Hanford Challenge

Please see the attached PDF for Hanford Challenge's comments.

Filed electronically at http://nw.ecology.commentinput.com/?id=F6msi

April 9, 2020

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RE: Comments on the Waste Treatment and Immobilization Plant Risk Assessment permit modification

To Whom It May Concern:

On behalf of Hanford Challenge, I am submitting these comments in response to the Waste Treatment and Immobilization Plant Risk Assessment permit modification.

Interest of Commenter

Hanford Challenge is a non-profit, public interest, environmental and worker advocacy organization located at 2719 East Madison Street, Suite 304, Seattle, WA 98112. Hanford Challenge is an independent 501(c)(3) membership organization incorporated in the State of Washington and dedicated to creating a future for Hanford that secures human health and safety, advances accountability, and promotes a sustainable environmental legacy. Hanford Challenge has members who work at the Hanford Site and within the Tank Farms who are at risk of imminent and substantial endangerment due to DOE's handling, storage, treatment, transportation, and disposal of Hanford's solid and hazardous waste. Other members of Hanford Challenge work and/or recreate near Hanford, where they may also be affected by hazardous materials emitted into the environment by Hanford. All members have a strong interest in ensuring the safe and effective cleanup of the nation's most toxic nuclear site for themselves and for current and future generations, and who are therefore affected by conditions that endanger human health and the environment.

In 2010, Hanford Challenge began assisting engineers, scientists and managers who worked at the Waste Treatment Plant (WTP) and who disclosed numerous design, construction and safety violations and defects at the WTP. These issues had been ignored or white-washed by existing managers at both DOE and the contractors. The employees who raised these issues found themselves unemployed in most cases. In some cases, these employees were outright terminated after raising these concerns.

The concerns were of a nature that impacted the safe and effective future operation of the WTP. The allegations were numerous and serious, and included, faulty and inadequate designs, quality assurance and quality control violations, suspect equipment and instrumentation, the risk of combustion and/or explosion and nuclear criticality events. The most troubling of the allegations was the campaign to suppress the reporting of and correction of these issues, including the removal of the source of the allegations: the people responsible for detecting and reporting the violations.

After many years of hearings, media reports, Congressional testimony, investigations and inquiries, then Secretary of Energy Stephen Chu visited the site for a period of several weeks, culminating in his decision to suspend all design and construction activities associated with the affected facilities of the WTP (including the Pretreatment facility, the High-Level Waste facility, and the Low Activity Waste facility). In short, the allegations by the engineers and scientists were validated.

Today, all focus has shifted away from attempting to bring the PT and HLW facilities online, and instead to build a direct-feed facility to the Low Activity Waste (LAW) facility. However, Hanford Challenge has ongoing concerns about unresolved safety issues identified by a special review team in 2014 in a predecisional draft report entitled, "Low-Activity Waste Facility Design and Operability Review and Recommendations."

Overview

The Focus Sheet that announces this comment period states,

"WTP will operate in two processing configurations. For near-term operations, WTP will operate in the DFLAW configuration, which requires the Lab, LAW, and EMF to become operational first to process the low-activity waste from tank farms. In the DFLAW configuration, the waste is pretreated to remove cesium and solids before the waste is sent to the LAW facility. In this configuration, the pretreated waste will bypass the PTF and be fed directly from the tank farms to the LAW facility. The LAW facility is where the low-activity fraction of the waste will be solidified by vitrification. The liquid effluents generated in the LAW facility and the Lab are transferred and treated at EMF, which will reduce the effluent volume by evaporation. WTP will later operate in the baseline configuration when the PTF and the High-Level Waste Facility become operational."

"In 2015, Ecology provided the draft WTP Risk Assessment Work Plan and associated supplements for public review; however, the Direct Feed Low-Activity Waste configuration was not addressed in the document at that time. Since 2015, the WTP Permit has been modified to include the DFLAW configuration."

"Proposed Changes
This permit modification will update and add new documents to the WTP portion of the Permit to support the Risk Assessment for the DFLAW configuration. Updates to the documents in Appendix 6.2 of the WTP portion of the Permit are necessary to ensure the DFLAW configuration has been adequately analyzed and reviewed through the Risk Assessment Work Plan. This permit modification also provides the draft Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant for Ecology review, as required by Permit Condition III.10.C.11.b and Interim Compliance Schedule EMF-9 of the WTP portion of the Permit. The draft Risk Assessment Work Plan for the Direct Feed Low Activity Waste Configuration and the Pre-Demonstration Test Risk Assessment for the Hanford Tank Waste Treatment and Immobilization Plant use the best available information, approved models, U.S. Environmental Protection Agency combustion risk assessment guidance, and conservative exposure scenarios and assumptions."

Comments

Comment Number 1: Hanford Challenge objects to the characterization of tank waste as "Low Activity Waste" since the statutory definition of HLW is quite clear: Hanford tank waste is HLW.

a. The DOE, contrary to law, has "reinterpreted" the definition of HLW. By doing so, DOE is fundamentally altering more than 50 years of national consensus on how the most toxic, radioactive, and dangerous waste in the world is managed and ultimately disposed in geologic repositories. The proposal will seriously endanger millions of Americans and countless future generations. Because HLW contains highly radioactive fission products and radionuclides that pose long-term dangers to human health and the environment, Congress has enacted laws defining HLW and defined DOE responsibilities to safely manage the waste at its sites and to dispose of that waste in geologic repositories. It has not given DOE authority to change the definition of HLW.

   Congress is clear. HLW by definition[1] is:

   > (A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and
   > (B) other highly radioactive material that the Commission [NRC], consistent with existing law, determines by rule requires permanent isolation.

   Thus, the NWPA defines HLW by its source – "the highly radioactive material resulting from the reprocessing of spent nuclear fuel"– rather than specifics of its hazardous characteristics. Reprocessing waste is categorically treated as HLW and defined by its origin because it is necessarily both "intensely radioactive and long-lived." Reprocessing is the act of separating the ingredients in irradiated nuclear reactor fuel and target materials, including plutonium, into constituent parts or streams. The extraordinarily radioactive waste that results from this process is HLW. This includes all of the wastes currently stored in Hanford nuclear waste tanks, as well as leaked and/or dumped wastes in the soil.

b. The DOE intends to rely on a discredited DOE Order, 435.1, to relabel some of the Hanford tank waste as "low level waste." However, a federal district court issued a decision[2] in 2002 that found that the tank wastes at Hanford fall within the definition of high level radioactive waste. The Department's assertion that it can exempt waste streams based on technical and economic constraints, the court found, "directly conflicts with" the Act's definition of high-level radioactive waste. The District Court also found that Congress has spoken clearly on the subject and that DOE Order 435.1 directly conflicts with the NWPA's definition of HLW (citing *Chevron v. NRDC*, 467 U.S. 837, 842 (1984)).

