyzed for other storage locations.

The MDSA and TSR both state that there are no vehicle access controls with respect to fuel limits for vehicles in WRSA. A service vehicle with up to 1010 gallons of flammable/combustible fluids may be staged in this area to facilitate servicing of CWC vehicles. This amount of combustible fluids is in addition to the 50 gallons of diesel fuel that the service vehicle uses. It is possible that a service vehicle could be engaged in a fire involving more than 1000 gallons of combustible fluids, impacting other vehicles and waste drums in this area. The Board's staff confirmed with CPCCo that there was no analysis for a service vehicle fire that may involve other vehicles staged in this area. Since the conditions at WRSA (fuel volumes, vehicle access, and general pace of operations) differ from those in the normal storage locations that are analyzed in the MDSA, WRSA would warrant separate analyses for identification of dedicated controls.

Additionally, TSR controls allow staged shipments to remain in this area until the end of the following workday. The CPCCo representatives stated there are "good operating practices" that are included in work orders but are not captured as requirements in any formal procedure, such as removing the tractor from the trailer. CPCCo representatives believe that the risk is minimized because the shipment is not in motion and the tractor is removed from the trailer. It would be prudent for the contractor to formalize these good practices to avoid deterioration of safety in the future.

Adequacy of Credited Controls—The Board's staff noted several weaknesses in identification and implementation of controls related to the facility fire and explosion accident scenarios. The *Hanford Safety Analysis and Risk Assessment Handbook (SARAH)*[5], HNF-8739 [9] describes the applied methodology and criteria for control selection. In general, though safety-significant administrative controls are identified in the MDSA where required, the ability of these controls to provide the necessary risk mitigation is not fully supported in all cases. Noted weaknesses generally fall into the following categories, with detailed discussion below:

- Alignment of functional requirements with credited safety functions,

[4] See also the Board Letter on DOE Standard 5506 issued July 26, 2021.
[5] SARAH was used by the contractor for implementation of the safe harbor methodology provided in Standard 3009-94. In a letter dated May 12, 2017, DOE-RL rescinded its previous approval to use SARAH.

- Protection of analytical assumptions,
- Less than adequate control due to implicit assumptions, and
- Formality of control implementation.

Alignment of Functional Requirements to Credited Safety Functions: The Large Inside Facility Fire scenario (FIR-7) is the bounding fire scenario for CWC, resulting in high consequences for the collocated worker and low consequences to the members of the public. It considers several initiating events, including a large waste transport vehicle traveling at high speed that collides with an array of waste containers, resulting in an instantaneous release of fuel and a fire. This fire is assumed to propagate through the facility, impacting MAR as a function of the amount of fuel involved.

A vehicle access control is identified as a safety significant TSR-SAC. It is the only mitigative control identified for this scenario at CWC. The vehicle access control functional requirements only limit the amount of the fuel: "The maximum quantity of fuel or other COMBUSTIBLE/FLAMMABLE liquids for any vehicle (including forklifts) operating within the CWC boundary is 125 gal" and "Vehicles/containers with more than 151 cumulative Liters [40 gal] of propane in a single locations SHALL not be allowed within the facilities or within 7.6 m of outside arrays of stored or staged waste containers."

The vehicle fuel limit solely serves to bound the event consequence by limiting the size of the fire. It does not prevent the event, nor does it reduce the probability of the fire event. During discussions, CPCCo personnel confirmed that there are no implemented aspects of the CWC vehicle access control that can credibly reduce the probability of a fire. Expanding the credited safety function of the vehicle access control to include improved vehicle barriers or other engineered features could enhance the safety posture of the facility by preventing the event or reducing its probability of occurrence. Although currently some fences, berms, and other barriers are in place at CWC, they are not credited in the TSR as passive design features. In response to a previous DOE request for improving barrier protection at CWC, the contractor had developed an assessment of enhanced barrier protection and transmitted it to DOE, however, the identified improvements have not been implemented to enhance the safety posture of the facility.

