September 30, 2020

Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

RE: Public Comment of Hanford Challenge on the WESF Permit Modification

To Whom It May Concern,

Thank you for the opportunity to submit comments on the permit modification to allow transfer of cesium and strontium capsules out of the Waste Encapsulation Storage Facility (WESF) by adding WESF to the RCRA Permit as Operating Unit Group 14.

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 with a mission to create a future for the Hanford Nuclear Site that secures human health and safety, advances accountability, and promotes a sustainable environmental legacy. Hanford Challenge has members who work at the Hanford Site. 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.

WESF is a known high-priority cleanup site at Hanford, and yet the work to move the strontium and cesium capsules out of the underwater storage pools at WESF into dry storage has faced delays. The stainless steel lined concrete storage pools are well past their design life (by 17 years) and the concrete has suffered damage from decades of gamma radiation exposure. In the event of an earthquake, failure of the concrete, drone attack or other accident that causes water to drain from the pools and uncover the capsules, the region would be threatened by a catastrophic release of radioactivity. Though plans are in place to move the capsules to dry storage by 2025, this date is a delay from the original milestone and Hanford Challenge fears that there may be attempts to postpone moving the capsules to safer dry storage in the face of budget cuts. Hanford Challenge urges the WA Department of Ecology to aggressively use its regulatory authority and accelerate the movement of the WESF capsules to safer storage, and at a minimum, reject proposals to delay the 2025 milestone.

Hanford Challenge has observed that the risk of a catastrophic release of radioactivity at WESF is downplayed by both the WA Department of Ecology and the U.S. Department of

Energy. This is a mistake. Hanford Challenge urges Ecology to require detailed and comprehensive emergency response plans in the RCRA permit in the event of a catastrophic-scale failure of the storage pools at WESF. Fast and decisive action is imperative in a scenario where water drains from the WESF storage pools. A description of a worst case scenario at WESF is included as an attachment to our comments. And to reiterate our point above, getting the capsules into dry storage as fast as possible is the best way to prevent a catastrophic release of radioactivity. The cost is minimal to move the capsules into dry storage in the larger scheme of Hanford cleanup and would be a major risk-reduction win that would be celebrated far and wide. In the meantime, please ensure that detailed catastrophic release emergency response plans are required that provide a step-by-step action plan to contain WESF's release of radioactivity as quickly as possible and the equipment necessary to protect workers from the high-radiation levels that would be encountered in a catastrophic release scenario.

It has been acknowledged that gamma radiation has weakened the strength of the concrete pools at WESF, however, the only data included in the analysis was for wet concrete, and the concrete at WESF is dry. Though Ecology only regulates hazardous and dangerous wastes in the WESF building and the pad where DOE will store the capsules, it is also incumbent upon Ecology to assure that the conditions are not only safe now, but will be safe throughout the design life of the facilities, and that they will preclude the release of these wastes to the environment. Ecology's authority on this matter can be found under the RCRA requirements that licensees who manage regulated hazardous materials must do so in a manner that does not pose an imminent and substantial risk to human health and safety.[1]

DOE announced major damage to the concrete in WESF from gamma ray dosage to the concrete in 2011. The damage is now much more severe than it was then from added gamma exposure in the succeeding nine years. This damage will continue to get worse with each passing day. The factual and evidential basis for DOE's assessment utilizes a very small data set for gamma damage to concrete. That entire data set is based solely on concrete which is internally wetted. The concrete at WESF is protected from the water in the pools by a thin stainless steel liner. That liner prevents water from reaching the concrete. The exterior of the concrete is exposed to dry desert soils. These have desiccated the concrete rendering it dry during the 47 years that it was been in place. Dry concrete is known to be more severely damaged by gamma radiation than is wet concrete. As a result, the safety criteria DOE applies

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[1] With enactment of the Resource Conservation and Recovery Act (RCRA) 42 USC § 6901 et. seq., Congress provided opportunities to bring suit against those who present an imminent and substantial endangerment to health or the environment while contributing to the handling of solid or hazardous waste. RCRA allows the EPA or equivalent state agency, if it receives "evidence that the past or present handling, storage, treatment, transportation or disposal of any solid waste or hazardous waste may present an imminent and substantial endangerment to health or the environment," to "bring suit… against any person… who has contributed or who is contributing to such handling, storage, treatment, transportation or disposal to restrain such person from such handling, storage, treatment, transportation, or disposal, to order such person to take such other action as may be necessary, or both." 42 U.S.C. § 6973(a)

are NOT conservative or protective. The real conditions are worse.

