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Washington State Department of Ecology
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Subject: Technical Concerns Regarding Hanford Waste Treatment Strategy and Critical-Path Scheduling

To Whom It May Concern:

I am submitting this letter to provide technical comments regarding the current strategy for treating radioactive Hanford tank waste, specifically proposals involving production of glass or grout from the waste tank supernatant fraction. Based on my professional experience developing thermodynamic models for Hanford waste treatment while working at Pacific Northwest National Laboratory under subcontract to Bechtel, I wish to outline several critical issues that directly affect the feasibility, schedule, and long-term success of Hanford cleanup operations.

Producing glass or grout from the Hanford waste supernatant does not advance the true critical path for tank waste treatment. The actual schedule-limiting step is the removal and treatment of the alumina sludge in the tanks. Because the caustic supernatant is required to leach this sludge, diverting it for glass or grout production would necessitate adding fresh caustic to the waste. This action is counterproductive, extends the treatment schedule, and yields no meaningful progress toward resolving the underlying sludge-processing bottleneck.

During my work at PNNL, I developed detailed thermodynamic models of Hanford waste chemistry and associated process technologies. These models revealed substantial deficiencies in the scientific and engineering basis used for the Waste Treatment Plant (WTP) design. The flowsheet transferred by BNFL was originally intended for acidic waste with low solids content. Hanford waste, by contrast, is highly basic and contains a large solids fraction. My modeling demonstrated that the planned leaching process, pulse-jet mixing systems, and filtration equipment were inadequate for Hanford waste conditions. Furthermore, the high sulfate content of the waste poses severe corrosion risks to both glass and grout matrices.

The models also demonstrated that the sodium hydroxide required to leach alumina sludge had been underestimated by a factor of five. This additional caustic would extend the waste-treatment schedule proportionally. In addition, adding the necessary quantity of caustic would precipitate trisodium phosphate dodecahydrate (TSP).

From my direct chemical-industry experience, both alumina sludge and TSP are extremely difficult to filter and impossible to dewater and decontaminate. The sludge has the consistency of toothpaste, and it contains abundant radioactive transuranic elements, strontium-90, and cesium-137. In its present form, the alumina sludge qualifies as high-level radioactive waste, requiring costly disposal. Its estimated volume is 11 million gallons - approximately 20% of the total waste volume. Because of its properties, treating it will require disproportionately far more time and cost than the supernatant.

These fundamental limitations of the critical-path processing requirements of Hanford waste were not recognized during the design of the Hanford treatment. These findings directly contributed to the abandonment of the multi-billion dollar WTP Pretreatment Plant, which was designed for the wrong chemistry and would have failed immediately.

The proposed grout-based treatment approach suffers from similar shortcomings. Sulfate in the waste is highly corrosive to grout and promotes formation of ettringite, a mineral that expands the ceramic matrix and causes cracking - a well-documented failure mode. As noted earlier, removing supernatant for grout production does not shorten the critical-path schedule; it lengthens it by depleting the caustic needed for alumina-sludge leaching and by increaseing the total volume of waste requiring high-cost treatment.

My thermodynamic modeling identified viable solutions to the sulfate, alumina-leaching, and filtration challenges. Although these methods were not adopted, they were patented to preserve the technology (U.S. Patents 6,787,120; 7,968,067; and 7,976,799). The methods have been validated through laboratory and pilot plant experience. While the patents have since expired, the underlying technical solutions remain valid and represent the only known methods capable of significantly reducing Hanford waste volume and shortening the true critical-path schedule.

Given the substantial implications for cleanup timelines, cost, and long-term environmental stewardship, I respectfully urge the Department of Ecology to reevaluate strategies that rely on supernatant removal for glass or grout production and to consider the proven chemical and engineering constraints outlined above to address the critical path treatment strategy and overcome the greatest challenges to treating Hanford nuclear waste.

Thank you for your attention to these technical concerns and for your continued commitment to protecting the environment and public health.

Sincerely,

Don Geniesse