Comment Number 2: Low Activity Waste Facility (LAW) Vulnerabilities: The Statement of Basis provided by the Department of Ecology for this permit cycle states, "The Preliminary Risk Assessment will provide an estimate of human health and ecological receptor risk based on engineering estimates of emissions from WTP units." Yet the information provided fails to take into

[1] See, 42 U.S.C. § 10101(12), the Nuclear Waste Policy Act.

[2] *Natural Resources Defense Council v. Abraham*, 2002 U.S. Dist. LEXIS 28418 (D. Id. Aug. 9, 2002). The decision was appealed to the Ninth Circuit by DOE, which held that the issue was not ripe for consideration because DOE had not yet applied the Order at Hanford.

account numerous safety-significant vulnerabilities identified by DOE itself. For instance, the 2015 Low Activity Waste Design and Operability Report identified approximately 362 "vulnerabilities" that were expected to result in unacceptable risk to the overall project mission.

The DOE's Office of River Protection (ORP) prepared a set of closure letters from 2015 to 2018 (per the attached table, which contains some excerpts). The "verified closure" letters often kick the issue down the road to startup and commissioning, or reject the issues all together based on future promises or because the FPD accepted the risk on the behalf of workers, taxpayers, and the environment. The attached table shows that these letters referred to commissioning at least 111 times. The accepted risks were apparently not used to add time for schedule margin or to add contingency for cost overruns.

The risk is demonstrated further in the discrepancy between DOE statements and the objective schedule evidence. ORP management expressed a lackadaisical attitude towards making any corrections per page 15 of the February 7, 2019 TPA PMM Meeting Minutes. In these minutes DOE indicated they were happy with the current Bechtel team, happy with the chronic delays – and they were not working on them.

On June 14, 2019, DOE replied to the Department of Ecology (in Letter 19-ORP-0004) that the DFLAW treatment facility is on schedule to meet the startup milestone for the LAW facility. The ORP Field Office Manager further insisted (on page 4) that schedules change "through no fault" of DOE. As a result, it appears the DOE has no interest in looking for the root causes of the delays, or the root causes associated with the failed fast track design-build/phased permitting decision.

In short, DOE has yet to show that it has completed all necessary actions to actually resolve the hundreds of serious safety and design issues at the Low Activity Waste facility raised in a 2014 . The report, which was publicized in the national media (including the *Washington Post* and the *Los Angeles Times*, states, "The review teams identified 362 significant design vulnerabilities that could limit LAW Facility functionality and operability for which mitigation is highly recommended prior to the start of radioactive operations and in many cases, prior to the start of commissioning. Unless resolved in a timely manner, these vulnerabilities are expected to result **in unacceptable risk** to the overall project mission." [emphasis added]

The authors of the draft report included 37 top experts on a wide range of engineering and scientific topics. Team leaders included the Federal Project Director for Special Projects at the Waste Treatment and Immobilization Plant (WTP) in Richland, Washington, and the WTP Design and Operability Manager for Washington River Protection, Solutions in Richland, Washington. Others were listed with expertise in Radiological Control and Industrial Health, Electrical Distribution Systems, Instrumentation and Controls, Container Systems, Mechanical Systems, Ventilation Systems, and Process Support Systems.

The report identified "eight key programmatic deficiencies are as follows:

1. Inadequate Discipline in Design Execution and Control
2. Inadequate and Incomplete Control System Design Requirements
3. Inadequate Analysis or Understanding of Production Capability
4. Inadequate Implementation of As Low As Reasonably Achievable (ALARA) Principles
5. Transfer of Scope and Risk to the Commissioning Phase

6. Inadequate Definition and Implementation of Design Requirements for Waste Management
7. Inadequate Consideration of Industrial Safety and Hygiene Requirements
8. Inadequate Consideration of Success of Operations and Maintenance Activities"

"If left unresolved, the design vulnerabilities, coupled with the programmatic design process weaknesses, would likely continue to have a compounding impact on the functionality of individual LAW systems and the LAW Facility as a whole to the extent that the facility is unlikely to achieve operational status within the anticipated timescale or achieve an acceptable throughput," said the report.

The team, for example, found that an O-ring designed to seal 1,250-degree gases would fail at 250 degrees. It also found a number of ventilation problems, potentially allowing radioactivity to migrate into safe areas of the plant. The experts warned that the plant's design would increase the difficulty of decontamination, if it ever became necessary.

Here are some more excerpts from the 2014 draft report that raise serious, and possible unresolved safety and design concerns that put public and worker health and safety at risk:

"Introduction

"During the course of this review, the teams identified recurring fundamental deficiencies in the approach to design that appeared to be key contributors to the evolution of the vulnerabilities affecting design functionality. These design approach deficiencies are reported in Section 4.0." p. 3.5

4.0 FUNDAMENTAL PROGRAMMATIC DEFICIENCIES CAUSING DESIGN AND OPERABILITY VULNERABILITIES

"The Design and Operability review teams observed recurring fundamental programmatic design process deficiencies that appear to be key contributors to or causes of the system specific design and operability vulnerabilities. The design and operability vulnerabilities in combination with the fundamental programmatic deficiencies are likely to have a compounding impact on the functionality of individual LAW facility systems and the LAW Facility as a whole." p. 4.0

1. Inadequate Discipline in Design Execution and Control: It was evident for the systems reviewed that requirements for design execution and control were not being met at an acceptable level. Failure to effectively establish disciplined design processes results in procurement and installation of equipment that does not meet the desired functional requirements and technical specifications. If left unmitigated, there is a potential that the final design cannot be validated and verified. This may result in an inability to effectively declare readiness to operate, pass an operational readiness review (ORR), and achieve operational status.

