

# HANFORD ADVISORY BOARD

A Site Specific Advisory Board, Chartered under the Federal Advisory Committee Act

## **Advising:**

US Dept of Energy  
US Environmental  
Protection Agency  
Washington State  
Dept of Ecology

April 1, 2011

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Jane Hedges, Program Manager  
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Re: 200-SW-2, Radioactive Solid Waste Burial Grounds

Dear Mr. McCormick and Ms. Hedges,

## **Background**

Hanford operations generated solid waste that went into radioactive solid waste burial grounds (SWBGs), as well as liquid wastes that went to tanks, cribs, ponds, and trenches. Hanford's SWBGs hold about 450,000 cubic meters of radioactive waste in more than 40 linear miles of unlined trenches. There is limited or no documentation for what was actually put into some of the burial grounds, and where it was placed. The U.S. Department of Energy (DOE) has acknowledged that the SWBGs contain a minimum of 363 kg of plutonium and 485 metric tons of uranium. The Hanford Advisory Board (HAB or Board) is concerned that there is no accurate assessment of the pre-1970 plutonium and uranium inventory contained in the SWBGs. The Board believes there is far more inventory of pre-1970 Transuranic elements than there is of the post-1970 retrievable waste. Knowledge of chemical waste disposal is limited. There are few meaningful chemical waste disposal records for many of the burial grounds. A number of locations within the SWBGs have received liquids. There are anecdotal accounts about liquid disposal events into the trenches.

DOE is preparing the 200-SWBG RCRA Facility Investigation/Corrective Measures Study and Remedial Investigation/Feasibility Study (RI/FS) Work Plan, which will define work leading to an RFI/CMS (Remedial Field Investigation/Corrective Measures Study), RI/FS report and proposed corrective action decision/proposed plan for remediation of the unlined burial ground trenches found in the 200-East and 200-West Areas of the Central Plateau.

## **Envirolssues**

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**HAB Consensus Advice # 243**

Subject: 200-SW-2 Radioactive Solid Waste Burial Grounds

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The RI/FS report will provide the foundation for remediation decisions. For these decisions, DOE will need to know the nature and extent of waste forms and any mobile contamination that might be produced from them to determine an appropriate action. Recently completed surface surveys will help to confirm the historical disposal information and have already disclosed that the locations of some trenches are not where they were identified on maps. Groundwater monitoring results from the current wells have not indicated that the burial grounds have yet contributed to groundwater contamination, but the Board feels that the groundwater monitoring network is inadequate (refer to the Groundwater and Vadose Zone Monitoring section under Board Comments following the advice), and that the well monitoring results may fail to detect possible contaminant plumes because of a lack of sufficient number of wells, the falling water table, and the architecture of the subsurface.

Experience with excavating other Hanford burial grounds suggest that quite a few of the containers originally used for disposal have failed or are failing to contain their contents in the decades since their disposal. Bags, boxes, cylinders, ion exchange columns, and drums were all used as disposal containers. Some of these temporary containers have collapsed, causing subsidence problems that pose a risk of potential release to the environment.

The Board offers the following advice concerning the parts of the Radioactive Solid Waste Burial Grounds program where DOE should focus their investigation, and the actions that should be taken to lower risk and increase safety in future actions at the SWBGs. Board comments and concerns following the advice provide the basis from which the advice was developed, and are designed to provide useful background for the public and agencies.

### *Advice*

The Board has previously issued extensive advice and a flow chart (HAB Advice numbers 170, 173, 207, 226, 229 and 231) for decision-making in regard to restricted use of caps and burial ground cleanup decisions on the Central Plateau. These should guide the TPA agencies in regards to the burial grounds. In addition, the Board submits the following advice points:

- The HAB has consistently encouraged Remove-Treat-Dispose (RTD) alternatives. The burial grounds would be an appropriate place to apply this. The Board advises the agencies to use the following four key values<sup>1</sup> to guide the decision-making process: 1) Minimize impacts on human and environmental health; 2) protect worker safety; 3) conduct an effective and cost-efficient cleanup; and, 4) guarantee public participation and transparency.

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<sup>1</sup> The four key values were identified by University of Washington Masters in Public Health COPH students in 2010 after interviewing representatives of the Tri-Party agencies, advocacy groups, Native American Nations, and citizens.

