U.S. Department of Energy
Office of River Protection
P.O. Box 450
Richland, Washington 99352

03-ORP-145

SEP 15 2003

Mr. Todd Martin, Chair
Hanford Advisory Board
1933 Jadwin Avenue, Suite 135
Richland, Washington 99352

Dear Mr. Martin:

CONSENSUS ADVICE #150, SUPPLEMENTAL TECHNOLOGY DOWNSELECT DECISION

Reference: HAB letter from T. Martin to R. J. Schepens, ORP, "Supplemental Technology Testing Downselect Decision," dated September 5, 2003.

Thank you for the Hanford Advisory Board (HAB) Consensus Advice #150, "Supplemental Technology Downselect Decision," and the opportunity for members of our staffs and CH2M HILL Hanford Group (CH2M HILL) to provide a real-time update on the downselection process and a supplemental technologies open house at the HAB meeting on September 4-5, 2003.

We agree that members of the public, Hanford stakeholders, and HAB members have a keen interest in ensuring decisions concerning supplemental treatment are made in the most rigorous, objective, and fair fashion. To that end, the U.S. Department of Energy, Office of River Protection (ORP) began briefing the HAB about this program prior to the release of the Hanford Performance Management Plan in early 2002, and we have incorporated values and principles recommended by the Washington State Department of Ecology (Ecology), the U.S. Environmental Protection Agency (EPA), the HAB, and other stakeholders as we conducted the initial technical evaluations of Cast Stone, Bulk Vitrification, and Steam Reforming.

ORP has worked along with Ecology and EPA over the past 18 months to determine whether supplemental technologies can play a role in immobilizing low-activity tank wastes and, if so, what should be the basis for selecting and deploying such technologies? We have not reached an endpoint in the process. This process has only just begun.

The agencies expect CH2M HILL to provide a recommendation to ORP in September 2003, as to which technology or technologies are best suited for the next level of testing (i.e., field testing) in 2004. The field tests will support the submittal of a report on supplemental technologies to Ecology in 2005. If information from those tests and other sources support moving forward with supplemental treatment, the agencies will enter into Tri-Party Agreement (TPA) negotiations to incorporate the technologies into a final tank waste treatment baseline in 2006.

An important step in this process is for CH2M HILL to enter into contracts with the selected vendors by December 1, 2003, in order for those companies to establish their facilities for the next phase of testing in 2004. A final decision on this next phase of testing will occur December 1, 2003, when one or more contracts are approved with the technology vendors to conduct field pilot-scale testing.

Between now and the December 2003 timeframe, we encourage the HAB to review the data and information that is available on each technology. Further, we hope that you will spend time on this issue in the Tank Waste Committee and further at the November HAB meeting to prepare advice for our consideration. To begin this review, documentation is attached that outlines selection criteria – including waste performance, costs, and operability – that is being used by agency staff in their review.

We believe that this information, along with your input at the November HAB meeting will enable your involvement without making changes to existing milestones. Further, ORP, Ecology, and CH2M HILL are very interested in working with the HAB to design an acceptable and appropriate public information and involvement process, beyond the requirements of the TPA, for the next phase of supplemental treatment evaluation.

We appreciate the time the HAB has taken over the past year to provide feedback on our continuing evaluation of supplemental treatment options, and we look forward to continued and constructive dialogue on this issue.

If you have any questions or comments, please feel free to contact Suzanne Dahl, Ecology, (509) 736-5705, or Dana Bryson, ORP, (509) 372-0947.