There is an additional small data set for gamma damage to dry concrete. DOE has scrupulously excluded that data from the assessment of gamma dose impacts on concrete. That data suggests that the concrete is or may be equally damaged at 500 to 2,000 times less aggregate dose for dry concrete than for wetted concrete.

The absence of assured data is a major data gap in the risk assessment for this structure, and for other concrete structures exposed to high radiation fields and high aggregate doses. This vastly greater sensitivity to radiation exposure implies that the concrete is damaged more severely, more deeply and more broadly.

This has direct importance and application to WESF. It also has direct and immediate application to the casks DOE has designed, and to the pad on which the casks will sit.
The effects of gamma dose on dry concrete also has direct immediate application to assessing the current and future conditions of:

1. The High-Level Waste storage tanks - both single and double-shell, and any newly designed tanks or tank capacity.
2. The High-Level Waste vitrification plant.
3. The Pretreatment Plant
4. The Low-Activity High-Level Waste vitrification plant
5. The High-Level waste glass log storage facility
6. The Low-Activity High-Level Waste glass log storage area &/or facility
7. Any additional new treatment and storage facilities that process high-level waste (high or low-activity)
8. Any concrete used in association with the recycle gas stream(s) from the vitrification facilities (particularly those that contain cesium or its salts in vapor form)
9. Any Cesium separation or pretreatment facilities, and casks associated with wastes from those
10. The Canister Storage Building.
11. The Castor Casks SW of PFP in the 200 West area, and possibly their containment structure.
12. Any other on-site facility in which concrete may be exposed to gamma doses in excess of 5 million rads during their entire design life - AND - any potential extension to that service life.
13. The Columbia Generating Station Reactor
14. The Columbia Generating Station Spent Nuclear Fuel Storage Pool
15. Possibly also at State regulated facilities operated by the US Navy at Bangor Naval Shipyards and/or Bremerton Naval Shipyard
16. Other facilities nationally and internationally

There is a paucity of good real-world data on the dose impacts of gamma exposure on concrete under storage conditions (dry or wet). The dismantlement of the WESF facility

once the capsules have been removed provides a unique and rare opportunity to gather the data required to assure the safety of ALL of these facilities, and of the public and the environment.

It is incumbent on Ecology to require that this concrete degradation data be urgently gathered for use in the assessments under Ecology's various permits, both at Hanford and elsewhere in the State.

The data on the concrete conditions at WESF has direct bearing on the calculation of risk from accidents or events at these facilities. Lacking reliable data, it is simply not possible to assure that the risk of catastrophic accident is low. That absence of significant relevant data requires that these risk assessments assert a high likelihood of failure in any adverse event - including from the simple passage of time. Assuming the adequacy of the existing base of data and standards for assessing safety is a dereliction of Ecology's duties.

The concrete structure at WESF was designed to meet certain structural standards. Those standards apply to holding the building up. Initially they also applied to retaining the water in the basins. With the severe calculated damage to the basin floor and walls, the basin integrity can no longer be assured for its design purposes of retaining the necessary water for cooling and shielding. The structural calculation for any concrete pads used to support the cesium storage casks must also include an evaluation of the aggregate dose to the pad concrete and how they may affect the pads ability to structurally support the weight of the casks and related equipment. DOE routinely uses buildings and structures far beyond their intended design lives. This is not an argument to extend their design lives. However, based on Hanford experience, the calculations must assure the structural adequacy of the concrete for a period at least twice the intended design life of the facility.