2. **Inadequate and Incomplete Control System Design Requirements:** The requirements for the equipment and process control systems lack sufficient clarity of definition and documentation to ensure the functionality of the LAW Facility systems. The quality classification for the control system software does not appear to be consistent with the hazards

and functions that the system is intended to control. Further, the current approach used to document the identified instrument and control system functions results in a very large number of documents, thereby making configuration control of the systems nearly unmanageable. Prior reviews have identified similar concerns.

3. **Inadequate Analysis or Understanding of Production Capability:** The basis for the LAW Facility production capability is incomplete and/or not technically defensible. Therefore, reasonable projections of future plant performance and production are not reliable.

4. **Inadequate Implementation of As Low As Reasonably Achievable (ALARA) Principles:** There are specific regulatory and contractual requirements associated with meeting goals and objectives intended to reduce worker exposures and the potential for spread of radioactive contamination within a nuclear facility to be As Low As Reasonably Achievable (ALARA). Due to a lack of task analyses to reasonably estimate worker exposure and models to predict contamination migration patterns, there is insufficient evidence that ALARA goals and objectives will be achieved. Given the nature of complex chemicals that will enter the LAW, this deficiency exists for chemical as well as radiological hazards.

5. **Transfer of Scope and Risk to the Commissioning Phase:** A number of activities were identified in which integrated testing or functional demonstrations of critical system components are deferred to the commissioning phase of the project. Therefore, additional cost and schedule risks are likely as a result of postponing functional design validation of some systems to commissioning.

6. **Inadequate Definition and Implementation of Design Requirements for Waste Management:** The design process has not adequately considered or implemented sufficient features necessary to ensure the capability and reliability of waste management systems to support the LAW mission.

7. **Inadequate Consideration of Industrial Safety and Hygiene Requirements:** There are specific safety and health regulatory and contractual requirements that must be met as part of the design and operational process. In addition hazard identification and control are key core functions of an effective ISMS Program. Fundamental weaknesses were identified in the hazard identification and mitigation process used to address chemical and physical hazards.

8. **Inadequate Consideration of Success of Operations and Maintenance Activities:** There was limited evidence that a thorough and systematic assessment of the facility design has been undertaken to ensure that operational and maintenance tasks required for the effective operation of the facility are safely executable, as the current design depends on hands-on operation and maintenance activities. There are questions about the safe and efficient performance of operators and maintenance technicians in environments with elevated temperature, chemical and radiological hazards and challenging ergonomics which are currently incompletely defined and have not been modeled or considered in sufficient detail.

4.1.2 Examples

Following are some representative examples of vulnerabilities that appear to be caused by inadequate discipline in design and execution control:

- The ventilation system failure modes and impacts for normal and off-normal conditions have not been identified. These conditions should include start-up

sequencing, reduced production modes, and defined maintenance modes as well as other conditions that are not considered "normal" operations.

- Exhaust fan sizing does not take into account design changes associated with higher incoming air temperatures. Fan performance is reduced with higher air temperatures and the flowrate will be reduced, resulting in potentially inadequate contamination confinement in some rooms.
- Uninterruptible power supplies (UPS) for critical components are undersized and do not meet capacity requirements during a loss of power event. Equipment rooms that house the UPS batteries are too small to accept the additional number of batteries needed to meet the requirements.
- Cooling times used in design analysis of the LAW container do not have a technically defensible basis. The cooling values provided to the review teams used non-prototypic tests as a basis for input to stress calculations to ensure the container integrity under thermal operating conditions. When a container full of molten glass is lifted, there is a chance that the container lifting flange will fail because it has not cooled enough to regain its strength.
- The Submerged Bed Scrubber (SBS) is a main component in the melter offgas system and is relied on to reduce the temperature of melter off gas stream and remove contaminants from the air stream. The design temperature requirement for off-gas stream coming directly off the melter was specified to be 1250°F. Therefore, the design of some SBS components, including an 0-ring gasket used to seal the vessel, must be compatible with this temperature. However, the 0-ring provided by the vendor will likely fail at temperatures above 250°F. This 0-ring design was accepted by the WTP Project without evidence of documented analysis or basis.
- Electrical equipment in high temperature areas are not properly designed for the ambient conditions as required. Projected temperatures in several areas of the pour handling system exceed the specified design values of electrical components. This may lead to reduced electrical capacity, overheating of components, signal failure, electrical shorts, and interruption of operation.
- According to the PDSA for the LAW Facility, one of the most significant postulated chemical events involves the release of nitrogen oxides (NOx). Current safety analysis indicates that the NOx hazard is eliminated two hours after feed to the melter is terminated.

4.1.3 Conclusions

Failure to effectively establish disciplined design processes, which are relied on to systematically establish and maintain the design bases, results in procurement and installation of items that do not meet the desired functional requirements and technical specifications. There is a risk the final design cannot be validated and verified, resulting in an inability to effectively achieve and demonstrate readiness to operate. Additionally, future design changes may be difficult to implement if these cannot be confirmed to meet the design basis requirements.

INADEQUATE AND INCOMPLETE CONTROL SYSTEM DESIGN SPECIFICATION AND EXECUTION

Control systems lack adequate specification of quality assurance and functional requirements: During the course of this review, it was observed that the functional requirements of the control systems were not clearly specified and did not include sufficient

supporting basis such that the intended control intent could be validated. Further, the D&O team questions whether the quality level of the software is in full compliance with DOE 0 414.1 C) which may therefore lead to conditions where personnel and the environment are not adequately protected.

Design process does not adequately consider operational control: Review of the design and operational parameters of the LAW Facility found that there was not a clear understanding of how certain components of the ICN will support safe operation of the facility. Consequently, systems may not function as expected under normal and off-normal condition.

Inadequate control system design: The monitoring and control system design for the LAW Facility does not appear to have adequately considered available design input, requirements, or industry standards. This will result in systems not functioning as expected under normal and off-normal condition.

4.2.3 **Conclusions**

The collective evidence indicates that the LAW Facility control systems are lacking in quality assurance, requirements definition, requirements traceability, design processes, design elements, and clear documentation. Further, this lack of requirements definition and traceability to upper tier requirements prohibited a full assessments of future plant operability, because it is unclear what the control system requirement are, and the basis for those requirements.