Protection of Analytical Assumptions: Some bounding accident scenarios, derived in the CHA and carried through to the MDSA and TSR, do not protect the implicit analytical assumptions at a TSR level. DOE Handbook 1224, *Hazard and Accident Analysis Handbook*,[6] Section 3.3, states "ICs [initial conditions], and in some cases the associated administrative control associated with the ICs, should warrant some level of **Safety SSC** [structures, systems, and components] **designation or SAC to ensure that the assumptions remain valid throughout the operating life of the facility** [Emphasis added]."

In the case of two vehicle-related collision and ensuing fire scenarios, failure to protect analytical assumptions could result in accident scenarios with higher consequences than analyzed, and consequently could impact the effectiveness of the control set:

[6] Issued for interim use in August 2018.

- Medium Outside Fire (FIR-3): The MDSA considers a set of different fire sizes for analysis and identification of controls. FIR-3 is stated to be the bounding medium fire for the SWOC facilities. The MDSA recognizes that "Radiological dose consequences greater than 25 rem [TED] to the CW [co-located worker] are considered to challenge the EG of 100 rem [TED] to the facility worker".[7] This scenario assumes a vehicle accident occurs, resulting in a metered release of fuel and subsequent fire. This fire involves less material-at-risk than the large fire scenarios.

  The metered release of fuel results in a fuel pool of a particular size, which is the primary determiner of the unmitigated dose consequence. Some analytical assumptions in this analysis are the fuel line diameter, gravity draining of the fuel, and vehicle size. If the vehicle fuel line has a larger diameter than assumed, or the fuel is ejected under pressure, the fuel pool would be larger than analyzed, resulting in a fire with greater consequences. Similarly, if the vehicle size were larger than analyzed, more waste containers would be impacted, again resulting in greater consequences. These assumptions are implicit in the analysis performed but are not carried through into the TSR. It is noted, however, that the vehicle size is controlled as part of the safety management program protected by CHPRC-02134 [10] and is implemented through procedure SW-100-143 [11], *Management of Solid Waste in CWC*.

  The Board's staff notes that CHPRC-02134 [10], *SWOC Safety Basis Compliance Matrix*, lists maximum vehicle fuel line diameters for the Burial Grounds and the T-Plant as identified within CHPRC-03081, *Fire Analyses for the Solid Waste Operations Complex Master Documented Safety Analysis* [8]. There are no similar controls for the vehicle fuel lines at CWC. Inclusion of a fuel line diameter and ensuring vehicles are equipped with an automatic fuel pump shutoff would be examples of potential controls to bound this size fire event.

- Medium Inside Fire (FIR-6): The MDSA identifies FIR-6 as the bounding medium fire for inside of SWOC facilities. The MDSA recognizes this fire as challenging the contractor evaluation guideline for the unmitigated analysis with respect to the collocated worker. In this case, the fuel quantity assumed for the accident (14 gal) is not protected as a TSR level control. Additionally, as discussed earlier, the FHA evaluated an accident related to the stacker/retriever in WRAP that could have different consequences than what is documented in the MDSA for this scenario at CWC. The importance of this event relates to the availability of controls to prevent or mitigate the event. FIR-6 is mitigated by the safety significant fire suppression system. Lack of adequate controls for limiting the amount of fuel would lead to propagation of the fire, and in turn, a larger fire that could overcome the capability of the fire suppression system and render it ineffective to mitigate the event.

[7] The Board's staff notes that DOE-STD-3009-94, *Preparation Guide For U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, does not specifically address a collocated worker dose criterion as an "evaluation guideline" threshold for identification of safety significant controls. However, the contractor uses this conservative threshold value throughout the SWOC MDSA for evaluating the need for safety significant controls.