- The Board believes that finding and dealing with the high-risk areas is the priority, and advises that trenches for which there is limited or no inventory information should be adequately characterized and understood. Characterization should be done through exhumation of trenches and identification of high-risk materials (using the Observational Approach<sup>2</sup>) after historical information searches, preliminary survey work, and preliminary sampling have identified the trench locations and gathered some information about the probable contents.
- The Board advises the agencies that a workable method to characterize the contents of trenches and caissons should be followed by phased determinations for further retrieval, immobilization or capping decisions. The Board supports characterization of the SWBGs to understand where the high-risk materials are located, so that well-informed decisions can be made before actions are taken. This initial characterization phase should lead to development of a burial ground uncertainty rating protocol to help determine where additional characterization is needed. The Board also advises planning characterization to address immediate risks to workers and providing that information to the workforce.
- The Board advises the agencies to adopt an adaptive approach to dealing with the SWBGs. High-risk materials – whether disposed prior to or after 1970 – should be retrieved from the burial grounds. Removal of long half-life radioactive wastes, mobile wastes, and those that release dangerous gas should be prioritized. Trenches or burial ground areas that are determined to be low risk should be capped only after confirmatory investigations determine that total cumulative impacts will not exceed standards. Higher risk burial ground trenches require more intensive study, remediation or exhumation during characterization, followed by phased decision-making about contents removal.
- The Board advises that the best solution at Hanford’s SWBGs would likely be some combination of targeted retrieval, combined with vadose zone monitoring and remediation, plus capping the remaining non-exhumed low risk parts of the SWBGs.
- The Board advises DOE to pursue characterization of the vadose zone below the SWBGs to determine moisture levels and the degree of mobile contaminant spread. Special attention should be paid to vadose zone characterization of those burial grounds emplaced over former pond sites. As with caissons found in other places, and consistent with earlier advice, the Board supports characterization around and below the caissons, looking for vadose zone impacts.

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<sup>2</sup> DOE/RL-98-28

- The Board advises that the Hanford Site-Wide Permit (Permit), in conjunction with the RI/FS process for the SWBGs, should require both vadose zone and groundwater monitoring. The Permit should recognize that vadose zone monitoring is an early warning system which should trigger corrective action (via enforceable contingency plan requirements in the permit) when contaminants are detected at action levels. Although groundwater monitoring under the burial grounds poses challenges, an improved monitoring network is necessary and should be required. Monitoring should be shifted from the interim status indicators to specific regulatory standards for potential chemical and radionuclide releases.
- The Board advises DOE to provide total volume estimates of plutonium, uranium, cesium, and thorium 232, which were recorded as disposed in the burial grounds. DOE should create, and make publically available, maps locating the most probable waste disposal locations for these elements, as well as perform an uncertainty evaluation of how much reliable data there is to back up this estimate.
- The Board is concerned that the current timeline for investigation and remedial action for the burial grounds anticipates no decision for remedial action until 2017, which would leave just seven years to the TPA deadline for completing all non-tank farm remedial actions. That is far too short a time period to carry out any remedy with extensive retrieval and treatment, and appears to be based on an unsupportable assumption that capping will be the only remedy.
- The Board advises that the investigation phase should include exhumation and treatment of wastes of high-risk trenches, and investigation of representative trenches where little is known of burial ground contents, to guide characterization decisions in a phased decision process. When the investigation is completed, the Board further advises that an assessment of cumulative impacts and risks from alternative remedies should be presented for public review and comment in a new EIS or supplement to the TC&WM EIS. Proposed remediation should meet RCRA and Washington State hazardous waste law closure performance standards.
- The Board appreciates DOE's commitment to hold public meetings and to explain how public input was used in development of the work plan. The Board advises that in discussing the work plan, DOE should use descriptive language to accurately communicate the contaminants of concern and actual condition of the subsurface areas. In addition, the Board advises the agencies to hold a formal public comment period on the draft RI/FS work plan.
- The Board advises DOE to make information available online from monitoring and characterization activities. The TPA agencies should endeavor to communicate the residual risk that may arise from the unremediated trenches, and

to explain how alternative cleanup actions could reduce that risk to acceptable levels.