Specifically:

- The LAW Facility functional requirements are not adequately defined and lack a basis traceable to upper-tier requirements.
- WTP has applied a questionable and likely inadequate software QA grading and classification process to the LAW Facility control systems (a unique WTP process). The inadequate software QA grading and classification process has resulted in a quality assurance implementation at a level lower than is required to support the ICN functions.
- WTP has not evaluated the hazards associated with the ICN, which monitors and controls the entire WTP. Lack of hazards evaluation has resulted in inadequate software quality assurance, functional requirements, and hazard controls. The hazards (as defined by 10 CFR 830) must be evaluated in order to successfully complete the design and achieve readiness.
- The LAW Facility control system documentation is inadequate, inconsistent, difficult to use, and is not consistent with industry standards (i.e., IEEE). The current LAW control system documentation issues must be corrected in order to successfully complete design and achieve readiness to operate. The current documentation could be replaced with a much simpler set consistent with industry standards.
- Resolution of identified specific control system issues prior to resolution of the underlying control system design processes would not be productive. Without the benefit of sound requirements, quality assurance and documentation system to inform and frame the design, the LAW Facility control system is at risk of not being able to meet operational expectations or achieve readiness.

4.3 INADEQUATE ANALYSIS OR UNDERSTANDING OF PRODUCTION CAPABILITY

4.3.1 **Summary**

The WTP project has developed an operational research (OR) model that includes the LAW Facility, however, there was significant evidence to indicate that the inputs to this model were incomplete or lacking conservatism, resulting in an inaccurate and overly optimistic assessment of LAW Facility production capabilities.

The production capability of the LAW Facility is unknown but likely significantly less than specified or anticipated to successfully execute the waste treatment mission as evidenced by the following:

- Equipment reliability and maintenance not adequately considered or lacks a defensible basis: There were recurring instances where the design did not appear to adequately or completely consider the impacts of equipment reliability and maintenance on the production capabilities of the LAW Facility. The review identified that spurious instrumentation trips on the melter off gas system alone will likely result in a decrease in the LAW Facility production capability to below the required 70%.
- Inadequate inputs and bases used to model production capability: The OR model developed and maintained by WTP does not provide a realistic prediction of overall plant performance, on which ongoing design decisions and future predictions of mission and operability can be based because:
    - The current OR model for the LAW Facility uses input assumptions and supporting bases that are not considered to be supportable based on operating experiences from other facilities with analogous equipment and operating constraints.
    - The current OR model does not incorporate all the systems necessary to represent integrated facility operations.
    - The current OR model is not used to evaluate the full range of operating conditions that might reasonably be anticipated during long-term plant operations.
    - The current OR model does not attempt to evaluate losses, other than availability, such as quality and performance losses, which on a minimally automated facility like the LAW facility could be even more significant than the availability losses.

- Design process does not adequately consider throughput impacts: The interactions of systems and associated operations within the LAW Facility have not been adequately considered and may result in unanticipated interruptions in melter glass production operations.

4.3.2 Examples

Following are some representative examples of vulnerabilities that provide substantial evidence that the LAW facility production capability is not adequately analyzed or understood:

- The melter off gas treatment system equipment is required to meet environmental requirements prior to discharge to the environment. The off-gas treatment system equipment is complex. This complexity coupled with a lack of component redundancy and numerous safety and permit affecting controls is likely to impact the ability to sustain

melter operations and meet production requirements because equipment failures are likely to be more frequent and take longer to repair than currently assumed.

- Maintenance of some melter primary off gas system equipment requires that a confinement barrier for radioactive material control be disconnected and opened. This will require that both melters temporarily cease production operations so that the system can be placed in a safe condition for maintenance. Further, the review team considers it possible that personnel entry to the melter off gas process cells for any reason could require that glass production from both melters be temporarily ceased and the cell vessels be de-inventoried in order to establish safe conditions for cell entry.
- For electrical safety reasons it is anticipated that the melter power will be disconnected and locked-out during some routine operations (such as replacement of air bubbler tubes used for agitation in the melters, maintenance of redundant power supplies etc.,). There is no evidence that the melter safe condition lock-out and subsequent time periods required for melter cool down and reheat have been factored into the facility production capability. These activities could represent a significant production impact for this routine consumable item replacement.
- Hot molten LAW glass produced in the melter is poured into steel containers. These containers must be allowed to cool for a minimum period of time so that the container can be lifted to the next handling station without risk of distorting the container flange. If this container flange were to distort, the container could fall when lifted. The review team concluded that the current time specified for cooling the containers was insufficient and should be extended. If the cooling time for a container is extended consistent with existing WTP data, container production could be significantly reduced.
- Automation of complex facilities is relied upon to ensure consistent control of the facility processes and to minimize time for response to changes and off-normal conditions, thereby increasing efficiency and production capability. However, the current level of automation in the LAW Facility intentionally emphasizes manual operations. As a result, many functions that are typically fully automated, such as start-up sequences, valve lineups, and shut-down sequences rely upon operator interaction for control.
- The impact of the extent of these operator control and response actions on the production capabilities of the LAW Facility do not appear to have been adequately considered. In addition, the WTP contract requires that the operational research model assess activities such as the time required to perform mechanical handling operations, which are generally assumed within the model to be performed instantaneously without consideration of operator response times. These operator response times could significantly impact LAW Facility glass production rates.

4.3.3 **Conclusions**

The evidence observed indicates that the basis for the expected LAW Facility production capability is insupportable. Without the benefit of accurate predictive models to inform the design and the design process that emphasizes production capability as a key consideration, the LAW Facility glass production capacity presents a significant challenge to the Hanford Tank Farms mission.