- Vehicle-initiated fires: In the case of vehicle-initiated fire scenarios, the FHA assumes only the initiating vehicle is involved in the fire. As such, the size of the fire and resulting consequences are based on the fuel load of the initiating vehicle only. CPCCo representatives confirmed that unattended vehicles are not treated as transient combustible materials, and that vehicles are not left unattended in waste storage areas. However, this is a good operating practice and is not explicitly identified in the MDSA, TSR, or other operating procedures. Unattended vehicles can substantially contribute to the combustible loading of an area, thereby, potentially leading to an accident scenario beyond what is currently analyzed in the MDSA.

Less than Adequate Controls due to Implicit Assumptions: DOE Standard 3009-94 requires that the hazard analysis process identify unique and representative bounding accidents to be carried forward to the accident analysis for identification of their associated controls. The Board's staff identified examples where implicit assumptions in the MDSA may lead to plausible unique accidents being screened when in fact they should be carried forward for identification of adequate controls.

- The MDSA makes certain assumptions regarding the availability of the amount of fuel that determines the size of a fire and its potential consequences. As a result, bounding fire scenarios do not consider a common mode failure for different combustible liquids utilized in vehicles. For example, a diesel driven forklift also contains a hydraulic fluid reservoir and hydraulic system. Only the diesel fuel load is accounted for in determination of the size of a fuel pool fire and identification of controls in the TSR.

- Use of a crane in CWC may lead to a fire event involving flammable/combustible liquids greater than that bounded by the TSR vehicle access control. TSR LCO 3.5.1 states, "Maximum fuel or other COMBUSTIBLE/FLAMMABLE LIQUID for any vehicle operated within the CWC boundary is 125 gal." CPCCo representatives confirmed that they limited the crane fuel volume to 125 gal but did not have any controls associated with the quantity of oil in the hydraulic tank. The FHA notes that the crane can hold several hundred gallons of hydraulic oil in addition to the diesel contents of its fuel tank. A fire resulting from a fuel pool fire could involve the hydraulic system on the crane, which would add fuel to the scenario above the TSR (and analysis) limit.

- The FHA only considers fires resulting from metered release from or sudden failure of the diesel fuel tank for vehicle crashes leading to fire. By comparison, LCO 3.5.3 for WRAP limits hydraulic oil capacity to 13 gallons based on the accident analysis for that facility. This is based on an analyzed scenario in which the hydraulic system is explicitly compromised by an external fire on the vehicle. This CWC fire scenario does not consider the potential for the hydraulic oil to be involved in a fire.

Formality of Control Implementation: The overall control strategy at CWC relies heavily on administrative and programmatic controls. Engineered controls are identified in a small subset of accident scenarios and are not typically applicable across all scenarios of a

particular type (e.g., the fire suppression system is only functionally credited in the Medium Inside Fire scenario). While there may be other engineered controls that could be implemented to improve the safety posture of the facility, more rigorous formality in the administrative and programmatic control elements would also provide additional risk mitigation. In several instances, the contractor described actions that are performed as "good operating practices" but do not appear to be captured in the TSR, or procedures implementing safety management programs. These include:

- Waste staging time limits: The MDSA allows for leaving a received shipment overnight in the WRSA and until the next day before it is dispositioned. CPCCo determined that this presents only a minimal risk and does not require any formal control to provide adequate protection against the potential hazards. CPCCo representatives stated that the determination of minimal risk associated with leaving a shipment overnight is based on the following:

  - The shipment would not be moving at any time,
  - The tractor would be removed from the trailer and moved out of the area,
  - A rope barrier is placed around the staged materials,
  - Speeds are limited for other in-use vehicles in the area, and
  - Traffic involving other vehicles is minimized.

  However, these limits on activities are considered "good operating practices" and not formally documented in the safety basis of the facility. This practice is discussed during the pre-job brief.