Should a drain down event be initiated at WESF, it is unlikely that the small makeup water capacity at the facility could keep up with the loss rate. If it fails to do so, the radiation levels in the structure will rapidly make building entry impossible due to enormous and instantly lethal radiation fields. Not long after that, the temperature rise in the building will preclude any human or robotic entry. That should be expected to rapidly be followed by the structural failure and collapse of the concrete structure into the pools. Radiation levels by that point will preclude close approach within about 50 yards of the building or its remnants. Radiation levels will also preclude flight over the facility and a flight exclusion zone will be required.

Upon loss of cooling the cesium capsules will heat to the point that chloride stress corrosion from the chloride salts the capsules contain will lead to rapid chloride stress corrosion and general corrosion failure of the capsules. They will then begin to release their contents, both radioactive and hazardous, into the rubble. Addition of water, whether from meteoric inputs from rain and snow, or human inputs will then drive the high temperature cesium wastes to migrate both deeper into the soil and to the surface through saltation and steam driven processes.

Radiation damage to the concrete at WESF and potential release has applicability to Ecology dangerous waste regulation of wastes in other facilities and sites at Hanford. Once on the surface, the hazards and radioactive materials released become the regulated concern of the Washington State Department of Health, as well as EPA and DOE.

Finally, the public involvement process could use some improvement in these unprecedented times where in person meetings are not an option because of Covid-19. Information, especially for permit modifications could be much clearer and organized in a way that enables the reader to at a glance know what each section of the permit modification is and where to go to get an overview of information. Virtual public meeting presentations should be the default, and at a minimum a recording of a presentation with slides that explain the proposed permit modification should be made available on the webpages for the comment period. Related information for a public comment period should also be included as links with a one sentence description of what the hyperlinked documents are, for instance, the document submitted by DOE to Ecology at Ecology's request after the first permit application was returned to DOE following Ecology's determination that the application was incomplete and was missing information. It was not possible to find the information DOE provided at Ecology's request and therefore impossible to find out if it was sufficient for the items that came up in Ecology's determination of incompleteness which stated:

- "There is insufficient general design, engineering information, and supporting documentation to demonstrate that the facility can and is designed to resist seismic ground motion and that the design is sufficient to withstand the maximum horizontal acceleration of a design earthquake specified in the demonstration, as required by WAC 173-303-806(4)(a)(xi).
- The Part B Application did not include the dangerous waste training plan that is required in WAC 173-303-806(4)(a)(xii), but was subsequently provided to Ecology upon request. There is insufficient supporting documentation on the training courses to determine if the dangerous waste training plan adequately meets the requirements of WAC 173-303-806(4)(a)(xii).
- There is insufficient general design and engineering information regarding design, construction and operation of the Pool Cells, Hot Cell G, and Truckport dangerous waste management units to determine if the application adequately address all miscellaneous unit requirements of WAC 173-303-806(4)(i)(xii)."

Hanford Challenge comments are summarized below:

- **Accelerate Dry Storage Timeline**: Hanford Challenge urges the WA Department of Ecology to aggressively use its regulatory authority and accelerate the movement of the WESF capsules to safer storage, and at a minimum, reject any proposals to delay the 2025 milestone.

- **Include Catastrophic Release Emergency Response Plans**: Ensure that robust, specific and detailed emergency response plans for a catastrophic release of radioactivity at WESF are included in the permit.

- **Apply Data Sets Showing Effects of Gamma Dose on Dry Concrete in Ecology's Evaluation of Structural Conditions and Disaster Prevention**: Require that data sets showing the effect of gamma dose on dry concrete are applied to assessments of risk at WESF and other DOE facilities where concrete structures are exposed to high-dose radiation fields. This data has been excluded and has direct relevance to WESF, the casks DOE has designed for dry storage and the pads the casks will sit upon. Ensure that conditions are safer now and in the future at WESF and other DOE sites. The data on the concrete conditions at WESF has direct bearing on the calculation of risk from accidents or events at these facilities. Lacking reliable data, it is simply not possible to assure that the risk of catastrophic accident is low. That absence of significant relevant data requires that these risk assessments assert a high likelihood of failure in any adverse event - including from the simple passage of time. Assuming the adequacy of the existing base of data and standards for assessing safety is a dereliction of Ecology's duties.