4.4 INADEQUATE IMPLEMENTATION OF AS LOW AS REASONABLY ACHIEVABLE (ALARA) PRINCIPLES

4.4.1 Summary

Throughout the review it was apparent that ALARA principles, incorporated as part of the design process, had not been effectively implemented. Key observations that the LAW Facility design may not effectively achieve ALARA requirements include:

- **Contamination control not effectively analyzed and demonstrated:** There were recurring instances where contamination control methods, defined in the design bases, such as airflow through doorway and hatches, were not sufficiently considered and demonstrated to be effective, challenging the ability of the project to successfully meet ALARA requirements. This is of particular importance for the LAW Facility because the contamination levels expected to be encountered as part of the hands-on maintenance approach are currently unknown and unanalyzed. Additionally, it was not apparent that the design of SSCs has adequately considered the need for periodic decontamination or provided features to facilitate decontamination efforts (such as use of high gloss/nonstick surfaces, or minimization of joints/crevices that can accumulate contamination).
- **Personnel dose assessments are not sufficiently documented to support contact operations and maintenance:** Radiation doses to personnel are undetermined for Operations, Maintenance, and Waste Management activities. Total cumulative radiation dose for a representative or bounding set of operations and maintenance evolution have not yet been determined; therefore, it is not known whether contract ALARA dose requirements can be met with currently planned staffing levels.

4.4.2 Examples

Some representative examples of vulnerabilities associated with inadequate implementation of ALARA principles include:

- The LAW Facility confinement ventilation system is a complex low airflow system. Some rooms require multiple ventilation manipulations to maintain correct air flow direction. Entry and exit from potentially contaminated rooms requires that airflow be manually controlled to prevent reversal of air flows and disruption or shutdown of ventilation systems.
- The storage tanks for incoming waste and the associated rooms are expected to become highly contaminated and the potential exists for personnel to receive significant radiation exposure in the process cells. The anticipated dose levels in the cells have not been assessed and no assumptions identified for the time required for removal of inventory from the cells and flush to attain levels acceptable for personnel entry.
- The transfer of bogies (rail based carts used to transport containers) between rooms may be a problem due to contamination potentially being transferred from rooms with higher contamination to rooms with lower contamination. This issue is exacerbated by the inclusion of design features such as recessed rails and unfinished walls above 7'6" that will trap contamination and make decontamination more difficult.
- The current carbon dioxide (C02) system uses C02 blast pellets to decontaminate the glass waste container. The C02 system uses pressurized air in the decontamination process and ablated contaminants are contained and removed by the vacuum effluent removal system. Because the C02 system has not been tested as an integrated system, it is unknown as to how well the vacuum effluent system will capture the ablated contaminants, or whether the contamination will be spread in the general Finishing Line area.

- Maintenance in the process cells, upstream of the melter, and within the Pour Cave and Finishing Line may require personnel to be in contact with equipment that exhibits high radiation exposure rates because of the hands-on maintenance design.
- Packaged waste containers that exceed a facility-specified radioactive dose limit, which is often set relatively low to limit cumulative uptake, require special handling and/or shielding so that the waste container can be safely handled and disposed.

4.4.3 **Conclusions**

There are specific regulatory and contractual requirements associated with meeting ALARA goals and objectives. The review team found that these requirements may not be met, primarily because of uncertainties related to how work will be conducted, a lack of systematic analysis, and modeling to confirm how contamination will migrate.

The effectiveness of a low flow ventilation philosophy has never been demonstrated in this type of facility using a hands-on maintenance approach. The low airflow design may cause contamination to accumulate in some areas or progressively spread in other areas of the facility. There is no model available to evaluate contamination migration paths throughout the facility. Radiological conditions in the LAW Facility are considered likely to deteriorate over the life of the facility thereby exacerbating difficulties associated with performing contact operations and maintenance. Consideration of design controls to address the radiological dose and contamination hazards over the life of the LAW Facility appears incomplete.

4.6 INADEQUATE IMPLEMENTATION OF DESIGN REQUIREMENTS FOR WASTE MANAGEMENT

4.6. l **Summary**

The review team identified that the design requirements for secondary radioactive waste management were incomplete, and adequate design features were not included to support efficient secondary waste management. The capabilities to perform size reduction, decontamination, storage, and export of secondary radioactive solid waste are considered insufficiently developed to support sustained LAW glass production operations. In addition, the forecasted secondary waste volumes appear to be underestimated based on other analogous facilities and processes.

4.7 INADEQUATE CONSIDERATION OF INDUSTRIAL SAFETY AND INDUSTRIAL HYGIENE REQUIREMENTS

4.7.1 Summary

Throughout the review process it was apparent that fundamental safety and health principles, incorporated as part of the design process of the LAW Facility, had not been effectively implemented. Key observations indicating inadequate consideration of industrial safety and hygiene requirements include:

- **Insufficient evidence of compliance with operational safety and health requirements in design:** During the course of this review, it was observed that there were recurring instances where safety and health requirements were not effectively incorporated into the design of the LAW Facility.
- **Inadequate implementation of the hazards analysis process for worker safety to address chemical hazards:** The identification of chemicals, other than chemicals

associated with the melter off gas system has not been considered as part of the facility design process. In addition, exposure assessments conducted to date were not accurate and did not adequately reflect hazards associated with the LAW Facility.

- **Inadequate implementation of the hazards analysis process for worker safety to address thermal hazards:** There are two worker safety thermal hazards that are expected to be encountered when the facility is operational: 1) the potential for burns due to hot equipment and 2) the potential for heat stress due to elevated room/work environment temperatures and heat. The Review Team found that these hazards had not been appropriately evaluated.

4. 7 .2 **Examples**

Some examples of vulnerabilities indicating inadequate consideration of Industrial Safety and Industrial Hygiene requirements include:

- The review team was not able to find any documentation that identified expected chemical compounds in the feed to the LAW Facility from the Pretreatment Facility. The WTP Project maintains a list of anions and cations, along with generic volatile organic compound information; however, no documentation was provided to the Review Team identifying the worst case, or bounding source term, for chemicals present in the waste feed. These compounds and/or list of chemicals need to be compared against worker protection limits to ensure engineering controls are adequate and workers are appropriately protected. In addition, no routine area monitoring for chemicals, other than those associated with the melter off gas system, was found to have been incorporated into the facility design process. This is of particular concern due to the worker protection issues that are associated with the Tank Farms operations and potential exposures to similar chemical vapors at the LAW Facility should incoming waste migrate from the containment piping (e.g., leaking valve, equipment maintenance).
- Ventilation is the primary means for controlling and mitigating exposure of personnel to chemical vapors. It does not appear that chemical dilution (immediate barrier to release), from a worker protection chemical perspective, was considered as part of the ventilation design.
- Breaker bars are required to provide mechanical advantage to open doors against the building depressions allowing personnel to exit a room during emergencies or other off-normal events. Although breaker bars are available for some areas they are not available for other similar areas, this may preclude egress in the event of an off normal or emergency condition. Operation of these devices under abnormal conditions is likely to cause the ventilation system to shutdown, resulting in a potential loss of effective confinement.
- The potential for carbon fines to ignite in the carbon beds during normal operations or during carbon replacement activities has not been thoroughly analyzed as part of the hazards analysis process. Further, replacement of the carbon in the carbon beds involves workers crouching under the beds in a space 3 feet high. The workers will work in these conditions for an extended period of time since it will require about thirty (30) 55- gallon drums to collect the spent carbon. This design does not adequately implement suitable worker ergonomic features.
- Container lids used in the finishing line must be manually loaded in the lid holder mechanism. Each lid weighs 45 pounds and there are 35 lid-and-seal assemblies. Back

