



HANFORD CHALLENGE UPDATE  
April 23, 2010

**New Report Warns of Safety Issues at Hanford's Waste Treatment Plant**

A new report from an oversight arm of Congress raises new and serious concerns about safety design and processes at Hanford's Waste Treatment Plant, also known as the vitrification facility. The Waste Treatment Plant is being built to immobilize high-level nuclear waste into glass logs. The plant is at least a decade behind schedule and three times over budget, with the latest estimates for completion topping \$12 billion, and an opening date of 2019.

The DNFSB issued a [Quarterly Report to Congress](#) on April 15, 2010 and raised new concerns about the design processes at the Hanford plant negatively impacting safety margins. Warning that "additional cost and schedule delays could occur," the DNFSB said that DOE has approved changes related to the classification and design of safety-related systems and components "without fully resolving key technical issues, preferring to grant conditional approval in areas involving significant technical uncertainty".

The report highlighted issues with hydrogen gas buildup, the potential of explosions, and the settling of plutonium sediments in tanks that could lead to a criticality or hydrogen gas explosion. The DNFSB said that while DOE seems comfortable with the changes, the "Board does not share DOE-ORP's confidence that these technical issues will be readily resolved without impact to the facility's design."

Hydrogen Gas Issues

DNFSB reported to Congress that recent changes in the design approved by DOE "allows hot cell piping to undergo permanent deformation from an explosion." While the DOE has said that such an explosion was unlikely to lead to a breach of the primary confinement barrier, the DNFSB pointed out that DOE's approach "is more complex and less conservative than the original design approach, and is heavily reliant on the engineering judgment of BNI." BNI, or Bechtel National, Inc., is the contractor in charge of constructing the Waste Treatment Plant. Specifically, the DNFSB noted:

- The proposed strategy will use quantitative risk assessment to determine the peak pressure and frequency of explosions. DOE has no standard governing the application of quantitative risk assessment. DOE-ORP approved the revised piping design criteria before BNI had defined the quantitative risk assessment methodology.
- BNI has performed testing to support the use of the new design criteria for piping up to 4 inches in diameter. However, DOE-ORP's approval allows BNI to apply the new design criteria to piping with diameters greater than 4 inches. There are no data available to justify the use of the new design criteria for piping greater than 4 inches in diameter, nor is testing planned.

- BNI has published test data for piping up to 2 inches in diameter. These tests used simplified geometries that generally tested a single variable (e.g., a single bend) and a limited number and types of components, and did not represent the more complex configuration in the facility. For example, the facility will have multiple pipe bends, elbows of varying radii, changes in pipe diameter, changes in hydraulic head, and numerous component types (e.g., valves, pumps, heat exchangers) and jumper designs.
- The new design criteria allow varying degrees of permanent deformation of piping in the hot cells of the facility. DOE's justification for allowing this deformation is that operators can inspect hot cell piping, observe leaks, and repair failed components. However, the facility **design does not include the capability to readily detect an explosion in process piping** or to measure permanent deformation from individual or successive events. If an explosion in a hot cell piping system were to result in significant permanent deformation, assessment of the significance of the deformation would be complex and costly. If repair or replacement of the piping were required, this work would be time-consuming, cause significant disruption of plant operation, and potentially result in considerable risk to the workers.

The Board 's review also questioned the accident analyses and the “questionable assumptions and methodologies, including the assumed deposition rate of radionuclides following a postulated accidental release and the analysis of accidental releases resulting from leaks and spills.”

The Board stated that the “current seismic design specification for piping and vessels should not be downgraded from its higher designation without full consideration of the need to protect the workers. Further, for those piping systems and vessels that are currently designated which a lower seismic design requirement, appropriate consideration should be given to revising the seismic design requirement to be consistent with DOE's stated expectations (i.e., a higher seismic design requirement when needed for worker protection).”

Another issue reported on by DNFSB relates to the ability of the site to adequately mix wastes in tanks to prevent the buildup of sediments at the bottom of the tank that could lead to a criticality accidents (too much plutonium in one place) or the generation of hydrogen gas that could lead to an explosion. DNFSB has pointed out that the pulse jet mixers which were installed on the plant’s holding tanks (about 40,000 gallon capacity) were inadequate to the task of keeping the waste mixed sufficiently. The problem is made worse by the fact that most of these mixer tanks have already been installed in the Waste Treatment Plant, and redesign and retrofitting could be costly and time-consuming.

DNFSB criticized DOE for attempting to resolve the issue using methods such as basing their “functional requirements for mixing on average instead of bounding properties of the waste to be processed, and (2) relies on mathematical models that are not appropriately validated through testing for this application.”

The DNFSB warned that criticality events and explosions were not the only issue: “The presence of a thick sediment layer could also have a detrimental effect on the bubbler systems used for measuring level and average density of the process fluid in the vessels. Inaccuracies in these measurements will result in errors in the calculation of the drive time of the pulse jet mixers, potentially causing numerous overblows. The cumulative effect of **a large number of overblows could be the material failure of components internal to the process vessels.**”