- **Require Structural Adequacy of Concrete for at Least Twice the Intended Design Life of the Facility**: The concrete structure at WESF was designed to meet certain structural standards. Those standards apply to holding the building up. Initially they also applied to retaining the water in the basins. With the severe calculated damage to the basin floor and walls, the basin integrity can no longer be assured for its design purposes of retaining the necessary water for cooling and shielding. The structural calculation for any concrete pads used to support the cesium storage casks must also include an evaluation of the aggregate dose to the pad concrete and how they may affect the pads ability to structurally support the weight of the casks and related equipment. DOE routinely uses buildings and structures far beyond their intended design lives. This is not an argument to extend their design lives. However, based on Hanford experience, the calculations must assure the structural adequacy of the concrete for a period at least twice the intended design life of the facility.

- **Require Concrete Testing of WESF Storage Pools Post Removal of Capsules to Dry Storage**: There is a paucity of good real-world data on the dose impacts of gamma exposure on concrete under storage conditions (dry or wet). The dismantlement of the WESF facility once the capsules have been removed provides a unique and rare opportunity to gather the data required to assure the safety of ALL of these facilities, and of the public and the environment. Due to the scarcity of data on the effects of gamma radiation on dry concrete, it is incumbent that Ecology require collection of concrete testing data at WESF for use in assessments under Ecology's permits to make conditions safer now and in the future. This data is extremely important to improve safety at Hanford and elsewhere.

- **<u>Increase Clarity in Communications</u>**: Permit Modifications are notoriously inaccessible to the public, but this does not need to be the case. In future permit modification public materials like fact sheets and presentations, use plain language to clearly communicate why an action is being taken and how it fits into the bigger picture of ultimate Hanford cleanup goals.

  Additionally, provide a guide for the public that explains the linked permit modification documents. For example, it was not clear that the first document the public should access for this comment period is the Focus Sheet. Information in the focus sheet could have been more widely circulated.

- **<u>Plan for Public Meetings</u>**: Ecology should plan and hold virtual public meetings on all permit modification comment periods to clearly explain what the modification covers and how it affects Hanford cleanup. In-person public meetings are also helpful, when safe and requested. As a baseline, it always helps to have an opportunity to present information and have a Q&A with interested members of the public. Meetings should be recorded and uploaded for those who are not able to attend.

- **<u>Make Relevant Documents Easier to Navigate and Accessible</u>**: In the future, please provide a summary of which documents are included in each permit modification package for ease of navigation. Please make sure these materials are available and accessible in an easy to navigate format online. In the case of this WESF permit modification, the information requested by Ecology from DOE was difficult to locate and once located did not contain the multiple attachments referenced in the transmittal letter. Only one of the referenced attachments was identified as for Official Use Only, and yet none of the other attachments were available.

Thank you for considering our comments.

Tom Carpenter, Executive Director

Waste Encapsulation Storage Facility

Potential Catastrophe, Emergency Response and Prevention

The following is provided as supplemental information Hanford Challenge created in consultation with Dirk Dunning, retired chemical engineer and nuclear specialist, for the Sept 2020 Washington State Department of Ecology Public Comment Period to add WESF to Section III of the Resource, Conservation, and Recovery Act (RCRA) Permit as Operating Unit Group 14 to transfer the capsules into dry cask storage.

The potential for a Chernobyl-like catastrophic spread of contamination from WESF should be eliminated by moving the strontium and cesium capsules to dry storage as soon as possible. The following is a description of what could happen if a major earthquake or other event caused water to drain from the pools.

The nearly 2,000 stainless steel capsules of cesium and strontium stored in underwater steel lined concrete pools at WESF are highly radioactive. Concrete is known to degrade when exposed to radiation for prolonged periods of time. DOE's own analysis in 2011 showed severe damage to the walls and floor from radiation. The walls between cells then were calculated to have less than 85% of their original strength at their centers, and essentially no strength at the wall surface behind the stainless-steel liner.