injuries are common when routinely lifting heavy equipment. Given the number of lids needed to be loaded, an engineered means to perform this task is warranted.

- Three high voltage (13.8 kV) electrical supply power disconnects are all located in the same power supply compartment on the melter power supplies. This configuration makes performing zero energy checks to ensure that the system is safe for worker maintenance impossible unless all incoming power to each LAW Facility melter power supply is disconnected. In addition, there is inadequate space for worker access to the power supply cabinet.
- Existing exposure assessments for the LAW Facility were found to be inadequate and in need of revision to accurately address chemical hazards and controls when performing work. In addition, no administrative process exists that ensures results of the exposure assessments are incorporated into the Engineering design process (ensuring engineered solutions to the mitigation of hazards).

4.7.3 **Conclusions**

There are specific safety and health regulatory and contractual requirements that must be met as part of the design process. The review team found fundamental weaknesses in the hazard identification and mitigation process related to chemical and physical hazards. There is a significant potential that similar worker safety concerns related to chemical vapors in the Tank Farms may be present in the LAW Facility because the incoming feed to the LAW Facility originates from the Tank Farms. Thermal hazards need to be thoroughly addressed to ensure workers are appropriately protected from burns and heat stress. Finally, several examples were identified within the LAW Facility that will require retrofitting of installed equipment to meet 10 CFR 851 requirements.

4.8 INADEQUATE CONSIDERATION FOR SUCCESS OF OPERATIONS/MAINTENANCE ACTIVITIES

4.8.1 Summary

The review team observed that the current LAW Facility design was not consistent with the stated operational intent. Inadequate consideration of operations and maintenance conditions needed to successfully operate and maintain the facility will likely impact the ability to meet production targets, challenge safety and hazard exposure goals, and ultimately extend the LAW Facility mission.

Example: "Design process does not include adequate consideration of maintenance performance: The LAW Facility relies upon hands-on maintenance for equipment repair, calibration and replacement. Implementation of hands-on maintenance may require special precautions to protect workers from chemical hazards, high temperature hazards, and to ensure radiological conditions are controlled to maintain worker safety. The impact of these special precautions on maintenance time durations or glass production do not appear to have been adequately considered."

5.0 SYSTEM REVIEW SUMMARY

5.1 PRIMARY OFFGAS PROCESS (LOP), SECONDARY OFFGAS/VESSEL VENT PROCESS (LVP) AND AMMONIA REAGENT (AMR) SYSTEMS

Without mitigating actions, there is collective evidence from this review that the current design of the combined LOP /LVP systems is likely to chronically limit the overall production capability of the LAW Facility.

The summarized principal evidence is as follows:

- There were a total of forty six (46) vulnerabilities identified in these systems. Thirty four (34) of these are considered to require corrective action, including some significant reanalysis/redesign, prior to start-up testing. Figure 5-1 shows the ratio of high-, medium-, and low-impact vulnerabilities identified for the two systems. See Appendix B for a list of vulnerabilities and OFIs.

5.2 INSTRUMENTATION & CONTROL

Without mitigating actions, there is collective evidence from this review that the current design of the WTP Instrument & Control (I&C) system is likely to significantly delay startup and commissioning, increase the risk of safety and regulatory noncompliance and limit the throughput capability of the LAW Facility.

- There were a total of fourteen (14) vulnerabilities identified in this system. All are considered to require corrective action, including some significant reanalysis-/redesign, prior to start-up testing. Figure 5-2 shows the ratio of high- and medium- impact vulnerabilities identified for the system. See Appendix B for a list of vulnerabilities and OFIs.

5.3 CONFINEMENT VENTILATION SYSTEMS

The LAW Facility Confinement Ventilation System has been determined to be incapable of meeting its intended function unless c01rective actions are taken. The extent and number of perturbations induced in the ventilation system as a result of routine operations are expected to result in an unstable system. The current ventilation system design may cause delays to facility startup and commissioning and impact facility operation during the life of the facility.

The summarized principal evidence is as follows:

- There were a total of seventy three (73) vulnerabilities identified in this system. Sixty six (66) of these require collective action, including some significant reanalysis/redesign, prior to start-up testing. Figure 5-3 shows the ratio of high-, medium-, and low-impact vulnerabilities identified for the system.

- **LAW Facility HVAC hazard analysis:** A number of hazardous conditions associated with upset and accident scenarios in the LAW off-gas system were identified in the PDSA hazard analysis with high toxicological unmitigated consequences to the facility worker and chemical exposures above threshold limits for the co-located worker. There is a strong potential that currently unidentified HY AC controls will be needed to mitigate the hazards identified in the hazard analysis. A final hazards analysis of the LAW ventilation system needs to be performed. Normal and off-normal operations as well as accident conditions need to be evaluated and all HY AC controls need to be identified.

5.4 ELECTRICAL DISTRIBUTION SYSTEM

It should be noted that many of the vulnerabilities are related, and performing corrective actions on one can resolve multiple vulnerabilities. Many of the vulnerabilities identified in the review had been previously self-identified by BNI and for those issues where evidence is available that resolutions are in process, those issues are not addressed in this report.

The summarized principal evidence is as follows:

- There were a total of thirty seven (37) vulnerabilities identified in this system. Thirty one (31) of these are considered to require corrective action, including some significant reanalysis/redesign, prior to start-up testing. Figure 5-4 shows the ratio of high-, medium-, and low-impact vulnerabilities identified for the system.