### **Board Comments**

#### ***Characterization***

Burial ground remediation alternatives need to be supported by in-depth characterization of burial ground contents. During the past 20 years, unanticipated materials have been found in other burial grounds at Hanford. Pre-1970s waste disposal into burial grounds was poorly inventoried at Hanford. These findings point to the limited knowledge of what substances exist in the trenches. Without a better understanding of the contaminants, as Oregon's cleanup board explains, "it is not possible to accurately assess the risks of leaving the waste in place."

A better approach to determine where dangerous and radiological waste has been disposed in the 200-SW-2 trenches is needed. Characterization of the waste in the trenches is challenged by the haphazard methods of disposal, lack of records, and an assumption that the waste had been permanently disposed. Typical sampling methodologies used to confirm expected locations of waste, or the distribution of mobile contaminants, are inadequate for the scale necessary. In order to know with reasonable certainty the content of the trenches, Washington State hazardous waste law (Revised Code of Washington Chapter 70.105) requires adequate characterization. The Board and the Regulators support the Observational Approach as a form of characterization that has been utilized successfully in remediation efforts at Hanford and other DOE sites. The Observational Approach involves surface geophysical and radiological surveys to help delineate the trenches, through partial exhumation of the trenches to allow evaluation of the risk of the waste on a container by container basis. Removing high-risk waste from the burial grounds would likely help reduce the cumulative waste impact at Hanford. The draft Tank Closure Waste Management Environmental Impact Statement (TC&WM EIS) projects the cumulative effect of the burial ground wastes with other wastes that contaminate the Central Plateau's groundwater at levels far above standards, far into the future. In choosing a protective remedy for the SW-2 Burial Grounds, the cumulative impacts from releases of all unlined trenches should be considered.

The Board has consistently encouraged Remove-Treat-Dispose (RTD) alternatives (HAB Advice #170, 173, 207, 226, 229 and 231). The burial grounds would be an appropriate place to apply this. The Board assumes that process knowledge has been used for initial characterization, but it is not clear if there is a risk threshold that regulates the amount of additional characterization required before a decision. The Board and public should know

what characterization will be done to supplement the historical data where few records exist, and what triggers the need for further characterization.

### ***Groundwater and Vadose Zone Monitoring***

A review of the groundwater monitoring maps and the most recent groundwater monitoring report for the Hanford site clearly shows that there are entire burial grounds that have no groundwater monitoring. There are others for which the monitoring is minimal or, the Board believes, of questionable value. The claim that there is no reason to believe that there are releases affecting groundwater is at odds with the existing minimal monitoring data. In the 200-West Area, LLBGs 218-W-4C, 218-W-4B, 218-W-4A, 218-W-11, 218-W-1, and 218-W-2 form an elongated cluster oriented in a north-south direction. Two wells located approximately down gradient of 218-W-4B and the northern extreme of 218W-4C had high total organic carbon and elevated total organic halide readings in February 2008 and August 2008 (wells are checked biannually). These elevated readings were reanalyzed and confirmed, and a groundwater quality assessment plan was written and submitted to the Washington State Department of Ecology (Ecology).

The configuration of the groundwater monitoring system may be inadequate. There are too few wells, and the water table under the Central Plateau has dropped to a level where the existing wells may be ineffective at representative sampling. Because groundwater monitoring may not sufficiently detect advancing contaminant plumes from the SWBGs, the Board supports the development of vadose zone monitoring technology and a monitoring well network. The Board believes that additional characterization of the vadose zone beneath the SWBGs is necessary. This vadose zone information is vital for determining further cleanup actions. The Board is concerned that the SWBGs have the potential to release high levels of soil gases and chemicals. Vadose zone monitoring can be used to detect such releases before they reach groundwater.

Some of the trenches were placed on top of older (infiltration) ponds, where waste-laden water was allowed to soak into the ground. The Board supports characterization under those burial grounds to determine if the pond-disposed waste poses a risk, whether or not the materials disposed in the trenches is deemed to be below threshold risk. The vadose zone under the old pond sites that now have trenches on them should be seen as a possible site for cleanup.

The Board has great concern about utilizing an analogous site approach, in which trenches of a similar age or similar process are assumed to contain the same materials. Each of the disposal trenches should be examined as separate risk-producing entities. Each step of the characterization process should be undertaken.

### ***Inventory***

There are multiple burial grounds where there is no knowledge of inventory and others where the information is very limited.