The safety basis DOE used for that analysis was based on accepted standards for radiation damage. All of the data to develop those standards came from studies of concrete with high moisture contents. The limited available data for dry concrete lacking this moisture points to it being equally damaged at total doses 500 to 2,000 times lower doses. As a result, it is likely that the concrete at WESF is far more badly damaged than DOE's own analysis suggests.

Imagine a major earthquake causing a rupture to the liner, or failure of the concrete, or an inaccessible pipe at the bottom of the pools failing, causing water to drain from the pools.

Once the water level falls to within 6 feet of above the capsules the radiation dose from gamma rays from the decay of radioactive cesium becomes so enormous that human entry to the building is simply not possible. Once the capsules are fully exposed, the temperature in the building rises to several hundred degrees Centigrade. No human can then enter the building. Facility control is lost.

When the water level falls well below the capsules, the radiation field created makes approach to the building within 50 yards lethal. Access even to the outside of the building is lost, as is access over the top of the building.

Once facility control is lost, the capsules overheat from lack of cooling. The salts in the cesium capsules attack and damage the capsules and they progressively fail, slowly releasing their contents. Radioactivity then spreads, gradually making the building and the areas around the building ever more unsafe to enter. The spread of radioactivity continues for months and years if nothing is done to stop it. However, the radiation levels and contamination make doing anything extremely dangerous, and potentially impossible. The contamination then spreads until the entire Hanford site is contaminated and potentially rendered inaccessible for hundreds of years.

So how would DOE respond to scenarios like this? One way (not in DOE's current plans) might be to pile tens of feet of dirt over the collapsing building to create a radiation shield covering the capsules, and doing so as fast as possible to slow the spread of radioactivity. Once complete, a barrier would then be needed to stop water moving into the wastes.

To do something like this would require using heavy earth moving equipment to bulldoze and dump the dirt closer to the building and ultimately over it. The radiation levels before that happens are enormous near the building. The equipment would have to be heavily shielded with lead to protect the workers. Even then the radiation doses may be high. The Russians did something similar at Chernobyl. They used ten thousand workers to shovel radioactive debris back into the reactor hall. Huge numbers of those workers reportedly ultimately died from their exposures.

If the capsules have failed before they begin, that might not even be possible. That would be far more like Chernobyl, where radioactive material was on the loose everywhere.

The Russians tried to use a remotely operated bulldozer at Chernobyl. It died before ever moving any waste. The Japanese repeatedly tried to use robotic equipment. Every attempt ended in failure as the electronic circuits were fried by the radiation fields.

Other methods could be tried. Each has equally large drawbacks.

The best answer is to ensure that no such catastrophe is even remotely possible. And the way to do that is to get the capsules into safe dry storage.

That should include using another capsule (DOE calls them sleeves) made of super alloys that will not crack, corrode or fail if or when the cesium capsules themselves fail. In truth, the cesium capsules should have been made of such an alloy from the start. But that cannot be changed now.

The dry cask storage is also planned to include air cooling of the capsules and concrete as a radiation shield. DOE must remember the lesson from WESF – that radiation destroys concrete. The concrete used must play no structural role - or – it must itself be shielded from radiation exposure. A better answer would be to use a material that is not destroyed by the radiation exposure, such as lead. If concrete is used it must be structurally contained itself so that when

the radiation destroys it that it does not further complicate the problem, or result in high radiation areas around the casks.

The same holds true for the pad the casks sit on. Radiation dose and damage to the pad must be planned, and damage prevented that might further complicate the problem by allowing the casks to sink or tip over, or that makes their retrieval for disposal more difficult.

Once the capsules are removed from the basin, it is essential to immediately begin a detailed forensic analysis of the concrete walls and floor to determine the degree of damage to the concrete. This must then be assessed against the estimated radiation dose to the concrete from the known history of the capsules stored in the basin. This real-world data is essential for evaluating every other nuclear facility in the DOE complex, all of the other DOE pools and basins, operating nuclear reactors, and all of their spent fuel pools. This analysis must be a very high priority. And on completion the data needs to be widely and publicly shared, so that nuclear facilities all over the world can use this information to assess their own risks and hazards.