5.5 RADIOLOGICAL CONTROL AND INDUSTRIAL SAFETY AND HYGIENE

5.5.1 RCISH Key Results/Consequences

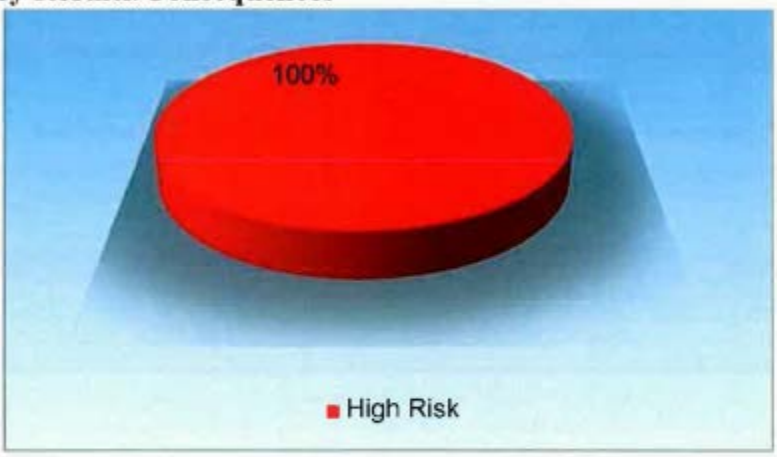

Figure 5-5. Unmitigated Vulnerabilities Identified for Radiological Control and Industrial Safety and Hygiene.

A total of eight (8) vulnerabilities were identified for the radiological control and industrial safety review area. Figure 5-5 shows that the vulnerabilities identified for the system were all considered high impact for which mitigation is recommended prior to cold commissioning and preferably prior to startup testing.

The review team identified specific issues with the radiological control approach all of which will require correction prior to startup testing. Listed below are summarized vulnerabilities:

- The potential for contamination to migrate to adjacent lower classification contamination zones are a key concern of the review team and the design of the low flow ventilation system further compounds this issue. This vulnerability was evident in a majority of the facility systems reviewed and includes examples such as:
    - The application of a special protective coating only to the seven and one half feet height level on many of the facility walls, will impact the ability to effectively decontaminate the facility,

- Low flow ventilation increases the quantity of material that settles in the facility rather than being captured on the HEPA filters,
- Potential contamination migration as equipment or material traverse from higher to lower contamination zones, and
- The activity level of the glass suggests that the potential contamination levels will be higher than are currently being assumed in the design (anticipated alpha activity concentration for LAW incoming waste stream is >600,000 dpm/ml and beta activity concentration is >20,000,000 dpm/ml).
- Inability to meet contamination control limits for container release. The container swabbing system smears a container over a 500 cm^2 surface area as opposed to the 100 cm^2 surface area regulatory limit for release to controlled areas. Currently no technical basis exists for the release criteria to meet regulatory requirements or the smear media planned to be used for surveying. A more rigorous swabbing regime is likely to challenge the facility throughput further.
- The project is in the process of developing radiation dose rates for specific areas of the facility but there has been no targeted assessment to understand the ability to effectively perform hands-on maintenance activities for the higher risk tasks. Dose rates have recently been calculated for areas like the melter but these rates have not been applied to a conservative task analysis to understand if there are chronic exposure concerns.
- Similarly there is no assessment of the implications of manual bagging operations of contaminated bubblers. For areas like the process cells, which are also manually maintained, there may be a more significant dose management challenge. Additionally the effort to de-inventory and decontaminate areas (like the process cells, pour cells, buffer stores etc.) to facilitate maintenance will have an unanalyzed impact on throughput and the radiation levels may restrict some maintenance evolutions even after deinventorying.
- Issues identified in this review were similar to and consistent with those found during the HL W Design and Operability Review that concluded:
    - Administrative controls appear to be favored over engineered controls; and
    - The confinement ventilation system design philosophy drives the need for frequent radiological cleanup to maintain radiological control and confinement, in excess of that normally anticipated at analogous facilities.

5.5.1.2 Industrial Safety and Hygiene

For Industrial Safety, the review team also identified four vulnerabilities of high significance that will require correction prior to startup testing. Listed below are summarized vulnerabilities:

- Insufficient evidence of compliance with operational safety and health requirements in the design process. Walk-throughs of the constructed facility found several locations where code requirements were overlooked as part of system design on individual pieces of equipment, and more importantly on the system as a whole. Examples include:
    - Thermal protection from bums due to potentially hot surfaces, motors, etc.,

- Inadequate workspace ergonomics and engineered features to enable workers to safely and efficiently fill and empty the carbon bed media,
- Inadequate access to maintain/operate elevated equipment e.g., ventilation dampers, cranes, etc.
- Inadequate implementation of the hazards analysis process. Examples identified include:
    - Limited or no task analysis of planned hands on maintenance tasks to assess the viability of the existing design to support safe maintenance/operation.
    - Experience on vitrification facilities in the nuclear industry require remote maintenance there is no precedent or relevant experience for the LAW Facility approach so additional conservative analysis is warranted.
- Lack of a defined chemical source term incoming to the LAW Facility.
    - Lack of identified chemical area monitoring, throughout the facility, to ensure workers are appropriately protected (greatest risk are work areas upstream of the melter).
    - Two completed WTP chemical exposure assessments used incorrect data, which only considered the off gas component and ignored the incoming waste feed. This waste is currently causing significant health concerns due to vapors at the Tank Farms and must be considered for WTP.
- There is no evidence that worker heat stress potential has been considered in the design and there is no task analysis that considers the anticipated temperatures applied to a detailed task analysis.
- The assessment for replacement of the melter implies Level A PPE will be required, yet Design Engineering has assumed that minimal PPE would be needed. This means that the current design may be incompatible with performance of tasks in this level of PPE.

5.6 MELTER EQUIPMENT SUPPORT HANDLING SYSTEM

The LSH System design may limit the production capability of the LAW Facility for the following reasons:

- The review team identified sixty one (61) vulnerabilities for the LSH System. Forty two (42) require remediation prior to startup testing. Figure 5-6 shows the ratio of high-, medium-, and low-impact vulnerabilities identified for the LSH System. The ability of the LSH system to provide the support necessary to assure sustained operation of the LAW Facility such that immobilized low activity waste (ILAW) throughput requirements can be met has not been demonstrated.