Roy J. Schepens
Office Of River Protection

Mike Wilson
Washington State Department
of Ecology

ORP:TEO

Attachment

cc w/attach:
M. K. Marvin, RL

ATTACHMENT 2

Supplemental Treatment Selection

<table>
<tr><th>Goal</th><th>Criterion</th><th>Measure</th><th>Bulk Vitrification</th><th>Cast Stone</th><th>Steam Reforming</th></tr>
<tr><td rowspan="2">Ensure worker and public safety</td><td rowspan="2">Achieve Safe System</td><td rowspan="2">Independent safety experts' assessment</td><td colspan="3">Based on qualitative HAZOPs and Preliminary Hazard Analyses:
• Each of the 3 technologies can be operated within nuclear safety guidelines with the appropriate safety controls
• There are no significant radiological consequences to the onsite worker or offsite public for any of the 3 technologies
• There are no toxicological consequences to the off-site public for any of the 3 technologies
• There are potential toxicological consequences to the onsite worker for bulk vitrification and steam reforming which can be mitigated by appropriate safety controls</td></tr>
<tr><td>Due to NOx generation, the bulk vitirification thermal treatment process will require safety SSCs and mitigative controls for the off-gas system
Moderate energetics available for hazard scenarios and dispersing material:
• High temperature (1500°C)
• Electrical (9MVA)
• Similar processes have been authorized in DOE Complex</td><td>No NOx generation; no safety SSCs or mitigative controls required
Low energetics available for hazard scenarios and dispersing material:
• Similar processes have been authorized in DOE Complex</td><td>The steam reforming process produces minimal NOx off-gas but will require NOx safety SSCs and mitigative controls
High energetics available for hazard scenarios and dispersing material:
• High temperature (1100°C)
• Oxygen and carbon fuel source in explosion-resistant reformers
• Similar processes have not been authorized in DOE Complex</td></tr>
<tr><td rowspan="4">Maximize schedule acceleration</td><td>Confidence in meeting 2028 dates**</td><td>Can technology achieve 10 GPM in time to meet 2028?</td><td colspan="3">• Ability to meet the 2005 TPA M62-08 milestone date is subject to further information from the Vendors.
• Each of the 3 technologies could meet a 2011 date
• Using vendor-supplied information, there is no indication that any of the 3 Supplemental Technologies cannot meet the 2011 hot start date and ultimately the 2028 date. However, uncertainties surrounding their ability to meet construction and production requirements need to be evaluated to increase assurance of meeting dates</td></tr>
<tr><td rowspan="3">Process capacity</td><td>Metric tons of sodium (Na) processed by 2028</td><td colspan="3">Each of the 3 technologies exceed average rate of 10 GPM and achieve processing of the necessary amount of Na by 2028.</td></tr>
<tr><td>MT/day Immobilized Waste</td><td>59.2 MT/d</td><td>139.5 MT/d</td><td>55.4 MT/d</td></tr>
<tr><td>%TOE</td><td>75%</td><td>85%</td><td>80%</td></tr>
</table>

Goal	Criterion	Measure	Bulk Vitrification	Cast Stone	Steam Reforming
		Na_2O Loading wt%	20.0%	7.6%	19.8%
		MT Na by 7/2028	42,100 MT Na (~100,000 m^3) [5]	42,800 MT Na (~350,000 m^3) [5]	41,700 MT Na (~250,000m^3) [5]
Maximize operability	Process/Operability risk	Independent expert assessment	Each of the 3 technologies meets the Operability requirements to meet the 2028 date.		
			Facility configuration consists of 6 lines operating in parallel. Thermal process with moderate process complexity, high demand on feed material handling	Facility configuration consists of 2 lines operating in parallel. Non thermal process with low process complexity, high demand on waste package handling	Facility configuration consists of 2 lines operating in parallel. Thermal process with highest process complexity, lower demand on feed material handling and waste package handling.
			Technology used commercially on hazardous and low level waste, with prototypic demonstration on simulated Hanford tank waste. Uncertainty on the mixer-dryer experience for transitioning from commercial to nuclear environment.	Technology used on waste that is similar to Hanford tank waste. Least uncertainty about the operability of the process.	Technology used on commercial nuclear waste, but not demonstrated (at production scale) on waste that is similar to Hanford tank waste. Integrated process test needed to validate operating characteristics.
			Number of immobilized waste packages is ~4,600 to 9,300. (Variation due to package fill efficiency)	Number of immobilized waste packages is ~8,100 to 33,000. (Variation due to package size)	Number of immobilized waste packages is ~5,800 to 7,500. (Variation due to immobilized waste density)
Minimize overall system interface impacts	System interface impacts	Liquid effluent compared to ETF capacity	ETF capacity (~65 GPM) is sufficient to meet requirements of any of the technologies		
			3.6 GPM [1]	5.2 GPM [1]	0.0 GPM [1]
		Dose of waste package	Each of the 3 technologies complies with contact-handled dose rate requirements. (200 mR/hr is maximum allowable contact-handled package dose rate and 500 mR/hr is maximum IDF dose rate for disposal)		
			5 mR/hr [2, 4]	80 mR/hr [2, 3]	110 mR/hr [2, 3]
		Volume returned to DST's	0	0	0
Provide environmental protection comparable to current vitrified waste disposal plan*	Disposal System performance	The current plan is to use the IDF and therefore the disposal system will be the same for all technologies and not a discriminating factor			
	Disposal space required	Acres of land for Integrated Disposal Facility (40,000 MT Na Basis)	ILAW PRODUCED BY EACH SUPPLEMENTAL TECHNOLOGY CAN BE ACCOMODATED BY THE CAPACITY OF THE IDF *Note: IDF = ~53 Acre; ERDF = ~230 Acres; Original plan of 230 Grout Vaults covering all Tanks = ~160 Acres*		
			10 – 21 acres	15 acres	9 – 11 acres