- Vehicle barriers: WRSA is separated from CWC by chain link fencing, jersey barriers, and embankments. Similarly, there are a limited number of jersey barriers placed around certain CWC buildings. Fences, berms, or other barriers are not currently credited as passive design features in the TSR. As stated earlier, CHPRC had developed an assessment of enhanced barrier protection, but identified improvements are not being implemented. Existing barriers, and the potential addition of other barriers, have not been evaluated with respect to mitigating potential accidents involving vehicles.

- Wind-blown vegetation: There is no time-based/accumulation-based (e.g., volume, mass) policy or requirement to remove wind-blown vegetation. CPCCo representatives stated that removal of wind-blown vegetation is a priority and discussions of vegetation accumulations are held as part of daily briefs. However, the Board's staff noted that removal of this vegetation is subject to third party contractor response and manpower availability. There are no defined time- or accumulation-based constraints placed on the removal of this wind-blown vegetation. Therefore, the facility lives with the risk of having an excess of these combustibles for undefined periods.

  Wind-blown vegetation is a common hazard at Hanford. It is not considered a transient combustible, which has specific TSR related controls. Buildup of wind-

blown vegetation, not expeditiously removed, may challenge the assumptions made in the FHA (CHPRC-03081) that: "No CWC buildings are at risk of damage from range fires because of a combination of separation by cleared boundaries, parking lots, and non-combustible construction."

TSR LCO 3.6.6 requires a fire break of 33 ft around all outside facility zones and requires removal of all transient combustibles from the fire break at the end of each day. Further, this LCO stipulates that "transient combustibles SHALL be limited to 5 MW as the default fire exposure." Per the TSR, maintaining a 33 ft separation distance around the waste storage facilities and outside storage areas minimizes fire propagation due to a range fire, which is an anticipated seasonal event. However, as noted above, wind-blown vegetation is not considered a transient combustible and no specific existing procedures drive removal of wind-blown vegetation within a prescribed period or accumulation value.

- Wooden pallet removal: CWC does not have a formal plan in place for eliminating the use of existing wooden pallets to reduce the risk of fire. New wooden pallets are not introduced into the facility, but existing wooden pallets are replaced by metal pallets only as opportunities arise. Currently, about 21 percent of the total pallets in CWC are made of wood. However, there is an uneven distribution that results in one building exceeding 75 percent wooden pallets, and some other buildings having more than 30 percent wooden pallets.

References

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2. Department of Energy-Hanford Site, *Solid Waste Operations Complex Technical Safety Requirements*, HNF-15280, Rev. 12A, approved May 1, 2019.

3. Department of Energy Richland Operations Office, *Operational Awareness*, DOE-ASMT-2020-4142, April 24, 2020.

4. Department of Energy-Hanford Site, *Hanford Site Solid Waste Acceptance Criteria*, HNF-EP-0063, Rev. 18, April 2019.

5. Washington Administrative Code 173-303, *Dangerous Waste Regulations*, September 30, 2020.

6. CH2M HILL Plateau Remediation Company, *Consolidated Hazards Analysis for the Master Documented Safety Analysis*, HNF-15589, Rev. 9, March 27, 2018.

7. Department of Energy-Hanford Site, *Solid Waste Operations Complex Fire Hazards Analysis*, HNF-21239, Rev. 9, approved March 28, 2018.

8. CH2M HILL Plateau Remediation Company, *Fire Analyses for the Solid Waste Operations Center Master Documented Safety Analysis*, CHPRC-03081, Rev. 2, approved June 29, 2019.

9. CH2M HILL Plateau Remediation Company, *Hanford Safety Analysis and Risk Assessment Handbook (SARAH)*, HNF-8739, Rev. 2, April 10, 2012.

10. CH2M HILL Plateau Remediation Company, *SWOC Safety Basis Compliance Matrix*, CHPRC-02134, Rev. 14, approved August 13, 2020.

11. CH2M HILL Plateau Remediation Company, *Management of Solid Waste in CWC*, SWSD-PRO-OP-51637, SW-100-143, Rev. 10, Publication Correction, November 3, 2020.