5.7 CONTAINER POUR HANDLING SYSTEM

The LAW Container Pour Handling (LPH) System supports the vitrification process by accepting empty containers from the LAW Container Receipt Handling (LRH) System, moving empty/filled containers into and out of the pour caves, placing containers under the melter pour spouts to be filled with glass, and allowing for preliminary container cooling prior to transporting filled containers to the LAW Container Finish Handling (LFH) System.

The current LPH system design may limit the overall production capability of the LAW Facility based on the following evidence:

- The review team identified 88 vulnerabilities, 55 of which require remediation prior to initiating production operations and preferably before startup testing. Fourteen of the fifty-five vulnerabilities require some level of significant redesign.

5.8 MELTER HANDLING SYSTEM

The dedicated LAW melter handling system (LMH) provides the mechanical handling equipment associated with the import of new Locally Shielded Melters (LSMs) and the export of failed or spent LSMs from the LAW Facility. Key components of the LMH System include the LSM rails and associated winch and pulley block arrangement.

Prolonged LAW Facility outages with attendant impacts to LAW production are anticipated in order to recover from existing shortcomings in LMH System design based on the following:

- The review team identified thirteen (13) vulnerabilities for the LMH System, twelve (12) of which require remediation prior to initiating production operations and preferably before startup testing. Figure 5-8 shows the percentages of high-, medium- and low impact vulnerabilities identified for the LMH System.

5.9 CONTAINER FINISHING HANDLING SYSTEM

The LAW LFH System receives filled containers from the LAW LPH System, provides glass sampling functionality, measures container fill level, inert fill addition, installs lid, decontaminates, swabs, and monitors contamination/radiation dose prior to transporting containers to the LAW Container Export Handling (LEH) System.

The LFH System cannot meet throughput requirements, unless significant changes are made. Decontamination issues, thermal issues, contamination control and product container handling issues, if unmitigated, will render this system unable to support throughput requirements for the following reasons:

- The review team identified seventy (70) vulnerabilities, forty three (43) of which require remediation before CD-4 and preferably before startup testing. Sixteen of the forty-three vulnerabilities are high impact and require some level of significant redesign.

5.10 RADIOACTIVE SOLID WASTE HANDLING SYSTEM

The purpose of the Radioactive Solid Waste Handling (RWH) System is to provide the mechanical handling equipment necessary to facilitate handling and packaging of secondary radioactive solid waste (RSW). Examples of RSW include failed equipment, consumable items, and maintenance wastes.

The functionality of the RWH system is not adequate to fully support life-cycle operations. Specifically, the RWH System may prevent the LAW Facility from achieving throughput requirements for the following reasons:

- The review team identified thirteen (13) vulnerabilities for the RWH System, nine (9) of which require resolution before startup testing. No high risk vulnerabilities were identified."

Hanford Challenge has learned from another commenter that some of these issues have been "resolved" through letters that either outright accepted the risks outlined in the Review, or promised that resolutions would happen at the time of commissioning. This is unacceptable. The attached table demonstrates the nature of the so-called resolutions that DOE has accepted, but which Ecology must not accept, in order to protect public health and safety.

Finally, there should be a full, final and independent operational, safety and quality review of all LAW facility systems to assure that safety of the operations can be validated and verified before waste is actually treated there. This review should include the efficacy of the "resolutions" of previously identified noncompliances and risks by accepting the risk "as is", or waiting to see if it causes a problem down the road, when radionuclides and chemicals will be in the system.

Comment Number 3. Tank Side Cesium Removal (TSCR) Project: In a February 2020 Defense Nuclear Facilities Safety Board (DNFSB) field report[3], the DNFSB indicated that there are hydrogen hazards for storing the TSCR spent ion exchange columns that were not envisioned in the Tank Closure &Waste Management EIS. The Notice of Construction permit for air emission says that the Cesium Ion IX columns are passively vented to the atmosphere, to prevent buildup of pressure inside the columns. However, weather conditions could cause the passive venting circulation to fail, and the hydrogen gas to build up. If the hydrogen deflagrates, there will likely be a release of radio-cesium and other isotopes to the air, presenting a hazard to workers, the public and the environment. Where is this scenario described, consequences calculated, and compensatory steps taken to prevent hydrogen deflagration and radioactive release?

Comment Number 4: The Department of Energy has not identified with specificity how the spent cesium ion IX columns will be disposed of, creating an orphan waste scenario. To fail to have a detailed and robust plan to remediate an estimated 10 megacuries of radio-cesium stored in the open air for decades is unacceptable. Eventual disposal will also involve additional worker risk and exposure. Operation of DFLAW should not be allowed until DOE has identified a NEPA-compliant funded pathway for disposal of the loaded ion exchange columns that will be created in order to feed the plant.

Comment Number 5: The Low Activity Waste facility Stack Discharge (SDJ) System does not include monitoring for ammonia, despite that fact that ammonia is present in the waste and ammonia is also added to the waste off-gas stream in the NOx destruction equipment. There is always excess ammonia in the discharge from selective catalytic reduction, and an upset could make this a large concentration. Ammonia is a highly hazardous chemical. An ammonia monitor must be required as a condition of operation. Similarly, it is not clear that there is monitoring for radionuclides, including tritium, carbon-14, and Alpha/Beta/Gamma emissions from the LAW Stack. There also appears to be no

[3] Hanford Activity Report for the Week Ending February 21, 2020, Defense Nuclear Facilities Safety Board, Caleca, B and Fox, P., February 21, 2020

mention of monitoring for the EMF stack, despite the fact that ammonia-bearing waste is processed at EMF. DFLAW cannot operate without the EMF.

Conclusion

Hanford Challenge appreciates the opportunity to submit comments on the Waste Treatment and Immobilization Plant Risk Assessment permit modification. This facility has unmitigated risks and the facility should not be allowed to operate unless and until an independent (of DOE) investigation and review team addresses the vulnerabilities and risks posed by the operation of a facility that will be handling and treating high-level nuclear waste in high-temperature, high-pressure operating environments, thus potentially endangering workers, the public and the environment.

Submitted by,

Tom Carpenter, Executive Director
Hanford Challenge
April 9, 2020