Goal	Criterion	Measure	Bulk Vitrification	Cast Stone	Steam Reforming
	Secondary Wastes produced	Each of the 3 technologies is permitable, pursuant to the Clean Air Act requirements. Site disposal resources are adequate for secondary solid waste generated. (Equals less than 1% of ILAW treated waste)			
		Potential to emit (PTE) air emission	Bulk Vitrification requires abatement practices to meet air permit requirements. RCRA Air Emission requirements for Thermal Treatment processes have not been evaluated.	Cast Stone is less reliant on abatement practices to meet air permit requirements	Steam Reforming requires abatement practices to meet air permit requirements. RCRA Air Emission requirements for Thermal Treatment processes have not been evaluated.
		Liquid Waste Volume	3.6 GPM (1) Liquid Waste Volume	5.2 GPM (1) Liquid Waste Volume	0 GPM (1) Liquid Waste Volume
		Solid Waste Volume	28 m^3/yr Solid Waste Volume	110 m^3/yr Solid Waste Volume	23 m^3/yr Solid Waste Volume
	Waste form performance	Flux at point of undisturbed soil, bottom of waste package, and groundwater impact	Given the assumptions of the study and the limited data; • Total groundwater impacts should include the immobilized waste and secondary wastes. Analysis is based on Hanford current burial-ground practices and shows significant impact from secondary wastes from thermal processes. • Iodine is a key driver in the risk assessment and the inventory of Iodine is uncertain for tank waste and secondary waste. In order for thermal processes, including WTP, to be permitted, the issue of Iodine in secondary waste will be resolved. • All but Cast Stone meet the 4 mR/yr drinking water dose rate standard and the 900 pCi/l MCL for Tc. • For all the waste forms, the groundwater impacts from the non-radioactive chemical constituents analyzed (chromium, nitrate, nitrite, uranium) will meet minimum standards. Numbers given below assume that 25% of total LAW goes into each treatment process. It is assumed that ~70% of the LAW will be treated by Supplemental Technologies		
			BV flux results in short-term (600-3000 years), high GW impact due to Tc salt outside vitrified immobilized waste (peak = 0.10 mR-EDE/yr drinking water dose, 128 pCi/l at 1650 years). *Note: Vendor believes an engineered solution is feasible.* Given the uncertainties, long term performance is indistinguishable from WTP glass and SR.	CS flux results in the highest GW impacts, which are beyond the drinking water standards (peak = 2.64 mR-EDE/yr drinking water dose from Tc and I, [1300 pCi/l Tc and <11 pCi/l Iodine at 1850 years)]. *Note: The Iodine number is a upper-limit, based on a detection limit from a laboratory test. Vendor believes optimization is feasible.*	SR flux results in the lowest calculated GW impact (1.5×10^{-5} mR-EDE/yr, 0.02 pCi/l Tc), but given uncertainties, SR is indistinguishable from WTP glass and to BV in the long-term.