Although DOE has said the process records are reasonably good and that it is possible to create disposal volume estimates, the chemical constituent information is not as reliable. The contaminants of concern were not tracked. DOE has said there needs to be an investigation to address whether there is any liquid waste in the solid waste burial grounds. In the past, there are issues with completeness of the burial ground inventory, including contaminant load from laboratory chemistry and volume of off-site waste.

### ***Caissons***

Caissons are pipes into which radioactive waste packages were disposed. Some Board members were surprised to learn there were caissons in the Central Plateau. The caissons in other operable units were used for disposal of “hotter” materials, including small amounts of dangerous liquids. DOE said there is no evidence of leakage from caissons, based on DOE’s groundwater monitoring. However, as discussed above, the groundwater monitoring system is not adequate to make those determinations. Since caissons were open at the bottom, and the water table is hundreds of feet below the bottom of the caissons, there is a possibility of vadose zone contamination that has not yet reached the groundwater.

### ***Risk/Uncertainty***

The Board realizes that it is difficult to weigh relative risks of different burial grounds with the data gaps presented. Records are incomplete and inconclusive. The records are especially incomplete when it comes to waste disposed before 1970. Further characterization will help disclose the level of risk from each waste stream. Groundwater monitoring does not exist for some of the burial grounds. It is important to know what kind of waste characterization will work for SWBG randomly disposed waste and to determine at what risk level a site is declared “clean.”

Ecology has looked at the data and has identified four burial grounds with high levels of plutonium and two with uranium. The Board is also concerned that certain trenches have been identified as higher risk than others. The results of actual characterization, including test exhumations of trenches, need to be evaluated in risk assessments with human exposure scenarios, plant exposure, and groundwater to consider the cumulative impacts from all trenches and other sources on the Central Plateau. DOE has indicated that it will calculate risk threats with historical disposal information. Given the lack of knowledge

regarding trench contents or of contaminant spread to date, the Board believes this risk assessment would be inadequate.

### ***Regulatory path forward***

The draft TC&WM EIS found that leaving waste in place, including in these SWBGs, would create serious future groundwater contamination problems. These issues are currently not being addressed. The Board is concerned that DOE's proposals are predicated upon an all or nothing premise – dig it all up, which would be expensive and may prove unnecessary for some areas, or leave it all in place beneath caps, which would ignore the risks posed by some of the dangerous and radiological waste.

Washington State regulations require enough characterization to know what is in the trenches and the extent and nature of current contamination in the soil column. These requirements cannot be met with surface studies and a review of the inadequate historical records. The current groundwater monitoring coverage is also inadequate. An opportunity now exists to include vadose zone and improved groundwater monitoring requirements from the Hanford Site-Wide Permit with the RI/FS phase for the SWBG units.

The Board believes there are lessons to be learned from the Idaho National Laboratory, where there was targeted retrieval of higher risk materials. The Board believes the best solution at Hanford's SWBGs would likely be some combination of targeted identification and retrieval of high-risk waste (Observational Approach), vadose zone monitoring and remediation, groundwater monitoring with a more effective well network, and capping the remaining non-exhumed low risk parts of the SWBGs. Finding and dealing with the high-risk areas should be the priority.

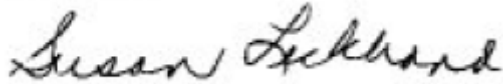
The decisions made now with regards to trenches are going to impact maintenance and surveillance for decades or possibly for centuries to come. These decisions should be made with future ramifications in mind. Life-cycle costs of institutional controls and other land use controls should be accounted for.

### ***Landfill Terminology***

The terms associated with these remediation areas are confusing to the public. The Board disagrees with calling these burial grounds "landfills," or "solid waste" burial grounds, because some of their characteristics (e.g. unlined trenches) are inconsistent with the requirements for landfills. "Solid waste" is a very broad category that fails to identify hazardous, radioactive or cancer-causing constituents. The Board understands the need for consistent terminology, but points out that these terms are not being applied appropriately.



Sincerely,



Susan Leckband, Chair  
Hanford Advisory Board

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*This advice represents Board consensus for this specific topic. It should not be taken out of context to extrapolate Board agreement on other subject matters.*

cc: Stacy Charboneau, Acting Manager, U. S. Department of Energy, Office of River Protection  
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