Goal	Criterion	Measure	Bulk Vitrification	Cast Stone	Steam Reforming
			GW impact from BV secondary waste (0.63 mR-EDE/yr drinking water dose, 4.2 pCi/l Iodine) is higher than from immobilized waste	CS has minimal secondary waste, therefore, GW impacts due to secondary waste are minimal.	GW impact from SR secondary waste (0.63 mR-EDE/yr, 1.4 pCi/l Tc and 4.2 pCi/l Iodine) is much higher than for the immobilized waste
			BV performance results are sensitive to 1) Tc salt not incorporated into the glass matrix and 2) the Iodine inventories in the secondary waste.	CS performance results are sensitive to 1) the use of a physical release model without direct consideration of chemical processes, and 2) an upper-bound diffusion coefficient for Iodine calculated from analytical detection limit.	SR performance results are sensitive to 1) the assumption that one SR sample that was produced is representative, 2) the assumption that the nosean mineral captures the CoCs, 3) the calculated nosean solubility constant, and 4) the assumption of inventory in the secondary waste. *Note: There is significantly less understanding of the degradation of nosean mineral compared to similar understanding of other waste forms.*
			BV does not pose a significant intruder risk	CS does not pose a significant intruder risk	SR has the highest intruder risk, based on the waste form analyzed. SR may need to be incorporated into a monolith.
			BV does not meet the definition of HLVIT, but is a similar process and is likely candidate to meet determination of equivalent treatment (DET), and is likely to meet organic LDR requirements. However, confirmatory investigation into volatile contaminants in disposal package needs to be conducted.	CS does not meet the definition of HLVIT. As a stabilization technology, CS is a less likely candidate for a determination of equivalent treatment (DET), and is generally not an acceptable treatment technology for organics.	SR does not meet the definition of HLVIT. Although not a glass waste form, it is a likely candidate to meet determination of equivalent treatment (DET) and is likely to meet organic LDR requirements.

Goal	Criterion	Measure	Bulk Vitrification	Cast Stone	Steam Reforming
			If the Tc salt problem in BV is resolved, then the BV glass appears to be equivalent to WTP glass.	CS performance is not equivalent to WTP glass.	Based on very preliminary data, SR performance appears to be equivalent to WTP glass.
	Meet PCB Framework Agreement Criteria	For DST waste, meet TSCA disposal requirements and demonstrate effective destruction/removal following dilution associated with necessary treatment.	BV is likely candidate to meet required TSCA demonstrations	• CS is not likely candidate to meet required TSCA demonstrations. • With respect to TSCA, may be appropriate for select secondary waste.	SR is likely candidate to meet required TSCA demonstrations.
Maximize Cost Effectiveness	Life cycle cost**	Life cycle cost (LCC)	• Ability to meet the 2005 TPA M62-08 milestone and need date at a competitive cost is subject to further information from the Vendors. • Because ALARA was not consistently applied in the design for all technologies, it was normalized through the package shielded design in Cast Stone and Steam Reforming. • Container configuration greatly affects Life Cycle Cost estimates • Pre-conceptual engineering information was used to develop these life-cycle cost estimates. With further engineering development and operational planning, the life-cycle costs are subject to increase. Therefore, these costs were not discriminating factors in the selection process. • Cast Stone and Steam Reforming life-cycle costs do not include potential cost increases due to schedule delays (due to more difficult permitting) of up to 2 years.		
			• Lowest container surface dose • Range for all cases examined is \$1.2B to \$1.3 B • This meets the ALARA case.	• Has the lowest facility and operating costs. • Has the highest container and disposal costs • Range for all cases examined is \$1.0B to \$1.5B • Upper-end of range reflects initial estimates of ALARA improvements.	• Has the lowest Life Cycle Cost for non-ALARA Cases • Range for all cases examined is \$0.9B to \$1.3B • Upper-end of range reflects initial estimates of ALARA improvements. • If a monolith is required due to intruder scenario performance objectives, considerable increase in cost could occur.
	Peak year cost	Peak year cost	**Peak-Year Cost:** \$ 142M	**Peak-Year Cost:** \$ 67M	**Peak-Year Cost:** \$ 97M
			Note: Peak-Year Costs assumes 3 years for Design and Construction.		

NOTES:

* Achieve comparable level of environmental performance to vitrification considering the nature of waste, pretreatment, and performance of the immobilized waste form and/or disposal units.

** Schedule and cost goals include consideration of the difficulty of obtaining facility permits, waste classification, additional infrastructure required, increased disposal costs based on waste volume differences, etc.

1. Vendor supplied information. Expert opinion indicates that worse case is 14 GPM.
2. Vendor supplied information based on 8.7×10^{-5} Ci/l Cs^{137}
3. Higher concentration feeds would require additional shielding for Cast Stone and Steam Reforming
4. Bulk Vitrification can accommodate waste feed up to 0.01 Ci/l without additional shielding.
5. Corresponds to the total volume of immobilized waste for 40,000 MT of Na.